AVREVS. Le Pouvoir de l'or / The Power of Gold

Arnaud Suspène
est spécialiste d'histoire politique et monétaire du monde romain. Il est professeur d'histoire ancienne à l'Université d'Orléans à l'Institut de Recherche sur les Archéomatériaux (UMR 7065).

Maryse Blet-Lemarquand
est spécialiste de l'archéométallurgie des métaux monnayés. Elle est ingénieure de recherche au CNRS à l'Institut de Recherche sur les Archéomatériaux (UMR 7065).

Frédérique Duyrat
est historienne du monde grec, de son économie et de sa monnaie. Elle est directeur du département des Monnaies, médailles et antiques de la BnF.

Sylvia Nieto-Pelletier
est spécialiste des pratiques économiques et monétaires du monde celtique. S. Nieto-Pelletier est directrice de recherche au CNRS à l'Institut de Recherche sur les Archéomatériaux (UMR 7065). Elle est directrice de l'IRAMAT et présidente de la Société française de numismatique.

Illustration de couverture :
Monnaie d'or romaine de la deuxième guerre punique (*RRC* 88/1 ; BnF FG 77).

Ausonius Éditions
— Scripta Antiqua 171 —

AVREVS. Le Pouvoir de l'or / The Power of Gold

Actes du colloque "AVREVS. Le Pouvoir de l'or : comprendre les usages économiques, politiques, sociaux et culturels de l'or monnayé en Occident (IV^e^ s. av. J.-C. – I^er^ s. ap. J.-C.)", Orléans, 12-14 nov. 2018.
Proceedings of the International Conference "AVREVS. The Power of Gold : Investigate the economic, political, social and cultural uses of gold coins in the Western World (IVth c. BC. – 1st c. AD)"

Edité par A. Suspène, M. Blet-Lemarquand, F. Duyrat, S. Nieto-Pelletier

Ouvrage publié avec le soutien de la Région Centre-Val de Loire

— Bordeaux 2023 —

Notice catalographique :

Suspène, A., Blet-Lemarquand, M., Duyrat, F. et Nieto-Pelletier, S., éd. (2023) : *AVREVS. Le Pouvoir de l'or / The Power of Gold*, Ausonius, Scripta Antiqua 171, Bordeaux.

Mots clés :
Or, monnaie, numismatique, histoire, archéométrie, analyses chimiques, transferts, Occident, Antiquité, monde romain, monde grec, monde celtique.
Gold, coinage, numismatics, history, archaeometry, chemical analysis, transfers, Antiquity, Roman World, Greek World, Celtic World.

AUSONIUS
Maison de l'Archéologie
F - 33607 Pessac cedex
http://ausonius.u-bordeaux-montaigne.fr/EditionsAusonius

Directrice des publications : Claire Hasenohr
Éditrice : Martine Courrèges-Blanc
Graphisme de couverture : Martine Courrèges-Blanc

ISSN : 1298-1990
ISBN : 978-2-35613-578-0

Achevé d'imprimer sur les presses
GN Impressions
1925 Route de Navidals
31340 Villematier

Dépôt Légal
10 octobre 2023

Distribution DILISCO
Zone artisanale Les Conduits - Rue du Limousin -
BP 25 - 23220 Cheniers
Tél. +33 (0)5 55 51 80 00 - Fax +33 (0)5 55 62 17 39

Diffusion AFPU-D
C/O Université de Lille - 3 rue du Barreau -
BP 60149 - 59653 Villeneuve d'Ascq Cedex
Tél. +33 (0)3 20 41 66 95

Auteurs

Michel AMANDRY	Société française de numismatique.
Jérémy ARTRU	IRAMAT-CEB, UMR 7065 Université d'Orléans-CNRS.
Barbara ARMBRUSTER	TRACES, UMR 5608 CNRS-Université Toulouse Jean Jaurès.
Mathilde AVISSEAU-BROUSTET	Bibliothèque nationale de France.
Sandrine BARON	TRACES, UMR 5608 CNRS-Université Toulouse Jean Jaurès.
Clara BERRENDONNER	Université Paris I-Panthéon-Sorbonne ; AnHiMA - UMR 8210.
Maryse BLET-LEMARQUAND	IRAMAT-CEB, UMR 7065 CNRS-Université d'Orléans.
Dorian BOCCIARELLI	Société française de numismatique.
François de CALLATAŸ	Bibliothèque royale de Belgique (KBR), Université Libre de Bruxelles, École Pratique des Hautes Études.
Anaïs CHEUTON	IRAMAT-CEB, UMR 7065 CNRS-Université d'Orléans.
Jean-Christophe COUVENHES	Lettres Sorbonne Université ; AnHiMA - UMR 8210.
Guido CREEMERS	Gallo-Romeins Museum Tongeren / Instituut Archeologisch Patrimonium.
Frédérique DUYRAT	Bibliothèque nationale de France.
Thomas FAUCHER	Centre d'Études Alexandrines (USR 3134 CNRS).
Wolfgang FISCHER-BOSSERT	Österreichische Akademie der Wissenschaften.
Julien FLAMENT	Chercheur associé IRAMAT-CEB, UMR 7065 CNRS-Université d'Orléans.
Benjamin GEHRES	Laboratoire Archéosciences - UMR 6566 CReAAH (Centre de Recherche en Archéologie, Archéosciences, Histoire).
Catherine GRANDJEAN	Université de Tours - CeTHiS (EA 6298).
George GREEN	Ashmolean Museum Oxford.
Pierre-Olivier HOCHARD	Université de Tours - CeTHiS (EA 6298) / Institut Universitaire de France.
Antony HOSTEIN	École Pratique des Hautes Études – Université PSL ; AnHiMA - UMR 8210.
Philip de JERSEY	Guernsey Museum.

Stéphane MARTIN	Chercheur associé, laboratoire HeRMA (UR 15071), Université de Poitiers.
Sylvia NIETO-PELLETIER	IRAMAT-CEB, UMR 7065 CNRS-Université d'Orléans.
Marilou NORDEZ	Post-doctorante, projet ANR-DFG Celtic Gold.
Julien OLIVIER	Bibliothèque nationale de France, chercheur associé IRAMAT-CEB, UMR 7065 CNRS-Université d'Orléans.
François PLOTON-NICOLLET	École nationale des chartes (PSL) ; EA 3624 Centre Jean-Mabillon / EA 4710 PoLeN.
Pierre PONTIER	EDITTA-UR 1491 / Sorbonne Université.
Arnaud SUSPÈNE	IRAMAT-CEB, UMR 7065 Université d'Orléans-CNRS.
Bernhard WOYTEK	Österreichische Akademie der Wissenschaften.

Sommaire/Summary

Aux origines de l'or monnayé romain / The Birth of Roman gold coinage

De la République à l'Empire / From Republic to Empire

Metrological and Metallurgical Data from Roman *Aurei*, 50 BC to AD 69

George Green

Museum collections have been extensively used to study Roman gold coinage. These collections have proved particularly useful for determining the various weight standards the *aureus* was struck to, and for looking at minting patterns in general. These curated collections are, however, devoid of the context of function: they contain selected pieces from various hoards and find spots that were deposited or lost across a range of closing dates. Important contexts – such as when these coins were deposited, or what they were deposited with – are therefore lost when analysing museum collections. As such, in order to investigate the function of Roman gold coinage and determine how ancient individuals used these objects, this context of function must be retained. As part of the 'Gold Coinage in the Roman World' project at the Ashmolean Museum and the university of Warwick, approximately 9000 *aurei* weights have been collected from Roman gold hoards closing between 50 BC and AD 450. The metrological data from hoards closing between 50 BC and Nero's coinage reforms in AD 64 is presented below in Figure 1. Furthermore, the Ashmolean museum has allowed its Roman gold coin collection to undergo a programme of analysis using XRF (X-ray fluorescence) and LA-ICP-MS (laser ablation inductively coupled mass spectrometry). The metallurgical data acquired via XRF from the gold coins issued between 46 BC and AD 76 is presented below in Figure 3.

The Metrological Data

The metrological data come entirely from hoards rather than museum collections (fig. 1). In a hoard, coins are being used as a store of wealth. As such, hoards provide a 'snapshot' of function. If we have a 'snapshot' of the function of these objects then we can determine how the ancient individual is actually using gold coinage. If we have a 'how' we can then propose a 'why.' Through proposing 'why' we can then explore the relationship between the individual and the state, elucidate concepts of trust in the Roman economy, examine the fundamental principles of the economy these individuals are operating in and, ultimately, gain a better understanding of the relationship between the Romans and their gold coinage. The use of weight data from hoards is not, in itself, novel. For example, Duncan-Jones[1] uses the weights

1 Duncan-Jones 1994.

from an unpublished hoard deposited in modern day Belgium to determine the rate of wear for *aurei* in circulation. However, the use of just a single hoard does not provide a particularly firm foundation for wide ranging conclusions; and nor is it necessary to restrict the analysis of this kind of metrological data to questions of circulation (or the velocity thereof). The role of trust in the Roman economy, for instance, is a particularly interesting concept that can be explored through the use of metrological data. Again, exploring the concept of trust in the Roman economy is not new either. For example, M. Haklai-Rotenberg[2] looks at how trust affected the value of coinage after the monetary reforms of Aurelian. In this particular instance, the focus is on applying economic theory to late third century history, rather than seeing how existing theories fit in with the primary material evidence. Considering all this, a substantial database of metrological data purposefully used to explore economic questions beyond circulation, across the geographical and chronological whole of the Roman Empire, has substantial scope for novel conclusions.

In the case of the 'Caesar to Nero' period at hand, the metrological data show that hoarders continued to trust the *aureus* as a store of wealth, despite numerous weight standard reductions, and were happy to store noticeably lighter *aurei* alongside heavier examples. Given that we have no evidence that the tariffed value of the *aureus* changed in this period; this suggests a significant degree of trust in the coinage considering the noticeable reduction in the intrinsic value of the *aureus*. If anything the greatest reaction to these changes to the weight standard is from the state itself, which attempts to withdraw older, heavier *aurei* from circulation during the reigns of Augustus and Claudius. This, again, appears to have had little impact on the trust hoarders had in the *aureus*.

The 'reign' of Julius Caesar was chosen as the start point for the hoard data as it was under his Dictatorship that the first regular production of Roman gold coinage began in 46 BC, during the praetorship of A. Hirtius.[3] This is not to say that gold coinage was not produced before this date, indeed the oldest *aureus* in the data collected here dates from 48 BC, but the scale of production of these earlier issues is significantly less than the Hirtius issues. For example, very few specimens of the 48 BC issue of *aurei* minted in Illyricum are known,[4] whereas M. C. Molinari[5] was able to collect 537 specimens of the Hirtius *aurei* in her die study. Generally, production of Roman gold coinage was rare before Caesar and when it was produced, for example under Sulla and Pompey, it was as *Gelegenheitsprägungen*[6] – 'celebration issues' or 'occasion coinages' – which are of a significantly different nature to the regular productions of *aurei* from Caesar onwards.

2 Haklai-Rotenberg 2011.
3 Woytek 2012, 32; Woytek 2003, 142.
4 Woytek 2012, 321.
5 Molinari 2003.
6 Bahrfeldt 1923.

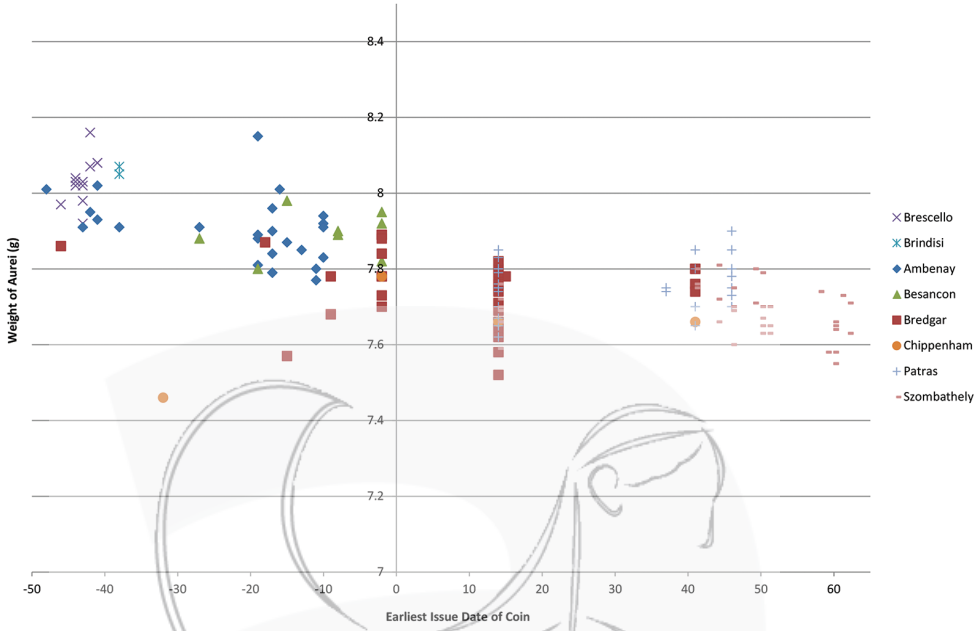

Fig. 1. Weights of *aurei* from hoards closing between 50 BC and AD 64.

