



HAL
open science

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

Arnaud Suspène, Maryse Blet-Lemarquand, Dorian Bocciarelli

► To cite this version:

Arnaud Suspène, Maryse Blet-Lemarquand, Dorian Bocciarelli. Roman gold coinage from Augustus to the year of the Four Emperors. Suspène A.; Blet-Lemarquand M.; Duyrat Fr.; Nieto-Pelletier S. *AVREVS. Le Pouvoir de l'or / The Power of Gold, ScriptaAntiqua (171)*, Ausonius, pp.499-537, 2023, 978-2-35613-578-0. <hal-04238490>

HAL Id: hal-04238490

<https://hal.science/hal-04238490v1>

Submitted on 12 Oct 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

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

Arnaud Suspène, Maryse Blet-Lemarquand, Dorian Bocciarelli

THE NEW IMPORTANCE OF GOLD COINAGE THROUGHOUT THE EMPIRE

After the troubled times of the triumviral period, the 95 years between 27 BC, when Octavian received his new *cognomen* Augustus, and the Year of the Four Emperors (AD 69) were marked by a new political environment: there was now a unity of command in the Empire. It was only at the very end of the period, during the revolts against Nero in the spring of AD 68, that civil war broke out again, bringing the Empire to the verge of destruction.

As far as coinage is concerned, this new stability meant greater control: as the financial needs of the state reached new heights,¹ coin production had to be reorganized. Older, Republican coins were recirculated and new issues had to be struck.² The imperial government carefully oversaw supplies, mint organization, legislation and of course, denominations and weight standards.³ Thus, Roman monetary magistrates, who had stopped issuing coins around 40 BC, resumed their activities (probably in 23 BC) and the college soon underwent some changes that saw the number of its members return from four to three, a conspicuous revival of Republican practice.⁴ Although their names and titles had disappeared from the coins by the end of Augustus' Principate, monetary magistrates were still appointed and duly mentioned in inscriptions until the 3rd century AD.⁵ The *IIIuiri monetales* were recruited from the most aristocratic families and could expect a bright future in the Emperor's service;⁶ although the precise functions of the *IIIuiri* are hard to fathom in imperial times, this suggests that the supervision of coinage may have remained an important task. The Emperor himself paid attention to monetary matters.⁷ In a famous passage that was certainly relevant for

1 Wolters 2012, 347; Duncan-Jones 1994, 11-12, 32-46.

2 Suspène 2017.

3 For organizational aspects, see Butcher & Woytek 2018 and Wolters 1999, 45-85; on weight-standards, see Butcher & Ponting 2014, 93-95, Green in this volume; on denominations and alloys, Suspène 2009, Suspène *et al.* 2020.

4 On the return of the monetary magistrates as part of the Augustan *Res publica restituta*, see Suspène 2009; on the Augustan *monetales*, see now Küter 2014 and for chronology Molinari 2015.

5 Wolters 1999, 86, n. 154.

6 Burnett 1987, 26-27.

7 Some kind of financial culture was already expected from a senator under the Republic: according to Cicero, senators needed to know at least what was kept in the *Aerarium* (Cic., *Leg.*, 3.41).

the whole imperial history and not only for the Severan Empire, Cassius Dio emphasizes the importance of money to rule the Empire: according to Cassius Dio, Maecenas even suggested creating a fully integrated Empire, using the same weights and the same coinage.⁸ If Augustus refrained from doing so, he nevertheless took many decisions affecting coinage. With the cooperation of the Senate,⁹ he devised a reform of bronze coinage, arranged many issues in different places, and reorganized coin production (see below). Above all, he made sure that the *Aerarium* was fully funded,¹⁰ thanks to the booty acquired from his victories and to the conquest of rich territories, such as Egypt in 30 BC and northern Spain in 25-19 BC. Finally, he set up a new tax system to ensure that the state would not run short of money,¹¹ implementing an in-depth and complex strategy for public finances.¹² A *lex iulia peculatus*, probably an Augustan law belonging to the great tribunician *leges* of 18-17 BC, prohibited tampering with *aurum*, *argentum* and *aes*,¹³ a familiar sequence referring to the bullion and alloys used to strike coins; this may reflect Augustus' commitment to guarantee the metal content of Roman coins. Augustus obviously took monetary matters very seriously. He thereby set an example that his successors would follow:¹⁴ a poem by Statius shows that the Emperor, through the agency of the *a rationibus*, an imperial freedman who would soon be replaced by an *eques*, took care of metal supplies.¹⁵

In the Julio-Claudian period, Roman gold coinage was dominant throughout the empire. Apart from small royal issues in Bosphorus and Mauretania,¹⁶ Roman *aurei* were the only gold coins issued in the Mediterranean, and definitely the only ones to circulate everywhere, maybe even in Egypt.¹⁷ Although gold coins were of course less likely to be lost and not retrieved than copper-alloy coins, for instance, extensive research has shown that stray finds

8 D.C. 52.30.9.

9 We will not address here the complicated question of the way the Emperor and the Senate shared responsibility for coinage (on the old debate over the "dyarchy", see Wolters 1999, 115-118). Our position is that cooperation prevailed (see Burnett 1987, 19): at least, there is no mention of controversy about monetary matters between the Emperor and the Senate.