Pliny's[7] discussion of the *aureus* seems to state that the *aureus* weight standard began at 1/40th of a Roman pound. Both B. Woytek[8] and K. Butcher *et al.*[9] reproduce the 1/40th of a Roman pound standard, but the former converts this to 8.18 g, whereas the latter puts it at 8.03 g. This rather highlights the issue of dealing in fractions of a Roman pound, when there is no definitive answer to exactly what that is.[10] The Brescello hoard contains 13 *aurei*, opens in 46 BC and closes in 42 BC. While one of these pieces is an anomalously heavy 9.03 g coin, the remaining 12 *aurei* have a mean and median weight of 8.03 g; which is in agreement with the figure from Butcher *et al.*[11] Interestingly these 12 *aurei* range from 7.92 g to 8.16 g and, given the short date range of the hoard, it is difficult to wholly blame wear through circulation for this discrepancy: the lightest coin was issued in 43 BC, the heaviest in 42 BC (fig. 1) This suggests that from the very outset there was a degree of variation that inherently existed in the *aureus* weight standard, and that both the state issuing the coin and the individual using it seemed to accept this. Considering this, it is perhaps not useful to talk about weight standards using specific fractions of a Roman pound and it is instead better to refer to a generally observed 'average' gram weight around which there is a degree of variation. As such, we can say that Caesar's *aurei* were struck to a target weight of approximately 8.03 g and that this was the standard until the reign of Augustus.

7 Plin., *HN*, 33.13.
8 Woytek 2012, 321.
9 Butcher *et al.* 2014, 93.
10 *Ibid.*, 2014, 92-94.
11 Butcher *et al.* 2014.

Under Augustus there appears to be a slight reduction in the *aureus* weight standard. R. Duncan-Jones[12] and K. Butcher *et al.*[13] are in good agreement over this standard: the former proposes a target weight of 7.87 g and the latter presents a mean weight of 7.86 g for Augustan *aurei*. In the Ambenay hoard (fig. 1), closing around 10 BC, the 20 Augustan *aurei* for which there are weights available have a mean weight of 7.88 g and a median weight of 7.875 g. The Besançon hoard (fig. 1) consists of 8 Augustan *aurei*, opens in 27 BC and closes in approximately 2 BC. The coins have a mean weight of 7.89 g and a median weight of 7.895 g.[14] The weight data from both of these hoards are, then, in good agreement with existing proposed standards. These hoards also further attest to there being a degree of variation expected around a weight standard. The Besançon hoard ranges from 7.82 g to 7.98 g, with the lightest coin being issued in 2 BC and the heaviest 15 BC, and the Augustan *aurei* in the Ambenay hoard range from 7.77 g to 8.15 g, with the lightest issued in 11 BC and the heaviest in 19 BC. Perhaps the underweight coins in these hoards could be attributed to wear, but wear certainly cannot be blamed for coins being *over* the target weight. The 6 out of 8 *aurei* from the Besançon hoard, and the 9 out of the 20 Augustan *aurei* from the Ambenay hoard, which are over 7.87 g must, therefore, have left the mint overweight. It would again appear that variation in strike weight was inherent and a phenomenon that was accepted by both minter and hoarder.

Another slight reduction occurred during the reign of Tiberius. R. Duncan-Jones[15] puts the new standard at 7.78 g, with the data presented by K. Butcher *et al.*[16] corroborating this figure. This standard appears to continue until AD 51. K. Butcher *et al.*[17] offer a different narrative, however, preferring to see the *aureus* standard dropping to 7.75 g under Caligula and then to 7.74 g for the first ten years of Claudius' reign. Within the data collected here there is not enough evidence to fully assess the weight standard under Caligula, but there is enough to assess it under Claudius. The data collected do not support a deliberate alteration to the weight standard of the *aureus* at this time. The Patras (fig. 1) hoard closes in AD 46 and contains seven *aurei* issued in AD 46, which have a mean weight of 7.79 g. The mean weight of the 11 *aurei* issued under Claudius in this hoard is 7.77 g. The Bredgar hoard (fig. 1) closes in AD 41 and has four *aurei* issued in this year, which have a mean weight of 7.78 g. The *aurei* from these two hoards, which are minted very close to the closing dates, simply do not support the notion that the state was deliberately and regularly minting *aurei* at 7.74 g. Indeed, it seems quite improbable that the state would use its resources to alter its coinage by three hundredths of a gram and then again by one hundredth of a gram. Furthermore, there is no evidence for this kind of minute alteration happening at any other point in the Imperial period – the Tiberian reduction is the smallest and this is approximately 0.09

12 Duncan-Jones 1994, 216.
13 Butcher *et al.* 2014, 172.
14 This hoard was deposited in the foundations of a building, along with three gold rings (Suspène *et al.* 2016, 89). As such, there is reasonable speculation that this deposition of wealth may have served a ritualistic function. However, metrologically speaking, the Augustan *aurei* selected for deposition here are largely indistinguishable from the Ambenay hoard.
15 Duncan-Jones 1994, 216.
16 Butcher *et al.* 2014, 172.
17 Butcher *et al.* 2014, 172.

grams, triple the proposed reduction under Caligula. Perhaps the weight standard was reduced under Caligula, but then raised back up again under Claudius. The two *aurei* minted under Caligula in the Patras hoard weigh 7.75 g and 7.74 g, which matches the proposed lower weight standard. However, it must be remembered that the Patras hoard closed at least ten years after these coins first entered circulation. The weight of these *aurei*, therefore, represents the mint weight minus the weight lost due to ten years of circulation. Unless these coins were almost immediately taken out of circulation, it is quite probable they were minted at a fractionally higher weight – probably something closer to 7.78 g than 7.75 g. Of course, significant conclusions cannot be based on two *aurei*, but the hoard evidence in general does not seem to support a stepped decline in the weight standard between Tiberius and Claudius. As such, it is probably broadly correct to state that from AD 14 to AD 50, the *aureus* weight standard clustered at 7.78 g.

The final reduction of the target weight of the *aureus* in this period occurs towards the end of Claudius' reign and continues through Nero's, until his reforms in AD 64. In AD 51 Claudius reduced the *aureus* standard to approximately 7.67 g,[18] and this strike weight seems to have been continued by Nero. The Szombathely-Herényi hoard (fig. 1) closes in AD 62 and contains 13 *aurei* minted from AD 51 onwards, which have a mean weight of 7.65 g. Allowing for some degree of weight loss due to wear, the mean weight expressed in this hoard is in good agreement with the 7.67 g figure for the standard at this point. Indeed, the mean weight of the two *aurei* struck in AD 62 is 7.67 g. Although an average of two is not particularly useful, the fact that these coins weigh 7.63 g and 7.71 g respectively suggests that small variations in strike weight was still an inherent part of the minting process.

Overall, it would appear that Pliny's characterisation of the *aureus* weight standards in this period is broadly correct, even if it is slightly imprecise. The *aureus* was struck at approximately 8.03 g under Caesar, after which Pliny[19] states that the standard declines until the reform under Nero. The evidence collected here supports the existence of this decline. The target weight drops to *c.* 7.87 g under Augustus and then to approximately 7.78 g under Tiberius. This standard appears to continue until AD 51, at which point Claudius reduces the standard again to approximately 7.67 g. This continues until Nero's reforms in AD 64. It should be remembered that the concept of a weight standard in the Roman world does not seem to be a minimum weight *aurei* have to reach to avoid being substandard or defective. Indeed, slightly overweight, slightly underweight and exact weight *aurei* are all used alongside each other by hoarders, suggesting they did not reject *aurei* that did not match the weight standard employed by the state. Instead, weight standards seem to be the weight around which freshly minted coins were intended to cluster, with a small degree of variation in weight accepted by the state issuing, and the individuals hoarding, the coins.

18 Butcher *et al.* 2014, 94, 172.
19 Plin., *HN,* 33.47.

Reaction to Weight Changes

In the first few decades of this period the introductory weight of the *aureus* seems to have been accepted as valid, by both the state and by individuals. *Aurei* are minted at this *c.* 8.03 g weight standard for approximately the next 20 years, and hoarders almost immediately begin trusting these coins as a store of wealth. For example, the Brescello hoard was deposited only 5 years after Caesar's regular production of the *aureus* in 46 BC and contained 13 *aurei* in total. This represents approximately a year and a half's pay for a contemporary legionary[20] and so it can be assumed that the hoarder would not have stored this kind of value in a medium they did not trust. Outside of the hoards collected as part of the weight data, there are a few other hoards containing *aurei* that are deposited soon after the start of regular *aurei* production in 46 BC. The Cavriago hoard (CHRR ID: CAV) contained seven *aurei* and was deposited in 45 BC, and the Thrace hoard (CHRR ID: THR) deposited in 43 BC contained two *aurei* alongside 54 *denarii*. The use of these *aurei* as a store of wealth so quickly after 46 BC suggests that there was, at least amongst these hoarders, almost immediate faith in the value of the *aureus*. The CHRR Online database has 4 hoards containing *aurei* that close between 46 BC and 28 BC, and the CHRE Online database has another 4 hoards containing *aurei* that close within this date range. These 8 hoards represent the deposition of over 100 *aurei* struck to the Caesarean standard in this 19 year period. It would appear that the overall reaction to the introduction of the Caesarean weight standard was one of acceptance. The 25 *denarii* face value of the *c.* 8 g gold coins was clearly close enough to the metallic value of the coin to preserve some kind of validity between the tariff and the intrinsic value of the piece. Essentially, the state did not overvalue the *aureus* to the extent that any trust in the face value was eroded. Equally, it can be quite safely assumed that the coin was overvalued enough to cover the resource costs incurred by the state for producing *aurei* in the first place. B. Woytek[21] argues that the regular production of *aurei* was predicated by the need to make large state payments in the form of pay to Caesar's victorious legions and as triumphal donatives to the people of Rome. As such, it makes very little sense for the state to willingly undervalue these *aurei* and produce them at a loss.

When the weight standard of the *aureus* was reduced in this period, the reaction from hoarders was relatively muted. Hoarders were happy to hoard the newer, lighter *aurei* with the older, heavier examples; and hoarders did not appear to be rejecting new *aurei* in favour of older examples, with some hoards consisting solely of the lightest standard in circulation at the time. For example, the Ambenay, Bredgar, Chippenham and Szombathely-Herényi hoards (fig. 1) all contained *aurei* minted to at least two different standards. Furthermore, the *aurei* in the Besançon hoard, deposited around 2 BC, are all minted to the new Augustan standard; and the *aurei* in the Patras hoard, deposited around AD 46, are all minted to the contemporary standard. In both cases older *aurei* struck to heavier standards were certainly still in circulation.

20 Speidel 2014, 56.
21 Woytek 2003, 182-6, 264-268.

In Pliny's description of the *aureus* he makes it clear that the weight standard changed over the course of this period, but does not mention any changes to the value of the coin at all. The textual evidence we do have for the value of the *aureus*, while scattered, does seem to support a tariffed face value of 25 *denarii* until the first half of the third century. The earliest reference we have is from Claudius Didymus, a grammarian active in the early first century AD under the emperor Claudius.[22] In a fragment preserved in Priscian's *De figuris numerorum* he says that 1000 *sestertii*, 250 silver *denarii* and 10 gold coins (*chrysa*) are all equivalent.[23] Josephus,[24] writing under Vespasian, records a story from the siege of Jerusalem in AD 70 where deserters fleeing to the Roman camp with "χρυσοῦς" (and those that had stolen the gold from them) were only able to exchange these for 12 Attics, where it had been 25 before. The fluctuation here appears to be caused by the massive distortion to the local economy caused by the siege, coupled with supply outstripping demand, rather than anything to do with the fabric of the *aureus* itself. Indeed, Josephus seems to suggest that the normal exchange rate was 25:1, if we assume parity between the Attic *drachma* and the *denarius*. Both Tacitus and Suetonius, writing at the beginning of the second century AD, record an instance of Otho distributing money to soldiers under Galba's command. Where Tacitus has the amount at 100 *sestertii*,[25] Suetonius instead records it as an *aureus*,[26] suggesting parity between the two amounts. Lucian, writing in the second half of the second century, writes in his *Pseudologista* that an old man was deceived out of 30 gold coins when he paid 750 drachmas for a book on rhetoric that was in fact a forgery.[27] Finally, when reading Cassius Dio alongside T. Buttrey's[28] commentary, it is clear that Dio is stating that he calls the coin worth 25 drachmas an *aureus*.[29] He did so in the early third century and so this statement provides evidence of the 25:1 relationship at least theoretically until the time of Alexander Severus.[30]

Our ancient writers are, then, reasonably consistent on the 25 *denarii/drachma* face value of the *aureus*. When they write about the ratio they do so without qualification about its fabric, in essence they do not stipulate the *aureus* must be, for instance, old, new, full, heavy, unworn or perceived to be of good quality. Given that all these authors would have been familiar with *aurei* that were either struck to multiple standards or had different weights due to wear, it does give the impression that the weight of the *aureus* did not affect the 25 *denarii* face value. Given the indirect and scattered nature of the textual evidence, an *argumentum ex silentio* may not be overwhelmingly convincing. However, we do have evidence for monetary phenomena that only really make sense if the *aureus* has a stable

22 Matthaios 2014, 280.
23 *De figuris numerorum,* 18 (Hultsch 1866, 86).
24 Jos., *BJ*, 5.13.4: δώδεκα γοῦν Ἀττικῶν ὠνοῦντο πρότερον ἰσχύοντας πέντε καὶ εἴκοσιν.
25 Tac., *Hist.*, 1.24: *centenos nummos diuideret.*
26 Suet., *Oth.,* 4: *aureos excubanti cohorti uiritim diuidebat.*
27 Luc., *Pseudol.,* 30: ἐξαρπάσας τοῦ ἀνοήτου ἐκείνου πρεσβύτου χρυσοῦς τριάκοντα, ὁ δὲ διὰ τὸν Τισίαν ἀντὶ τοῦ βιβλίου πεντήκοντα καὶ ἑπτακοσίας ἐξέτισε κατασοφισθείς.
28 Buttrey 1961.
29 D.C. 55.12: χρυσοῦν γὰρ δὴ καὶ ἐγὼ τὸ νόμισμα τὸ τὰς πέντε καὶ εἴκοσι δραχμὰς δυνάμενον κατὰ τὸ ἐπιχώριον ὀνομάζω.
30 Buttrey 1961, 45.

face value and is not exchanged like a piece of bullion. In the period at hand, this includes the existence of periods of withdrawal of older, high weight *aurei* after changes to the weight standard, which would be pointless if the coins circulated by weight.

As such, we must conclude that the changes to the mint weight of the *aureus* did not affect its face value in this period. Indeed, it would certainly be strange for Pliny to write about the weight standard changing, but to then deliberately exclude any changes made to the tariffed value of the coin. While Pliny's quantitative description of the weight standards may be imprecise, his qualitative description is broadly accurate – there is no real reason to assume he, or any of our other textual sources, is deliberately misleading us about the value of the *aureus* in this period. With this in mind, the fact that hoarders are happy to store *aurei* of noticeably different weights together, or are at least happy to store newer, lighter *aurei*, should be interpreted as these hoarders seeing these different weight *aurei* as equally valid stores of wealth. This is because the face value of the *aureus* remains constant, and the reduction in weight does not appear to have caused hoarders to lose faith in the validity of the coin. If hoarders were to lose faith in the face value of lower weight *aurei*, we would expect them to reject them and just store the high weight examples. This does not appear to be the case in the data collected. Alternatively these hoarders may be storing a variety of weights together because there is no face value at all and the *aureus* is circulating like a piece of bullion. This is quite the leap and requires us to believe that our literary sources are simply lying about quite basic facts they've included in their work. Realistically, it would appear that hoarders in this period were relatively resilient to alterations to the *aureus* weight standard and continued to have faith in the face value of the *aureus*.

Between 46 BC and AD 63 there were four distinct weight standards, with three of these coming in the first 60 years of the period. The first weight reduction occurs only 19 years after the introduction of regular *aureus* production. One would assume that the state would be hesitant to alter the intrinsic value of a relatively new denomination, in order to build long term trust in the coin. As shown above, the state was able to lower the weight standard of the *aureus* without, it seems, affecting the validity of the face value of the coin or causing hoarders to behave differently towards the *aureus*. It is worth exploring why the state may have chosen to risk affecting trust in the *aureus* in order to reduce its intrinsic value. There are two potential explanations: necessity or efficiency.

In the case of the former, the state may have felt forced to reduce the amount of precious metal in its coinage in order to be able to meet its financial obligations. There are some counterpoints to this notion. K. Butcher *et al.*[31] do not see the gradual decline of the *denarius* weight standard in this period as an indicator of any serious fiscal inadequacy. Furthermore, if we use patterns in maritime trade as a broad proxy for the health of the wider economy, then this is a period during which it would appear that the Roman economy is growing – or at least when Mediterranean trade is increasing.[32] Broadly speaking, Roman hegemony of the

31 Butcher *et al.* 2014, 173.
32 Wilson 2011.

Mediterranean is effectively unchallenged in this period, the borders of the empire expand and it is difficult to find a series of major crises that follow the reductions in the weight standards. As such, without powerful evidence to the contrary, it is difficult not to conclude that state finances were probably relatively healthy in this period. Instead, these reductions should probably be viewed as acts of economic efficiency by the state. It would appear that the state had sufficient confidence in the strength of the face value of the *aureus* that it on multiple occasions reduced the amount of gold in the coin. If the state was not forced by economic circumstances to do this, then it was effectively 'cashing in' on the trust in the *aureus*.

By the end of Augustus' reign, the state had reacted to its own weight change by starting to withdraw older, heavier *aurei* from circulation. For example, the depositor of the Ambenay hoard still had access to a number of Caesarean *aurei* in 10 BC, but a few years later it would appear that the depositor of the Besançon hoard did not have access to these older coins. The same can be said for the Limoges (2 BC/AD 14, CHRE ID: 6069), Saint-Priest-sous-Aixe (11 BC/4 BC, ID: 6074), Tipasa (AD 14, ID: 4941), Campiglia Maritima (2 BC/AD 4, ID: 9294) and Sallèdes (AD 14/AD 37, ID: 7351) hoards. The *c.* 8 g, Caesarean *aurei* were withdrawn and were presumably melted down, then struck into slightly lighter *aurei* at the new, lower standard. Of course, there are some hoards from later in this period that do contain pre-Augustan *aurei* that were presumably minted to a heavier standard: the Bredgar and Chippenham hoards (fig. 1), for instance. These are both Claudian depositions that contain an *aureus* of Julius Caesar and of Octavian respectively. What is interesting is that in both these cases the older *aurei* are relatively underweight: 7.86 g and 7.46 g respectively. Both are no heavier than some of the Augustan standard *aurei* that were still in circulation and their relatively light weight may be part of the reason why they managed to escape the melting pot. In general, it does appear that the state managed to withdraw the vast majority of high weight, Caesarean standard *aurei* from circulation. At some point during Claudius' reign the state appears to have embarked on another program of withdrawal. The Bredgar and Chippenham hoards, deposited in AD 41 and AD 42 respectively, both contain *aurei* issued under Augustus. However, the Patras hoard, deposited in AD 46, does not contain any *aurei* issued before Tiberius; and the same is true of the Szombathely-Herényi hoard that has a closing date of AD 62 (fig. 1). The composition of numerous other hoards seems to fit with this pattern. For example, the Montans I hoard (AD 42, ID: 5464) is deposited early on in Claudius' reign and contains *aurei* issued under Augustus. The Beaufort-en-Vallée (AD 47, ID: 5922), Iluro (AD 51, ID: 8477), Saint-Georges-sur-Loire (AD 51, ID: 5911) and Lentilly (AD 60, ID: 6312) hoards are all mid-Claudian or early Neronian depositions, and do not appear to contain any *aurei* issued before Tiberius. It seems, then, that at some point during the middle of Claudius' reign that the state made a deliberate effort to withdraw the older, heavier Augustan *aurei* from circulation and that they were largely successful in this endeavour.

The Metallurgical Data

X-ray fluorescence was used in order to determine the purity of the *aurei* in the Ashmolean's collection. The data are historically interesting in and of themselves: stability

in the data can be indicative of the economic health of the Roman state, whereas reductions in the purity of the gold can indicate times of acute crisis. These analyses can also help to contextualise some of the concepts that have arisen from the weight data. The *intrinsic* value of an *aureus* is a function of its weight and its gold purity – it follows that if the weight of the coin can have an effect on trust, so too can the purity. Furthermore, during periods of withdrawal and presumed recycling, the state views *aurei* as pieces of circulating bullion that they can exploit – again, if the weight can have an effect on what coins are recycled, so too can the purity.

The XRF analyses were performed using an Oxford Instruments 'X-MET8000' handheld energy dispersive X-ray fluorescence unit with a voltage of 40 kV, a current of 8 μA and a 1000 μm aluminium filter. The unit contains a rhodium target X-ray tube and a 25 mm² high resolution silicon-drift detector. This particular analyser comes factory-loaded with fundamental parameters (FP) that are specific to various applications. All analyses here were performed using the pre-loaded 'Precious Metals FP' calibration setting. External standards of known quantities of gold, silver and copper were also used throughout the analysis. On each coin, three separate 10.7 mm x 9.4 mm spots were analysed – two on one face of the coin, and one spot on the other. The flattest parts of the coins were chosen for analysis, as irregularly shaped surfaces can affect the accuracy of the results produced.[33] The handheld unit was docked into a benchtop stand, and the in-built camera was used to select the spots. Given the intricate designs on Roman *aurei* it was not always possible for the whole area sampled to be flat. Each spot was analysed for 30 seconds, totalling 90 seconds per coin. Quantitative results were extracted using the standard software provided with the unit. These results were then manually compared with the spectra to check for anomalies – sum peaks, escape peaks, diffraction errors, surface contamination, etcetera – that the standard software did not identify or account for.

A major drawback of XRF is that it is a surface level technique. If the object analysed is surface enriched – whether deliberately or through diagenetic alterations when buried – then the results from the XRF analyses are not representative of bulk composition of the object. Roman silver coinage, for example, is deliberately surface enriched[34] and early XRF analyses of *denarii* by Walker[35] fell afoul of the misleading purity on the surface of the coins analysed. In terms of diagenetic alterations, copper from the surface layers of the coin leaching into the burial environment would be the most probable cause of a discrepancy between the interior and exterior of the coin. In gold alloys, the copper on the surface of the object is able to corrode and form soluble corrosion products, which are then able to leach into the burial environment.[36] This leaching of base metals from archaeological gold alloys is an established phenomenon.[37]

33 Blakelock 2016, 915; Geil & Thorne 2014, 1358-9.
34 Butcher & Ponting 2005; Hampshire *et al.* 2019.
35 Walker 1978.
36 Blakelock 2016, 913.
37 Blakelock 2016; Hall 1961; Hook & Needham 1989; Tate 1986.