10 *RGDA* 17.1-2.

11 France 2016.

12 Speidel 2000.

13 Ulp., *Dig.*, 48.13.1: *neue quis in aurum argentum aes publicum quid indat neue immisceat neue quo quid indatur immisceatur faciat sciens dolo malo, quo id peius fiat*, with Ferrary [2007] 2020 (esp. for the date).

14 Suspène 2017.

15 Stat., *Silv.*, 3.3.86-105. Given the nature of the text, a very flattering poem, fraught with rhetoric, it is very hard to know precisely what the *a rationibus* actually did (see Burnett 1987, 25-27).

16 See MacDonald 2005 and Amandry in this volume.

17 Burnett 1987, 50; Woytek 2014, 218. There is no agreement about the circulation of Roman gold coins in Egypt under the Julio-Claudians however, as the archaeological evidence is inconclusive (Howgego 1992, 10-11). The presence of at least two legions in the province probably meant that some gold coins reached Egypt. Suetonius also mentions the indirect gift by Augustus of a significant amount of *aurei* to merchants from Alexandria (Suet., *Aug.*, 8.2). Although this happened in the Bay of Puteoli, it proves at least that these merchants knew how to deal with these coins. Papyrological mentions confirm the occasional presence of *aurei* in Egypt between Augustus and Claudius, but rather in Roman contexts (see Blouin & Burnett 2020, 262-266). After a careful survey of all the evidence available, Blouin & Burnett 2020, 274 conclude that "at least for the moment there is no decisive evidence for the circulation of *aurei* in the province".

of gold coins are well attested in well-studied areas.¹⁸ Hoards of Julio-Claudian gold have also been found,¹⁹ and all the more so after AD 64, when a huge recycling programme of older coins took place. All this shows the importance of gold coins throughout the Empire.²⁰

Gold coins now played a central part in the Roman monetary system. They were issued by every emperor²¹ and some issues, such as the C. L. CAESARES *aurei* under Augustus or the PONTIF MAXIM issues under Tiberius were quite large. Post-reform Neronian issues are fairly common as well.

	Number of coins	Average gold content (%)	Standard deviation (%)
Augustus	138	99.8	0.2
Tiberius	22	99.8	0.1
Caius	11	99.7	0.1
Claudius	23	99.7	0.2
Nero, Lyons	20	99.6	0.4
Nero, Rome	8	99.6	0.2
Anonymous coins	11	97.6	2.3
Galba	18	99.2	0.7
Otho	8	99.5	0.2
Vitellius	21	99.2	0.6
Vespasian, Spain	2	97.2	0.9

Fig. 1. The fineness of 282 *aurei* from Augustus to Vitellius (%), data from AVREVS.

It has also been emphasized that gold coinage represented a very important part of the total value of Roman coinage,²² which of course had far-reaching consequences on the economy.²³ After the debasement of silver in AD 64, the gold content of the *aurei* and gold *quinarii* stayed above 99% (although the target weight was reduced),²⁴ so that gold coins were the only pure metal denominations of the whole Roman monetary system (fig. 1). K. Butcher and M. Ponting even suggested that, as a consequence, one of the most important functions of gold coinage was to “anchor” Roman coinage to the real economy.²⁵ Even during the Civil War of 68-69, a time of significant output of gold coins,²⁶ the different contenders for power went to great lengths to strike solid gold *aurei*: only slight variations in gold contents can be noticed, and they are to be explained by haste and poor striking conditions rather than

18 Callu & Lorient 1990; Bland & Lorient 2010; Lorient 2011-2012; Suspène, 2021a.

19 See for Gaul, Suspène *et al.* 2016 and Suspène 2021a.

20 See also Howgego 1992, 10-11; Lo Cascio 2008.

21 Rhythms of production and outputs were of course very different.

22 Duncan-Jones 1994, Lo Cascio 2008 and Woytek 2014.

23 Lo Cascio 2008.

24 Suspène *et al.* 2020.

25 Butcher & Ponting 2014.

26 See Bocciarelli *et al.* 2017 and below.

by a wish to debase the metal.²⁷ This suggests that plentiful and high-quality gold coinage was needed to keep the military content and loyal.²⁸ The Empire could not do without gold coinage any more.²⁹

THE MINT ORGANIZATION OF GOLD COINAGE

To provide the gold currency the Empire needed, mints had to be considered. The geography of the mints for gold coinage is rather complicated under Augustus; it became simpler over time, until the outbreak of the civil war in AD 68 brought back complexity.