Surface enrichment is not, however, thought to be a major problem in Roman gold coinage produced during 'normal times'. The surfaces of *aurei* and solidi are generally very high purity. As such, the use of the specific gravity method is sufficient to determine whether there is any more than a few percentage points of the alloying metals in the coin than surface analyses reveal. The specific gravity results obtained by E. Caley,[38] for example, are in very good agreement with the XRF results presented in Figure 3. This suggests that it is unlikely that *aurei* are routinely and deliberately surface enriched during manufacture. The results from muonic X-ray emission spectroscopy Roman gold coins[39] performed by the author also show that there is no appreciable difference between the surface and interior of the gold coins analysed. The technique is capable of performing totally non-destructive, penetrative analyses of cultural heritage objects and, at present, is able to determine the concentrations of major elements down to a fraction of 1%. As such, this technique provides direct evidence that the surfaces of *aurei* are representative of their bulk composition.

The high precious metal content of Roman gold coinage also seems to partially inoculate it against the effects of copper leaching. *Aurei*, generally speaking, are almost entirely gold and the primary alloying metal is generally silver. Unlike copper, only very small quantities of silver can be leached out of archaeological gold via corrosion products – normally the removal of silver from gold requires a deliberate chemical process.[40] The vast majority of the *aurei* dating between 46 BC and AD 76 analysed here contained a fraction of 1% of copper. The rate of leaching would have to be improbably great for there to have ever been a significant proportion of copper within the majority of the coins analysed. E. Blakelock[41] identifies copper leaching in a few gold coins from the Staffordshire hoard, but these objects were approximately 2% copper to begin with, and the leaching reduced this on the surface by around 20% in two cases and 40% in another. Given that the *aurei* here generally contain less than 0.2% copper, a similar proportion of leaching would have a negligible effect on the overall picture of the composition of the coins analysed. This is only in general, however – an *aureus* of Galba and an *aureus* of Otho were found to be 5.75% and 5.40% copper respectively. This is a high enough proportion for a leaching of 20% to 40% to negatively alter how representative the surface is of the bulk composition. These two coins were analysed using muonic X-ray emission spectroscopy, and the initial results suggest that this kind of leaching had not occurred in these coins – although statistical work on the spectra is still ongoing. Thankfully, these sort of copper measurements are rare in this data set and it would appear that surface enrichment, whether deliberate or due to the burial environment, will generally not be an issue for the *aurei* analysed here.

Three certified alloy standards were used. These were made by Micro-Analysis Consultants Ltd and are referred to as MAC 1, 2 and 3 (fig. 2). Each standard was analysed 12 times across the duration of the analyses. Figure 2 shows that the XRF unit was most accurate

38 Caley 1952, 678, Table V.
39 Green *et al.* 2021.
40 Blakelock 2016, 923-924.
41 *Ibid.*, 923, Table 3.

when analysing MAC 1 and MAC 2 – the results were within a fraction of 1 wt% for gold, silver and copper for both of these standards. The margin of error was greater for MAC 3, however. This is not particularly a problem here as none of the coins analysed are less than 80% gold, and as such MAC 1 and 2 are much more representative standards. Given all this, the margin of error for the results is probably significantly less than one percentage point.

Standard (wt%)	Mean Au (wt%)	S.D. Au	Mean Ag (wt%)	S.D. Ag	Mean Cu (wt%)	S.D. Cu
MAC 1 (94% Au, 4.5% Ag, 1% Cu)	94.16%	0.05	4.55%	0.04	0.96%	0.02
MAC 2 (75% Au, 19% Ag, 5% Cu)	75.28%	0.11	18.83%	0.13	5.12%	0.06
MAC 3 (59% Au, 30% Ag, 9% Cu)	57.68%	0.2	32.58%	0.29	8.46%	0.13

Fig. 2. Standards analysed during the analysis of *aurei* dating between 46 BC and AD 76.

The XRF results themselves are quite straightforward. Between 46 BC and the beginning of the AD 68/69 civil wars, the purity of the *aureus* clusters at just over 99% pure.[42] The least pure coin in this set was 98.90% gold and the most was 99.95% pure (fig. 3). For over a century, then, the *aureus* was characterised by metallurgical stability. This is in quite clear contrast to the weight standard of the *aureus*, which seems to have been changed at least four times before the Neronian coinage reforms in AD 64. A reduction in the purity of the *aureus* and a reduction in weight effectively had the same outcome – less gold was used to make each coin. So why did the Roman state *only* reduce the weight standard in this period, but not the purity?

On a practical level, a weight reduction is much easier for the user of the coin to assess than a metallurgical debasement. A weight reduction of a few tenths of gram can just about be detected by feel, but it can be easily and accurately detected using a simple set of scales. A metallurgical debasement, on the other hand, is much harder to detect. A major debasement of the gold coinage would almost certainly cause the colour of the coin to change, but a small debasement would be hard to visually identify. We know that touchstones were in use in the ancient world,[43] but without access to a variety of strong acids this technique was, again, based on the ability to visually detect colour differences. The final option was to attempt to refine out any suspected impurities and weigh the mass of pure gold left at the end; this, of course, involves the individual destroying their coin. A weight reduction, then, is relatively straightforward, open, and easy for the user of the coin to detect and assess.

42 These results are congruent with those presented by Suspène *et al.* 2020; Bocciarelli *et al.* 2017, 178; and Callu *et al.* 1985, 81.

43 Oddy 1986.

A purity reduction is more complicated: its extent is hidden from the user and it is much more difficult to accurately quantify.

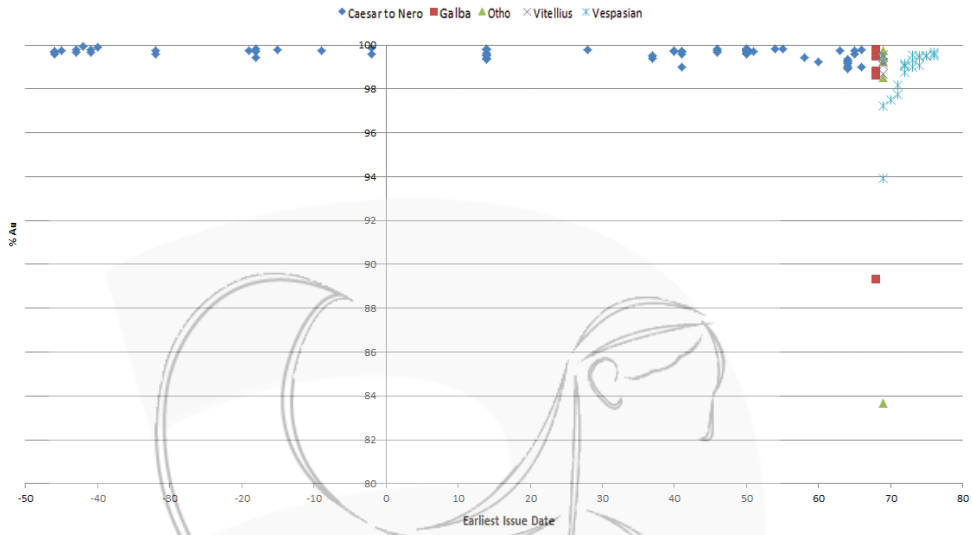

Fig. 3. The percentage of gold in *aurei* dating from 46 BC to AD 76 in the Ashmolean's collection, obtained via XRF.

By keeping the purity highly consistent the Roman state is effectively trying to breed trust in the gold coinage. An individual is much more likely to be, or at least feel, deceived by a small debasement than they are by a weight reduction. Furthermore, if an individual can trust that the *aureus* is generally pure gold, then all they have to worry about to determine the intrinsic value of a coin is its weight. In the reverse system – where the weight standard is trusted to be stable but the purity is not – the user not only has to find a way to accurately determine the purity of the coin, but also has to take into account incidental weight loss through wear to determine the intrinsic value. As such, not only is an individual at a greater risk of deception in the second system, but they also have to go through much more effort to indemnify themselves against it. By ensuring a high purity gold coinage, then, the Roman state is instituting a much simpler system of trust for individuals to have faith in.

Of course, not all economic decisions in the Roman world are rational ones. D. Walker[44] states that Roman economic ideas are inseparable from moral ideas, and Butcher *et al.*[45] broadly agree that rational economic ideas do not always govern Roman economic decisions. Considering this, it can be argued that there is a moral dimension to debasements in the Roman world. For example, J. Williams[46] sees the restoration of the purity of the *denarius* under Domitian and Diocletian as public acts of moral revivalism. Emperors, then, may be

44 Walker 1978, 106.
45 Butcher *et al.* 2014.
46 Williams 2007, 177-178.

unwilling to debase the gold coinage as this could be seen as an act of lowering and debasing standards more generally.[47] This may not necessarily be completely irrational on the part of the state. With the absorption of the powers of the *Pontifex Maximus* and the *Censor*, the office of Emperor held ceremonial responsibility for upholding religious, moral and social standards. An emperor's position, then, may be weakened if he is perceived to be failing in this duty. Refusing to debase the gold coinage could help an emperor project his commitment to maintaining these standards more generally.

The metallurgical stability of the *aureus* in this period ends with the civil wars of AD 68/69. D. Bocciarelli *et al.*[48] also detected intermittent debasements of one or two percentage points at this time, although the Ashmolean collection seems to contain a number of much more heavily debased issues. For example of the six *aurei* of Galba analysed, one was heavily debased at only 89.0% pure; and of the four *aurei* of Vespasian with an earliest issue date of AD 69 analysed, two were debased at 93.8% and 97.2% pure (fig. 3). After the civil wars it seems to have taken a few years for Vespasian to restore the purity of the *aureus*. *Aurei* issued in AD 70 and AD 71 cluster at around 97% pure, but by AD 72 they seem to be clustering at approximately 99% pure again (fig. 3). These debasements are all relatively short lived, and should probably be seen as responses to acute fiscal inadequacy brought on by the various civil wars these claimants for the throne were fighting. The level of debasement that is seen is not insignificant, however. *Aurei* that are only 80% to 95% pure are not produced again until the Third Century Crisis,[49] which should give some idea of the disruptive impact of the AD 68/69 civil wars. Furthermore, it seems that a few years recovery time was required before the state was able to start producing *aurei* at full purity again. It seems that only some of the coins produced were heavily debased during the wars themselves, and Vespasian's more regular debasement in the immediate aftermath was only by two percentage points – and, of course, ended within a few years. In terms of trust, it is unlikely that the production of these coins did much to shake the faith of individuals in the monetary system as a whole.

Conclusion

Depending on which data set is used, two quite radically different characterisations of the *aureus* could be written. If only the metallurgical data is used, then one could argue that the state spent well over a hundred years ensuring the purity of the *aureus* and that it was unwilling to test the faith individuals had in the gold coinage by altering it in any way. Indeed, when fiscal inadequacy seemed to have demanded debasement during the AD 68/69 civil wars, restoration to full purity came within a few years – reinforcing the state's commitment to a full purity gold coinage. From this data, then, we get the picture of a gold coinage governed by metallist principles. The metrological data, however, give the opposite view. Here the state is willing to lower the weight standard every few decades and individuals

47 Suspène *et al.* 2020, 59-60.
48 Bocciarelli *et al.* 2017, 178, fig. 3.
49 Morrisson *et al.* 1985.

– or at least hoarders – seem to keep their faith in the value of the *aureus* regardless. Looking at this dataset alone, then, it seems that the gold coinage is governed by more chartalist principles. These seemingly contradictory conclusions really sum up the economic tension that defines trust in the Roman economy. Certainly, individuals had faith in the face value of the *aureus* – and the state was able to test this trust by altering weight standards – but this trust was actively cultivated by the Roman state by ensuring a full purity gold coinage. In this sense, then, trust in the *aureus* existed within a tension between the seemingly contradictory metallist and chartalist principles held by individuals.

Abbreviations

CHRE Online
Coin Hoards of the Roman Empire Online (http://chre.ashmus.ox.ac.uk)
CHRE ID
Identification number of hoards on the CHRE website. Replace #### at the end of the following URL with an ID number to access specific hoard records (http://chre.ashmus.ox.ac.uk/hoard/####)
CHRR Online
Coin Hoards of the Roman Republic Online (http://numismatics.org/chrr)
CHRR ID
Identification code of hoards on the CHRR website. Replace XXX at the end of the following URL with an ID code to access specific hoard records (http://numismatics.org/chrr/id/XXX)
LA-ICP-MS
Laser ablation inductively coupled plasma mass spectrometry
S. D.
Standard Deviation
wt.%
Weight Percentage
XRF
X-ray fluorescence

Hoard List

Hoards used for metrological data:
Ambenay, France, CHRE ID: 5441[50]
Besançon, France, CHRE ID: 5443[51]
Bredgar, England, CHRE ID: 1042[52]
Brescello, Italy, CHRE ID: 10064[53]
Brindisi, Italy, CHRE ID: 10065[54]

50 Giard 1974.
51 Giard 1992, 128.
52 Loriot & Bland 2010, no. 332, 187.
53 Schwabacher 1944.
54 Friedländer 1874, 288-289.

Chippenham, England, CHRE ID: 92[55]
Patras, Greece, CHRE ID: 6729[56]
Szombathely-Herényi, Hungary, CHRE ID: 5465[57]

All other hoards

Beaufort-En-Vallée, France, CHRE ID: 5922
Campiglia Maritima, Italy, CHRE ID: 9294
Cavriago, Italy, CHRR ID: CAV
Iluro, Spain, CHRE ID: 8477
Lentilly, France, CHRE ID: 6312
Limoges, France, CHRE ID: 6069
Montans I, France, CHRE ID: 5464
Saint-Georges-Sur-Loire, France, CHRE ID: 5911
Saint-Priest-sous-Aixe, France, CHRE ID: 6074
Sallèdes, France, CHRE ID: 7351
Thrace, Greece, CHRR ID: THR
Tipasa, Algeria, CHRE ID: 4941

Bibliography

Allag, C. and Janin, M., ed. (1992): *20 000 m³ d'histoire : les fouilles du parking de la mairie à Besançon*, Besançon.

Blakelock, E. S. (2016): "Never judge a gold object by its surface analysis: A study of surface phenomena in a selection of gold objects from the Staffordshire hoard", *Archaeometry*, 58(6), 912-929.

Bocciarelli, D., Blet-Lemarquand, M. and Suspène, A. (2017): "Les monnaies d'or des années 68-69 p.C. frappées dans les provinces occidentales : l'apport de l'étude pondérale et des analyses élémentaires", in: Bricault *et al.*, ed. 2017, 175-188.

Bricault, L., Burnett, A., Drost, V. and Suspène, A., ed. (2017): *Rome et les Provinces. Monnayage et Histoire. Mélanges offerts à Michel Amandry*, Bordeaux.

Butcher, K., ed. (2020): *Debasement. Manipulation of coins standards in pre-modern monetary systems*, Oxford-Philadelphia.

Butcher, K., and Ponting, M. (2005): "The Roman Denarius under the Julio-Claudian emperors: Mints, metallurgy and technology", *OJA*, 24(2), 163-197.

Butcher, K., Ponting, M., Evans, J., Pashley, V. and Somerfield, C. (2014): *The Metallurgy of Roman Silver Coinage: From the Reform of Nero to the Reform of Trajan*, Cambridge.

Buttrey, T. V. (1961): "Dio, Zonaras and the value of the Roman *Aureus*", *JRS,* 51, 40-45.

Caley, E. R. (1952): Estimation of composition of ancient metal objects", *Analytical Chemistry*, 24(4), 676-681.

Callu, J.-P., Brenot, C., Barrandon, J.-N. and Poirier, J. (1985): "*Aureus obryziacus*", in: Morrisson *et al.* 1985, 81-111.

Duncan-Jones, R. (1994): *Money and Government in the Roman Empire*, Cambridge.

Friedländer, J. (1874): "Die Erwerbungen des Königlichen Münzkabinetts in Jahre 1874", *ZfN*, II, 285-294.

55 Loriot & Bland 2010, no. 49, 121.
56 Touratsoglou 1978.
57 Torbágyi 1994.

Geil, E. C. and Thorne, R. E. (2014): "Correcting for surface topography in X-ray fluorescence imaging", *Journal of synchrotron radiation*, 21(6), 1358-1363.

Giard, J.-B. (1974): "Le trésor d'*aurei* d'Ambenay", *RN*, 16, 68-80.

Giard, J.-B. (1992): "Un trésor à Vesontio", in: Allag & Janin, ed. 1992, 128.

Green, G. A., Ishida, K., Hampshire, B., Butcher, K., Pollard, A. M. and Hillier, A. (2021): "Understanding Roman gold coinage inside out", *Journal of Archaeological Science*, 134, 105470

Haklai-Rotenberg, M. (2011): "Aurelian's monetary reform: between debasement and public trust", *Chiron*, 41, 1-39.

Hall, E. T. (1961): "Surface enrichment of buried metals", *Archaeometry*, 4, 61-66.

Hook, D. R. and Needham, S. P. (1989): "A comparison of recent analyses of British Late Bronze Age goldwork with Irish parallels", *Jewellery Studies*, 3, 15-24.

Hultsch, F. (1866): *Metrologicorum scriptorum reliquiae* (Vol. II), Leipzig.

Loriot, X. and Bland, R. (2010): *Roman and Early Byzantine Gold Coins Found in Britain and Ireland*, London.

Matthaios, S. (2014): "Greek Scholarship in the Imperial Era and Late Antiquity", in: Montanari *et al.*, ed. 2014, 184-296.

Metcalf, W. E., ed (2012): *The Oxford Handbook of Greek and Roman Coinage*, Oxford.

Molinari, M. C. (2003): "Gli *aurei* a nome di Giulio Cesare e Aulo Irzio", *RIN*, 104, 165-253.

Montanari, F., Matthaios, S. and Rengakos, A., ed. (2014): *Brill's companion to ancient scholarship Vol. 1*, Leiden.

Morrisson, C., Brenot, C., Callu, J.-P., Barrandon, J.-N., Poirier, J. and Halleux, R. (1985): *L'Or monnayé I. Purification et altérations de Rome à Byzance*, Paris.

Oddy, W. A. (1986): "The touchstone: the oldest colorimetric method of analysis", *Endeavour*, 10(4), 164-166.

Reddé, M., ed. (2014): *De l'or pour les braves ! Soldes, armées et circulation monétaire dans le monde romain*, Bordeaux.

Robinson, D. and Wilson, A., ed. (2011): *Maritime archaeology and ancient trade in the Mediterranean*, Oxford.

Schwabacher, W. (1944): "Tessin and the Brescello gold hoard of 1714", *Nordisk numismatisk årsskrift*, 231-243.

Suspène, A., Bocciarelli, D., Blet-Lemarqand, M. and Gehres, B. (2020): "Gold coinage and debasement. A preliminary examination of the fineness of Roman gold coinage from the Republic and early Empire", in Butcher, ed. 2020, 53-62.

Suspène, A., Chausserie-Laprée, J. and Rétif, M. (2016). "Un ensemble d'*aurei* (46-27 a.C.) mis au jour sur le site de Tholon lors des fouilles d'archéologie préventive du lycée Paul-Langevin à Martigues", *BSFN,* 71, 3, 82-91.

Speidel, M. (2014): "Roman army pay scales revisited: responses and answers", in: Reddé, ed. 2014, 53-62.

Tate, J. (1986): "Some problems in analysing museum material by nondestructive surface sensitive techniques", *Nuclear Instruments and Methods in Physics Research*, 14, 20-23.

Torbágyi, M. (1994): "A Szombathely-herényi aranyéremlelet / Der römische Münzfund von Szombathely-Herény", *Numizmatikai Közlöny*, 92-3, 27-33.

Touratsoglou, J. (1978): "The 1976 Patras Hoard of *Aurei* from the Early Empire", *Nomismatika chronika*, V-VI, 41-52.

von Bahrfeldt, M. (1923): *Die Römische Goldmünzenprägung während der Republik und unter Augustus. Eine chronologische und metrologische Studie*, Halle.

Walker, D. R. (1978): *The Metrology of the Roman Silver Coinage, Part III: From Pertinax to Uranius Antoninus* (*BAR Suppl. 40*). Oxford.

Williams, J. (2007): "Pliny, antiquarianism, and Roman imperial coinage", *BICS,* 50, Suppl. 100, 71-182.

Wilson, A. (2011): "Developments in Mediterranean shipping and maritime trade from 200 BC to AD 1000", in: Robinson & Wilson, ed. 2011, 33-59.

Woytek, B. (2003): Arma et nummi *: Forschungen zur römischen Finanzgeschichte und Münzprägung der Jahre 49 bis 42 v. Chr.*, Vienna.

Woytek, B. (2012): "The Denarius coinage of the Roman Republic" in: Metcalf, ed. 2012, 315-331.

Résumés

The LA-ICP-MS analysis of gold coins for the AVREVS project. Method and Methodology

Maryse Blet-Lemarquand

Abstract: The elemental analysis of gold coins by LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry) is at the heart of the scientific approach developed for the AVREVS research project. This article aims at presenting the analytical method and the methodology implemented for addressing issues of coined gold provenancing on the basis of case studies. While the focus is on the interpretation and significance of platinum and palladium contents –tracer elements of ancient gold – compositional trends are also highlighted for other trace elements in gold coins.

Keywords: LA-ICP-MS, Gold coins, gold stock, provenance, trace element, platinum elements.

Résumé : L'analyse élémentaire des pièces d'or par LA-ICP-MS (Laser Ablation Inductively Coupled Plasma Mass Spectrometry) est au cœur de la démarche scientifique développée pour le projet de recherche AVREVS. Cet article a pour objectif de présenter la méthode d'analyse et la méthodologie mises en œuvre pour aborder les questions de provenance de l'or monnayé à partir de cas d'étude. Si l'accent est mis sur l'interprétation des teneurs en platine et palladium – éléments traceurs des ors anciens – et sur leur signification, des tendances de composition sont aussi mises en évidence pour d'autres éléments traces des monnaies d'or.

Mots clés : LA-ICP-MS, monnaies en or, stock d'or, provenance, élément trace, éléments platinoïdes.

Une représentation grecque de l'or du Roi : Agésilas et les "trente mille archers"

Pierre Pontier

Résumé : Lorsqu'Agésilas est rappelé en Grèce en 394 a.C. par les éphores pour venir au secours de sa cité menacée par une coalition grecque, il aurait plaisanté sur l'apport supposé du Roi à cette coalition en disant qu'il avait été chassé par "trente mille archers". Parmi les trois versions de l'anecdote rapportée par le seul Plutarque, celle des *Apophthegmes Lacédémoniens*

est probablement la matrice des deux autres. Si Xénophon ne mentionne pas la plaisanterie qui fait partie de la propagande du roi spartiate, c'est parce qu'elle ne correspondait pas au récit historique qu'il voulait faire du transfert d'or perse, par l'intermédiaire des relations diplomatiques ambiguës entre Tithraustès et Agésilas. S'inscrivant néanmoins dans la même propagande royale que le bon mot, il a préféré représenter la force militaire de l'armée grecque et la faiblesse perse en acte plutôt qu'en mots et en symbole.

Mots clés : Agésilas, or, darique, talents, archer, Sparte.

Abstract: When Agesilaus was called back to Greece in 394 BC by the ephors to come to the rescue of his city threatened by a Greek coalition, he may have joked about the supposed contribution of the King to this coalition by saying that he had been driven out by "thirty thousand archers". Among the three versions of the anecdote reported by Plutarch, that of the *Lacedemonian Apophthegms* is probably the template for the other two. Xenophon does not mention the joke which is part of the propaganda of the Spartan king: it did not fit the historical account that he wanted to give of the transfer of the Persian gold, by stressing the ambiguous diplomatic relations between Tithraustes and Agesilaus. Nevertheless, in keeping with the same royal propaganda as the joke, he chose to represent the military strength of the Greek army and the Persian weakness in deed, rather than in words and symbol.

Keywords: Agesilaus, gold, daric, archer, talents, Sparta.

Greek Gold Coinage before Alexander the Great

Wolfgang Fischer-Bossert

Abstract: As Greek coinage was essentially a silver coinage, the rare gold issues had to adjust themselves to the current gold-silver ratio in one way or another. Either they have the weight of a silver denomination, thus allowing for changing exchange rates, or they fix a certain gold-silver ratio by having weights that implement the ratio according to existing or fictious silver denominations. Some Greek cities issued gold coins of both kinds side by side. Discussing examples from the first three centuries of Greek coinage, the article underlines that most gold issues were produced in times of hardship.