The mint of Rome is probably responsible for some late triumviral/early Augustan gold issues. The famous CAESAR DIVI F and IMP CAESAR coins are first and foremost of these Roman issues (fig. 2).³⁰ Their precise place of minting has been debated for a long time, but scholars now favour a western mint, and the one in Rome seems to be the best solution.³¹ Dating precisely these coins is a difficult task,³² but we accept Crawford's *terminus ante quem* (29 BC)³³. These coins are mentioned here because they bridge the gap between triumviral and Augustan coinage, and, as they clearly foreshadow the following issues, they can be considered as the first imperial coins.³⁴ The mint of Rome was probably also responsible for striking other gold coins displaying Octavian's head, an eagle, laurel branches and a wreath, and celebrating the *cognomen* Augustus given to Octavian at the beginning of his seventh consulate in 27 BC (fig. 3).³⁵ The origin of other gold coins from the seventh consulate showing a crocodile with the *AEGVPT(O) CAPTA* legend is still debated: they might have been struck in Rome or elsewhere.³⁶ Between 19 and 12 BC, other gold coins were issued in Rome under the supervision of the *triumviri monetales*,³⁷ in rather limited numbers (fig. 4); then the mint of Rome ceased to strike gold for several decades.

27 Bocciarelli *et al.* 2017; Suspène *et al.* 2020.

28 Although the *denarius* seems to have remained “the original unit of calculating basic army pay rate” (Speidel 2014), *aurei* did matter to the military (see Wolters 2000-2001, 580; Suspène, 2021a).

29 On the different uses of gold coins, Howgego 1992, 10-11.

30 *RIC* 258-262, 268 and 273 (gold only). See as well Suspène *et al.* in this volume for the triumviral period.

31 Suspène *et al.* 2016 (focusing on a gold hoard recently found in Martigues, France, and containing many coins of these series); see as well Butcher & Woytek 2018, 255 and n. 22.

32 For the historiography of the dating of these coins, see Assenmaker 2007.

33 See Suspène *et al.* 2016; Butcher & Woytek 2018, 255; Suspène 2020a; Suspène & Chausserie-Laprée 2020.

34 They are duly registered in Sutherland's *Roman Imperial Coinage* (but not in Crawford's *Roman Republican Coinage*, although Crawford dates them to 34-29 BC).

35 *RIC* 277.

36 *RIC* 544 (see Sear 1998 for instance: “Rome or East?”). A gold multiple dated 27 BC is also attested (*RIC* 546, kept in Madrid) but its authenticity is not beyond doubt. If it is genuine, a production at the mint of Rome seems logical, as these coins were probably meant for high-ranking aristocrats.

37 On these series, see now Küter 2014.



Fig. 2. CAESAR DIVI F aureus RIC 262; BNC I 0082; IMP-3682.



Fig. 3. Aureus of Augustus' seventh consulate RIC 277; BNC I 0912; IMP-4541.



Fig. 4. Aureus struck for P. Petronius Turpilianus Illuir at the mint of Rome RIC 293; BNC I 0106 ; IMP-3708.



Fig. 5. Aureus struck in Pergamum (?) RIC 512; BNC I 0975; IMP-4617.

Other mints operated in the East under Augustus. The famous *LEGES ET IVRA* issue struck in 28 BC closely resembles Augustan *cistophori* and it was for this reason attributed to Ephesus.³⁸ Although this attribution should be taken cautiously, other Augustan *aurei* were struck in the East, at least in Pergamum (fig. 5) and various other eastern locations have been proposed for undated coins of various style and fabric.³⁹ After these issues, that belong to the early years of the Principate of Augustus (before 15 BC in any case), no other gold coins were issued in the *pars orientalis* of the Empire until Vespasian.

Under Augustus, several gold issues were also struck in the West, between c. 19 and 16 BC, as shown by their iconography and hoard evidence.⁴⁰ The different styles of the coins has led scholars to hypothesize the existence of at least two mints. A Spanish location has been the traditional choice, which would make sense, but a place of minting in Gaul, for instance, for some of the coins or for the whole coinage,⁴¹ has also been suggested and cannot be excluded. We will refer to these coins as “Uncertain western issues”, and, when specifying one of the two mints, “Uncertain mint 1 Caesaraugusta?” (fig. 6) and “Uncertain mint 2 Patricia?” (fig. 7), as in *RIC I*².