Keywords: Sardes, Syracuse, Cyrene, Tarentum, Lampsakos, Philip II, Gold-silver ratio, West African gold, Darics, Attic standard, Chian standard, Bimetallic coinage.

Résumé : La monnaie grecque étant essentiellement une monnaie d'argent, les rares émissions d'or ont dû s'adapter d'une manière ou d'une autre au rapport or-argent qui existait. Soit elles ont le poids d'une dénomination d'argent, ce qui permet de modifier les taux de change, soit elles établissent un ratio or-argent en adoptant des poids qui mettent en œuvre ce ratio en fonction de dénominations d'argent existantes ou fictives. Certaines cités grecques ont émis des monnaies d'or des deux sortes en même temps. En discutant des

exemples des trois premiers siècles du monnayage grec, l'article souligne que la plupart des émissions d'or ont été produites dans des périodes difficiles.

Mots clés : Sardes, Syracuse, Cyrène, Tarente, Lampsaque, Philippe II, ratio or-argent, or d'Afrique occidentale, Dariques, étalon attique, étalon chiote, monnayage bi-métallique.

L'or du monde grec : fantasmes et réalités (un panorama général quantifié)

François de Callataÿ

Résumé : La présente étude fournit pour la première fois un panorama général quantifié de l'or monnayé du monde grec, du monde archaïque à la fin de l'époque hellénistique, en tirant parti de toutes les études de coins disponibles. La mise en perspective de ce riche matériel confirme l'importance de la monétisation opérée par Alexandre le Grand à partir des trésoreries perses (telle qu'en rendent compte les pièces de Plaute et de Térence évoquées ici en préambule). Mais les émissions massives de statères au nom d'Alexandre sont recadrées dans un contexte plus large en insistant sur l'importance des frappes antérieures et contemporaines.

Mots clés : Histoire grecque, or monnayé, quantification, études de coins, alexandres, Plaute.

Abstract: This study provides for the first time a quantified general overview of monetized gold for the Greek world, from the Archaic to the end of the Hellenistic period, taking advantage of all available die studies. Put in perspective, this rich evidence confirms the importance of the monetization carried out by Alexander the Great from Persian treasuries (as reflected by plays of Plautus and Terence here mentioned in the preamble). But the massive issues of gold coins in the name of Alexander is reframed in a broader context by emphasizing the abundance of earlier and contemporary production.

Keywords: Greek history, monetized gold, quantification, die studies, Alexanders, Plautus.

Greek Gold from East to West

Frédérique Duyrat, Julien Olivier, Benjamin Gehres

Abstract: The IRAMAT-Centre Ernest-Babelon began analysing Greek gold at the end of the 1990s. The first efforts, all using the LA-ICP-MS method, mainly focused on the gold of the Hellenistic dynasties in the Eastern Mediterranean. The AVREVS project has provided an opportunity to extend the study to the gold coinage of Greek cities in the western

Mediterranean. This article explores the results of the analyses of eastern gold and compares them with the results obtained for the Greek cities of the western Mediterranean, Carthage and Rome. It highlights a stock of Hellenistic gold with a very broad signature - maybe due to the remelting of the Persian treasures put into circulation following the Macedonian conquest - as well as the flow of metal during the reigns of Alexander and his successors. Western Greek golds are distinguished by different fingerprints confirmed by a separate circulation from that of the Eastern Mediterranean.

Keywords: gold, elemental analyses, LA-ICP-MS, Persian Empire, Alexander the Great, Hellenistic kingdoms.

Résumé : L'IRAMAT - Centre Ernest-Babelon a débuté les analyses de l'or grec à la fin des années 1990. Les premiers travaux, utilisant tous la méthode LA-ICP-MS, ont surtout concerné l'or des dynasties hellénistiques en Méditerranée orientale. Le projet AVREVS a été l'occasion d'étendre l'étude aux monnayages d'or des cités grecques de Méditerranée occidentale. Cet article explore les résultats des analyses de l'or oriental et les met en regard des résultats obtenus pour les cités grecques de Méditerranée occidentale, Carthage et Rome. Il met en évidence un stock d'or hellénistique à très large signature - sans doute due à la refonte des trésors perses mis en circulation à la suite de la conquête macédonienne - ainsi que les flux de métal à l'époque d'Alexandre et de ses successeurs. Les ors grecs occidentaux s'en distinguent par des signatures différentes confirmées par une circulation séparée de celle de Méditerranée orientale.

Mots clés : or, analyses élémentaires, LA-ICP-MS, Empire perse, Alexandre le Grand, royaumes hellénistiques.

L'or de Pyrrhos en Occident

Catherine Grandjean, Jean-Christophe Couvenhes, Maryse Blet-Lemarquand

Résumé : Les analyses élémentaires par LA-ICP-MS de monnaies pratiquées dans le cadre du projet AVREVS confirment l'attribution à l'atelier de Syracuse des émissions en or aux types d'Athéna et de Nikè au trophée et au nom du roi Pyrrhos. La composition "orientale", c'est-à-dire similaire à l'or des rois hellénistiques d'Orient, d'une monnaie en or de ce type invite toutefois à réexaminer l'hypothèse d'une aide apportée au souverain épirote par Ptolémée II, mais des analyses complémentaires seraient nécessaires pour trancher, d'autant que le texte de Justin n'est pas clair. À en juger par les données disponibles sur la production monétaire contemporaine en Grande-Grèce et en Sicile, Pyrrhos a utilisé le numéraire disponible, sans chercher à unifier le domaine sur un plan monétaire ni à multiplier les émissions à son nom et à ses types, à l'instar d'Alexandre le Grand en Orient.

Mots clés : Tarente, Héraclée de Lucanie, Syracuse, Locres, Carthage, Ptolémées, Pyrrhos.

Abstract: LA-ICP-MS elemental analyses of coins carried out within the framework of the AVREVS project confirm the attribution of gold issues to the Athena and Nike types to the trophy and in the name of King Pyrrhus at the Syracuse workshop. The "eastern" composition, *i.e.* similar to the gold of the Hellenistic kings of the East, of a gold coin of this type invites, however, to re-examine the hypothesis of an aid given to the Epirote sovereign by Ptolemy II, but further analyses would be necessary to decide, especially as Justin's text is not clear. Judging from the available data on contemporary monetary production in Magna Graecia and Sicily, Pyrrhus used the available cash, without seeking to unify the field in monetary terms or to multiply issues in his name and type, as Alexander the Great did in the East.

Key words: Taranto, Heraclea Lucania, Syracuse, Locri, Carthage, Ptolemies, Pyrrhus.

Carthaginian and Syracusan gold, from the reign of Dionysios the Elder to the end of the First Punic War: a comparative examination

Jérémy Artru, Pierre-Olivier Hochard, Benjamin Gehres

Abstract: This study aims to explore the interaction of Carthage and Syracuse between the mid-fourth and mid-third centuries by examining their gold coinage. Both the capital of the Punic world and the main Greek city in the West produced an abundant gold coinage which it is of fundamental importance to study to understand the place and circulation of gold in the western Mediterranean. This work is mainly based on the results of archaeometric analyses, which provide new information on the elemental composition of coins, both in major and trace elements. Coin hoards are also investigated. These two different approaches reveal close correlations between Carthaginian and Syracusan gold coinages in terms of metal composition and circulation. These similarities are particularly clear during the period of Agathocles' reign in Syracuse, but take their roots earlier and remain observable until the end of the First Punic War. The latter, which marks the beginning of Roman rule in the region, is indeed a major rupture in the political life as well as in the monetary production of the two cities.

Keywords: Syracuse, Carthage, Greco-punic interactions, gold coinage, archaeometric analyses, Greek coin hoards, coin circulation.

Résumé : Cette étude se propose de mettre en lumière les relations entretenues par Carthage et Syracuse entre le milieu du IV^e^ et le milieu du III^e^ siècle en se fondant sur l'étude renouvelée de leurs monnayages d'or. Tant la métropole du monde punique que la principale cité grecque d'Occident ont en effet émis d'abondantes séries de monnaies d'or, qui sont de première importance pour l'étude de la place et de la circulation de ce métal en Méditerranée occidentale. Ce travail s'appuie essentiellement sur le nouvel apport que constituent les résultats d'analyses archéométriques, qui permettent de connaitre la composition élémentaire des monnaies en métal précieux, tant en éléments majeurs qu'en

éléments traces. Les trésors monétaires font également l'objet d'un examen dédié. Ces deux approches permettent de faire ressortir d'étroites corrélations entre les monnaies d'or carthaginoises et syracusaines en matière de composition et de circulation. Ces parallèles sont particulièrement nets pendant la période du règne d'Agathocle à Syracuse, bien qu'ils prennent leurs racines antérieurement et restent observables jusqu'à la fin de la première guerre punique. Cette dernière, qui marque le début de l'hégémonie romaine dans la région, constitue en effet une rupture majeure dans la vie politique comme dans la production monétaire des deux cités.

Mots clés : Syracuse, Carthage, relations gréco-puniques, monnayage d'or, analyses archéométriques, trésors monétaires grecs, circulation monétaire.

Les bijoux en or du Cabinet des médailles à l'épreuve du laser : analyses de composition métallique de bijoux gréco-romains par LA-ICP-MS

Mathilde Avisseau-Broustet et Thomas Faucher

Résumé : Le programme AVREVS fut l'occasion de profiter de la convention entre le département des Monnaies, médailles et antiques de la Bibliothèque nationale de France et l'IRAMAT – Centre Ernest-Babelon pour étudier un échantillon de l'exceptionnelle collection de bijoux en or de la Bibliothèque nationale de France. Les analyses de onze bagues gréco-romaines en or menées avec la méthode LA-ICP-MS sont donc présentées ici. Cette méthode, également utilisée dans le cadre du programme pour analyser les monnaies en or, permet de comparer la composition des deux ensembles, aussi bien dans leurs teneurs en éléments majeurs qu'en éléments-traces.

Mots clés : Orfèvrerie, bijoux, or, LA-ICP-MS, Égypte, Proche-Orient.

Abstract: The AVREVS project offered the chance to profit from the agreement between the Department of Coins and Medals of the Bibliothèque nationale de France and the IRAMAT – Centre Ernest-Babelon to study a sample of the outstanding gold jewellery collection of the Bibliothèque nationale de France. Analyses of eleven Graeco-Roman gold rings, conducted with the LA-ICP-MS method, are presented here. This method, also used in the framework of the project to analyse gold coins, allows fruitful comparisons between the metallic composition of the two categories of object, in the contents of both major and trace elements.

Keywords: Jewellery, Gold, LA-ICP-MS, Egypt, Near East.

Greek and Celtic gold (4th-3rd c. BC.): transfer or interplay?

Sylvia Nieto-Pelletier et Julien Olivier

Abstract: The link between the adoption of coins in Celtic societies and the Greek-Macedonian coinages that served as a model for them has been studied on numerous occasions. For a long time this connection was perceived through the lens of the Celtic mercenaries in the Mediterranean societies, who were then considered as the only vector of the importing of Greek coins in Gaul, staters with types of Philip II of Macedon in particular. In an article published in 2016, S. Nieto-Pelletier and J. Olivier tried to show that the numismatic and archaeological data went against this as the only viable hypothesis. This article proposes to place the adoption of gold coins by Celtic societies in a broader context at the turn of the 4th and 3rd centuries BC, drawing on numismatic, archaeometric, spatial and textual data. As an example of a Western and Eastern Mediterranean connection, and/or as an "anomaly" on the level of Celtic society, the introduction of gold coins in Gaul in the 3rd century BC proves to be a complex phenomenon that is particularly difficult to define precisely.

Keywords: Gold coins, Greek coinages, beginnings of Celtic coinages, elemental analysis, stocks of gold, Western Mediterranean area.

Résumé : Le lien entre l'adoption de la monnaie dans les sociétés celtiques et les numéraires gréco-macédoniens qui leur ont servi de modèle a été étudié à de nombreuses reprises. Longtemps cette connexion fut perçue à travers le prisme du mercenariat celte dans les sociétés méditerranéennes, alors considéré comme seul vecteur de l'importation de numéraires grecs – notamment macédoniens aux types de Philippe II – en Gaule. Dans un article paru en 2016, S. Nieto-Pelletier et J. Olivier ont tenté de montrer que les données numismatiques et archéologiques allaient à l'encontre de cette seule hypothèse. Cet article propose de replacer l'adoption de la monnaie d'or par les sociétés celtiques dans le contexte plus large des sociétés du pourtour du bassin méditerranéen au tournant des IV^e^ et III^e^ siècles a.C. grâce aux données numismatiques, archéométriques, spatiales et textuelles. Exemple de connexion à l'échelle de la Méditerranée occidentale et orientale, et/ou "anomalie" à l'échelle de la société celtique, l'introduction de la monnaie d'or en Gaule au III^e^ siècle a.C. s'avère un phénomène complexe particulièrement difficile à cerner avec précision.

Mots clés : Monnaies d'or, monnayages grecs, naissance de la monnaie gauloise, analyses élémentaires, stocks d'or, pourtour du bassin méditerranéen.

Référentiels miniers pour le traçage de l'or durant les périodes anciennes

Sandrine Baron

Résumé : Les districts miniers contiennent des ressources minérales dont l'histoire géologique a été plus ou moins complexe. Leur caractérisation, dans une perspective archéologique et historique, est un point clef nécessaire pour résoudre et affiner les études de provenance et plus particulièrement celles de l'or, métal pour lequel le manque de référentiels miniers et métallurgiques est important.

Il sera exposé ici *i*) les limites classiquement rencontrées dans les études de provenance de l'or, *ii*) l'intérêt de travailler à l'échelle du district minier et métallurgique, *iii*) les apports d'une approche géologique et géochimique couplée à l'archéologie minière.

Deux exemples archéologiques illustreront ces différents points : d'une part la Dacie (Roumanie, Mont-Apusènes) pour la période romaine, d'autre part le territoire des Lemovices (France, Limousin) pour la période protohistorique.

Mots clés : chaîne opératoire, minerais, archéologie minière, géologie, isotopes, analyses élémentaires.

Abstract: Mining districts contain mineral resources whose geological history has been more or less complex. Their characterization, from an archaeological and historical perspective, is a key point necessary to solve and refine studies of provenance and more particularly of gold where the lack of mining and metallurgical referentials is important.

This paper will discuss *i*) the limitations traditionally encountered in gold provenance studies, *ii*) the value of working at the mining district level, and *iii*) the contributions of a geological and geochemical approach coupled with mining archaeology.

Two archaeological examples will illustrate these different points. On the one hand, Dacia (Romania, Apuseni Mountains), for the Roman period and on the other hand, the Lemovices territory (France, Limousin), for the Protohistoric period.

Keywords: *chaîne opératoire*, ores, mining archaeology, geology, isotopes, elemental analysis.

The Beringen Hoard (Limburg, Belgium). An assemblage of gold coins and ornaments from the 2nd century BC

Marilou Nortez, Guido Creemers, Barbara Armbruster, Maryse Blet-Lemarquand, Sylvia Nieto-Pelletier, Anaïs Cheuton

Abstract: The Beringen hoard was discovered in Belgium in 1995 when a house was built. Thirty gold elements were deposited, namely: five ornaments, materialized by fragments of tubular torcs and a fragment of a twisted bracelet, and 25 coins, consisting of 3 crescent staters and 22 "Rainbow cups". The latter provide a *terminus post quem* around the middle of the 2nd century BC (La Tène C2-D1).

The typo-technological study of ornaments makes it possible to highlight that different manufacturing techniques coexist within the same hoard (lost wax casting, chasing, mechanical joints, metal soldering, etc.). The elemental composition analyses of coins and objects by LA-ICP-MS reveal that the gold used was intentionally alloyed with copper and silver, both for the ornaments and for the coins: the result yielded a gold fineness mainly ranging from 66% to 73%. The uniformity of the platinum and palladium chemical fingerprint suggests the use of a single gold stock to create all the objects of the hoard.

From the 2nd century BC onwards, most of the hoards with ornaments also contain coins, indicating an undeniable link between these two object categories, although the nature of this link remains difficult to characterise.

Keywords: coins, gold, hoard, Late Iron Age, ornaments, torcs.

Résumé : Le dépôt de Beringen fut découvert en Belgique en 1995 lors de la construction d'une maison. Trente éléments en or composent ce dépôt, à savoir : cinq parures, matérialisées par des fragments de torques tubulaires et un fragment de bracelet torsadé, et 25 monnaies, parmi lesquelles trois statères au croissant et 22 "Rainbow cups". Ces dernières fournissent un *terminus post quem* autour du milieu du IIe siècle a.C. (La Tène C2-D1).

L'étude typo-technologique des objets de parure permet notamment de souligner que différentes techniques de fabrication coexistent au sein du même dépôt (fonte à la cire perdue, déformation plastique, assemblages mécaniques, soudures métalliques, etc.). Quant aux analyses de la composition élémentaire des monnaies et des objets par LA-ICP-MS, elles permettent de mettre en évidence que l'or employé a été allié volontairement à du cuivre et à de l'argent, aussi bien pour les parures que pour les monnaies : en résulte un titre en or généralement compris entre 66 % et 73 %. La relative uniformité de la signature chimique en platine et en palladium suggère que l'ensemble de ce dépôt résulte de l'emploi d'un même stock d'or.

À partir du IIe siècle a.C., la plupart des dépôts non-funéraires de parures contiennent aussi des monnaies, indiquant un lien indéniable entre ces deux catégories d'objets, bien que la nature de ce lien demeure difficile à caractériser.

Mots clés : Dépôt non funéraire, monnaies, or, parures, second âge du Fer, torques.

Precious little? Some aspects of the circulation of gold in Armorica and south-west Britain

Philip de Jersey

Abstract: The westernmost coin-using regions of the Celtic world – Armorican Gaul and the region occupied by the Durotriges, in south-west Britain – seem to have in common a comparatively small quantity of gold in their coinage. This is in marked contrast to the rest of south-east Britain, or to Belgic Gaul. This paper will consider some of the reasons why this seems to be the case, and examine how developments in one region may have influenced the other. It will also consider whether we run the risk of assuming that 'absence of evidence is not evidence of absence'.

Keywords: Gold, Durotriges, Armorica, Gallic War, Jersey, coins, torques.

Résumé : Les régions de l'ouest du monde celtique qui utilisaient la monnaie – l'Armorique et la région occupée par les Durotriges, dans le sud-ouest de l'Angleterre – semblent avoir en commun des monnayages contenant de faibles quantités d'or, ce qui contraste avec les émissions des régions voisines, dans le sud de l'Angleterre et en Gaule Belgique. Cet article examine les raisons à l'origine de cette situation, et s'interroge sur les influences que ces régions ont pu exercer les unes sur les autres. On se demandera également s'il est pertinent de considérer que "l'absence de preuve n'est pas une preuve d'absence".

Mots clés : Or, Durotriges, Armorique, Guerre des Gaules, Jersey, monnaies, torques.

Du statère à l'*aureus*. L'exemple du *Belgium*

Stéphane Martin

Résumé : Dans les années 1990, plusieurs auteurs ont avancé l'idée que la circulation du statère d'or en Gaule aurait pu favoriser l'implantation de l'*aureus* dans la province nouvellement conquise. Cet article explore l'hypothèse d'une continuité dans l'usage de l'or en Gaule en se concentrant sur le cas du Belgium (Gaule du nord-ouest). Grâce au croisement des études de coins, des analyses de composition métallique et des contextes archéologiques de découverte, il est en effet possible d'avoir pour cette région une vision bien plus fine que par le passé de la production et de la circulation des monnaies d'or entre 50 a.C. et le début de notre ère.

Mots clés : statère, *aureus*, Gaule, Belgium, volumes de frappe, aristocratie, armée romaine.

Abstract: In the 1990s, various authors have put forward the hypothesis that the circulation of gold staters in Gaul could have favoured the introduction of the *aureus* in the

newly conquered province. This paper explores possible continuities in coined gold uses in Gaul, focusing on ancient Belgium (northwestern Gaul). Thanks to the combination of die studies, metal composition analyses and insights given by archaeological contexts, we now have for this region a much clearer vision of gold coin production and circulation between 50 BC and the beginning of the 1st century AD.

Keywords: stater, *aureus*, Gaul, Belgium, volume of issues, aristocracy, Roman army.

L'or monnayé romain de la République à l'Antiquité tardive : une vision globale

Bernhard Woytek

Résumé : Cet article présente un aperçu général du monnayage d'or romain, de la deuxième guerre punique (218-201 a.C.) au IV^e^ siècle p.C. Les aspects économiques, politiques et artistiques de la frappe de monnaies d'or (surtout de l'*aureus* et du *solidus*) sont abordés. Cette contribution vise aussi à contextualiser le phénomène du monnayage d'or romain sur le plan international, dans une perspective diachronique.

Mots clés : Or, *aureus*, *solidus*, médaillon, Jules César, Géta.

Abstract: This contribution presents a general overview of Roman gold coinage, from its beginnings during the Second Punic War (218–201 BC) down to Late Antiquity. It discusses economic, political and artistic aspects of the production of the *aureus*, the *solidus* and their related denominations, and contextualises the phenomenon of Roman gold coins both diachronically and in a world historical perspective.

Keywords: Gold, *aureus*, *solidus*, medallion, Julius Caesar, Geta.

The sources of the first Roman gold coins (3rd century BC)

Arnaud Suspène, Jérémy Artru, Sylvia Nieto-Pelletier, Julien Olivier, Benjamin Gehres

Abstract: This paper focuses on the sources of the first Roman gold coins, the Oath scene and Mars/eagle coinages, struck in Italy at the end of the 3rd century BC. Archaeometrical comparisons with contemporary and approximately contemporary gold coinages from Egypt, Sicily, Italy and the Celtic world reveal the importance of a gold stock present in Sicily during the First Punic War in the chemical composition of the first Roman gold coins. Occasional contacts with Celtic gold are also pointed out, while an Egyptian provenance for the gold bullion used in Roman coins is excluded. The typology of the Roman coins is reassessed in the process.

Keywords: Oath scene coins, Mars/eagle coins, Sicily, Punic Wars, coined gold, chemical analyses.

Résumé : Cet article concerne l'origine des premières monnaies romaines en or, les monnaies au serment et les monnaies Mars/aigle, émises à la fin du IIIe siècle a.C. Des comparaisons archéométriques avec des monnayages contemporains ou quasi contemporains provenant d'Égypte, de Sicile, d'Italie ou du monde celtique soulignent l'importance d'un stock d'or présent en Sicile au moment de la première guerre punique dans la composition des premières monnaies d'or romaines. Des contacts sont également mis en evidence avec certains monnayages celtiques, tandis que l'hypothèse d'une origine égyptienne de l'or utilisé pour frapper les monnaies romaines est écartée. La typologie des monnaies romaines est réévaluée à la lumière de ces informations.

Mots clés : Monnaies au serment, monnaies Mars/aigle, Sicile, Guerres puniques, or monnayé, analyses chimiques.

Roman and Italian gold coins from the age of Sulla

Arnaud Suspène and Maryse Blet-Lemarquand

Abstract: This article studies gold coins struck by the Romans or the Italians at the time of Sulla. The different issues, sometimes known only from unique specimens, are presented and the results of chemical analyses by LA-ICP-MS are used to investigate possible transfers of gold stocks. The importance of gold circulating in the East in the Ist century BC as sources for the Roman coinage of the time of Sulla clearly emerges from the investigation.

Keywords: Social War, Mithridatic Wars, Sulla, *aurei,* gold transfer, chemical analyses.

Résumé : Cet article étudie les monnaies d'or frappées par les Romains ou les Italiens à l'époque de Sylla. Les différentes émissions, connues parfois par des exemplaires uniques, sont présentées et les résultats d'analyses chimiques par LA-ICP-MS sont utilisés pour mettre en evidence d'éventuels transferts de stocks d'or. L'importance de l'or circulant en Orient au premier siècle avant notre ère dans le monnayage romain de l'époque de Sylla ressort clairement de l'enquête.

Mots clés : guerre sociale, guerres mithridatiques, Sylla, *aurei*, transferts d'or, analyses physico-chimiques.

L'or de l'*Aerarium Sanctius* de l'époque médio-républicaine à César

Clara Berrendonner

Résumé : L'*Aerarium Sanctius* était un fonds de réserve de la République romaine, composé d'or. Il est attesté pour la première fois en 209 a.C., mais a peut-être été créé dans le courant du IIIe siècle ; il est mentionné pour la dernière fois en 49 a.C., et a probablement disparu lorsque César s'empara, au début de la Guerre civile, des ressources financières de l'*Vrbs.* L'article propose de localiser l'*Aerarium Sanctius* au Capitole et écarte l'hypothèse que son or ait servi à frapper les séries Mars/Aigle à l'époque de la deuxième Guerre punique.

Mots clés : *Aerarium, Aerarium Sanctius,* Capitole, César, deuxième guerre punique, séries Mars/Aigle.

Abstract: During the Roman Republic, the *Aerarium Sanctius* was a gold reserve. It is attested for the first time in 209 BC, but was perhaps created in the 3rd century BC ; we hear tell of it for the last time in 49 BC, and it probably disappeared when Caesar seized the public treasure-houses of Rome, in the first months of the Civil War. The paper suggests to locate the *Aerarium Sanctius* on the Capitoline Hill and refutes the hypothesis that its gold was used to coin the Mars/Eagle series during the second Punic War.

Keywords: *Aerarium, Aerarium Sanctius,* Capitoline Hill, Caesar, Second Punic War, Mars/Eagle series.

L'imaginaire romain de l'or

François Ploton-Nicollet

Résumé : Pourvu d'une forte charge symbolique, l'or est, dans l'imaginaire romain, un matériau exogène et perçu comme étranger aux origines de la cité, ainsi qu'en témoigne la réactualisation latine du mythe grec de l'âge d'or. Les passions qu'il suscite sont la marque des dérèglements et de la violence du monde barbare aussi bien qu'une menace pour la société romaine. Mais il est aussi symbole de puissance, de noblesse, voire de divinité. De cette contradiction apparente, il ressort qu'il n'est pas tant l'emblème d'une passion précise que du caractère excessif de ces passions.

Mots clés : or, symbolique, barbarie, Rome, poésie, valeurs morales.

Abstract: Endowed with a strong symbolic charge, gold is, in the Roman imagination, an exogenous metal and considered foreign to the origins of the city, as evidenced by the Latin myth of the golden age. The passions it arouses are the mark of the barbaric world's violence, as well as a threat to Roman society. But it is also a symbol of power, nobility, even of divinity.

This apparent contradiction leads to the idea that it is not the emblem of a specific passion, but the symbol of the excessiveness of passions.

Keywords: Gold, Symbolism, Barbarism, Rome, poetry, moral values.

Gold for a Revolution: the sources of Caesar's gold coinage

Arnaud Suspène, Maryse Blet-Lemarquand, Sylvia Nieto-Pelletier, Benjamin Gehres

Abstract: This paper investigates the possible sources for Caesar's gold coinage. After relevant issues and literary evidence are introduced, the results of chemical analyses of Caesarian coins are compared with similar data for close and/or contemporary issues. The main conclusion is that while different gold supplies were used by Caesar, Celtic gold seems to have provided the larger part of Caesar's bullion. The unique *aureus* of Metellus Scipio, kept at the Bibliothèque nationale de France, is also taken into account in an appendix.

Keywords: Caesar, gold coinage, *aurei*, Celtic gold, chemical analyses.

Résumé : Cet article cherche à identifier les diverses sources de l'or monnayé de César. Les émissions correspondantes et la documentation littéraire font l'objet d'une présentation liminaire, puis les résultats d'analyse de monnaies d'or de César sont comparés à la composition élémentaire de monnayages voisins et/ou contemporains. La conclusion principale est que si César put utiliser des ors de provenance différente, c'est l'or des Gaules qui a fourni l'essentiel du métal employé. L'*unicum* de Metellus Scipion conservé à la Bibliothèque nationale de France fait également l'objet d'une étude en annexe.

Mots clés : César, or monnayé, *aurei,* or des Gaules, analyses élémentaires.

Roman gold coinage in the triumviral period (43-30 BC): the spread of gold currency and the difference between East and West

Arnaud Suspène, Maryse Blet-Lemarquand, Julien Flament, Benjamin Gehres

Abstract: Between 43 and 30 BC, Roman *aurei* were extensively struck in various places of the Mediterranean, ensuring the success of the "Caesarian revolution". This paper aims to investigate the gold stocks used to strike all these different issues. Gold coins struck in the West show the same chemical fingerprints as gold coins struck by Caesar. However, coins struck in the East seem to be made out of a different stock of gold. Although occasional mixing can occur, these different stocks are still distinct till the end of the triumviral period. These results are compared with the literary evidence to cast new light on the history of the triumviral period.

Keywords: Triumviral period, gold coins, West, East, archaeometry, gold stocks.

Résumé : Entre 43 et 30 a.C., des monnaies d'or romaines furent émises de manière très régulière en divers endroits du bassin méditerranéen, ce qui marqua le succès définitif de la "Révolution de César". Cet article a pour objectif d'identifier les stocks d'or utilisés pour frapper toutes ces émissions. Les monnaies émises en Occident présentent les mêmes caractéristiques de composition chimique que les monnaies produites par César. Les monnaies frappées en Orient en revanche paraissent avoir été émises à partir d'un stock très différent. Bien que des mélanges puissent intervenir à l'occasion, ces différents stocks métalliques restent distincts jusqu'à la fin de la période triumvirale. Ces résultats sont confrontés à la documentation textuelle pour éclairer l'histoire de la période triumvirale.

Mots clés : période triumvirale, monnaies d'or, Occident, Orient, archéométrie, stocks d'or.

Le monnayage d'or des rois de Maurétanie

Michel Amandry

Résumé : Le monnayage d'or des souverains de Maurétanie, Juba et son fils Ptolémée, est réexaminé à la lumière de découvertes nouvelles.

Mots clés : Juba, Ptolémée, Maurétanie, monnayage d'or.

Abstract: The gold coinage of the Kings of Mauretania, Juba and his son Ptolemy, is reasessed in the light of new discoveries.

Keywords: Juba, Ptolemy, Mauretania, gold coinage.

La distribution des monnaies d'or romaines en territoire éduen. L'exemple des *aurei* de Caligula

Antony Hostein

Résumé : L'article propose d'examiner la distribution spatiale des *aurei* de Caligula mis au jour en Gaule. Fondée sur les listes réalisées par J.-P. Callu et X. Loriot, cette analyse portant sur une douzaine de pièces d'or permet de dégager deux secteurs où de telles trouvailles se concentrent : le territoire des Éduens d'une part, plusieurs sites localisés le long du Rhin d'autre part. À l'échelle des monnaies elles-mêmes, deux faciès différents mais cohérents ont pu être identifiés. Pour quelles raisons ne trouve-t-on dans le secteur du limes que des séries

du début du principat ? Pourquoi les monnaies d'émissions plus tardives sont-elles mises au jour ailleurs, en particulier sur le territoire éduen ?

Mots clés : *aureus*, Caligula, Gaule, territoire des Éduens, *limes*.

Abstract: This paper discusses the spatial distribution in Gallia of finds of *aurei* struck in the name of Gaius. Based on the surveys carried out by J.-P. Callu and X. Loriot, this spatial distribution of only 12 gold coins shows two concentration areas of discoveries: the *ager Aeduorum* on one hand, and sites located alongside the Rhine river on the other hand. At the coin level, these groups show two very different but consistent patterns. Why inaugural issues of Gaius are to be found only in the limes area while later issues are mostly discovered in the territory of the Aedui?

Keywords: *aureus*, Gaius, Gaul, *ager Aeduorum*, *limes*.

Metrological and Metallurgical Data from Roman *Aurei,* 50 BC to AD 69

George Green

Abstract: Two data sets are explored in this piece. The first is the weights of gold coins from hoards deposited between 50 BC and AD 64. The second is the metallurgical data from coins issued between 46 BC and AD 76 held by the Ashmolean museum. In short, the hoard data can not only inform us of changes to the *aureus* weight standard and periods of withdrawal, but it can also elucidate concepts of trust in the Roman world. When the *aureus* is introduced, hoarders almost immediately begin using it as a store wealth and continue to do so despite regular changes to the weight of the coin in this period. X-ray fluorescence analyses show that the *aureus* was effectively full purity across this period, only dropping in AD 69 during the civil wars. The *aureus* is characterised by metallurgical stability in this period, and this consistently high purity most probably helped to reinforce trust in the gold coinage.

Keywords: Roman, Gold, Trust, XRF, Metallurgy, Weights.

Résumé : Deux séries de données sont étudiées dans cet article. La première regroupe les masses de monnaies d'or provenant de trésors enfouis entre 50 a.C et 64 p.C. La seconde rassemble les données archéométriques de monnaies émises entre 46 a.C. et 76 p.C. conservées à l'Ashmolean Museum. En résumé, les données provenant des trésors peuvent non seulement fournir des informations sur les changements concernant l'étalon pondéral de l'*aureus* et sur les différentes périodes de retrait de la circulation, mais elles permettent également d'éclairer le concept de confiance dans le monde romain. Dès que l'*aureus* fut introduit, il fut aussitôt thésaurisé comme réserve de valeur et ce phénomène se poursuivit

malgré les changements pondéraux successifs intervenus à cette période. L'analyse par fluorescence X montre que l'*aureus* était une monnaie d'or pur tout au long de la période considérée, la seule baisse de titre constatable se plaçant en 69 p.C. dans le cadre des guerres civiles. L'*aureus* est caractérisé par sa stabilité sur le plan métallurgique à cette période, et le maintien de ce très haut degré de pureté contribua très probablement à entretenir la confiance placée dans le monnayage d'or.

Mots clés : romain, or, confiance, XRF, métallurgie, masses.

Roman gold coinage from Augustus to the year of the Four Emperors

Arnaud Suspène, Maryse Blet-Lemarquand, Dorian Bocciarelli

Abstract: This paper focuses on the Roman gold coinage of the Imperial Age from an archaeometric perspective. The analysis of a representative sample of gold coins from *c.* 27 BC to AD 69 provides new insight into the monopolization of Mediterranean gold supplies by imperial Rome. The chemical pattern of coins from the first years of the Augustan Principate, from 30 to 20 BC, bears a close resemblance to that of previous Roman gold coins, but at least two new gold stocks can be distinguished later on: the first one appears in the western mints from 19 BC onward and becomes prevalent in Lyons after 15 BC; the other one is first used under Tiberius and becomes more and more important during the 1st century AD. Although the general trend is clear (a shift towards high palladium gold stock), there were still different gold supplies in the West at the end of the 1st century AD. Hypotheses are put forward as to the provenance of the gold supplies. The importance of the technical aspects of the production of gold coins in the Emperors' policy is reassessed.

Keywords: imperial gold coins, platinum, palladium, mines, recycling, gold stocks.

Résumé : Cet article est consacré au monnayage d'or romain d'époque impériale dans une perspective archéométrique. L'analyse d'une sélection représentative de monnaies romaines frappées entre 27 a.C. et 69 p.C. apporte de nouvelles informations sur l'appropriation des stocks d'or par Rome au début de l'Empire. Si la signature élémentaire des monnaies d'or des premiers temps du principat augustéen, entre 30 et 20 a.C., reste très similaire à celle des monnaies d'or précédentes, au moins deux nouveaux stocks d'or peuvent être observés par la suite : le premier apparaît dans les ateliers occidentaux à partir de 19 a.C. et devient dominant à Lyon à partir de 15 a.C. ; le second est employé pour la première fois sous Tibère et gagne en importance tout au long du I^{er} siècle p.C. Même si la tendance générale est claire (une augmentation régulière de la part d'un or à forte teneur en palladium), des stocks différents restent attestés en Occident jusqu'à la fin du I^{er} siècle p.C. Des hypothèses concernant l'origine de ces stocks sont proposées. L'importance des considérations techniques relatives à la frappe de l'or dans la politique générale des empereurs fait également l'objet d'une réévaluation.

Mots clés : monnaies d'or impériales, platine, palladium, mines, recyclage, stocks d'or.