³⁸ Rich & Williams 1999.

³⁹ *RIC* 511-514; 521-522 (Pergamum); see as well *RIC* 536-539 (unknown Eastern provenance). Burnett 1978 rightly emphasizes the difficulty to locate (and even to date) these Eastern issues.

⁴⁰ *RIC* 26-32 (Uncertain mint 1 “Caesaraugusta?”); *RIC* 50, 52-53, 55, 59-63, 66, 68, 73, 76, 78, 80, 85, 88, 90-91, 104, 107, 109, 114, 116, 118, 121-123 (gold *quinarii*), 125, 127, 129, 131, 133, 135, 138, 140-141, 143, 147, 149, 151 (Uncertain mint 2 “Patricia?”). We will follow here the dates proposed in *RIC I*².

⁴¹ For useful remarks, see still Burnett 1978, 177-179; against Spain, see Volk 1997, Crawford 1985, 257 and 261; for Spain, García-Bellido 2008 (with Celsa instead of Caesaraugusta as the first mint), Gómez Barreiro 2018. For further bibliography and detail, Suspène *et al.* 2011; Molinari 2017; Gómez Barreiro 2018, 83-91.

The main development of Augustan coinage is the puzzling centralization of gold (and silver) coinage in Lyons, around 15 BC.⁴² The opening of a mint in Lyons was a major move that would shape the geography of the mints for gold coinage for half a century.

The first *aurei* to be coined in Lyons commemorate Augustus' 10th imperial *salutatio* (between 15 and 13 BC). Other issues followed that mention his 12th imperial *salutatio* (between 11 and 10 BC).⁴³ Then came gold coins celebrating Caius Caesar's debut and the German campaign of Augustus in 8 BC.⁴⁴ Later on the C. L. CAESARES gold coins were struck from 2 BC to an unknown date (fig. 8).⁴⁵ These issues were quite large. Gold *quinarii* were also struck on a regular basis at the mint of Lyons⁴⁶ and two issues of gold multiples are even attested.⁴⁷ A late group of Augustan *aurei* was struck in Lyons in AD 13-14, which alluded to the imperial succession and announced the position of Tiberius.⁴⁸ As is now generally recognized,⁴⁹ all the gold of Tiberius (fig. 9), Caius and Claudius, and most of Nero's gold coinage (until AD 64) was also struck in Lyons.⁵⁰



Fig. 6. "Uncertain mint 1 (Caesaraugusta?)" *aureus* RIC 29b; BNC I 1279; IMP-4959.



Fig. 7. "Uncertain mint 2 (Patricia?)" *aureus* RIC 147; BNC I 1235; IMP-4915.



Fig. 8. C. L. CAESARES *aureus* from the mint of Lyons RIC 206; BNC I 1648; IMP-5354.



Fig. 9. PONTIF MAXIM *aureus* of Tiberius from the mint of Lyons RIC 27; BNC II 17; IMP-5617.

- 42 On this centralization, see Suspène 2014; Butcher & Woytek 2018.
 43 RIC 163-164, 166, 168, 170, 172 (IMP X); RIC 176-177, 179, 181, 186, 188, 190, 192, 194, 196 (IMP XII). Gold *quinarii* were also struck in 11-10 BC (RIC 184-185).
 44 RIC 198 and RIC 200. On these issues, see Amandry & Aubin 2001-2002 and Suspène 2021b.
 45 RIC 206 and 209. On the C. L. CAESARES coinage in general, see Woytek & Blet-Lemarquand 2017.
 46 RIC 184 (TR P XII), 185 (TR P XIII), 202 (TR P XVI), 203 (TR P XVII), 213 (TR P XXIII), 214 (TR P XXV), 215 (TR P XXVII), 216 (TR P XXVIII), 217 (TR P XXX), 218 (TR P XXXI).
 47 RIC 204 (an IMP XV four-*aurei* multiple from Pompeii) and RIC 205 (a C. L. CAESARES four-*aurei* multiple).
 48 RIC 219, 221, 223, 225 (on these issues and their close relationship to early Tiberian coinage, see Suspène 2018).
 49 For the demonstration, see Metcalf 1989, followed by Wolters 1999, 61-85, Wolters 2012, 339, Butcher & Ponting 2014, 175, Butcher & Woytek 2018.
 50 Butcher & Ponting 2014, 175 (see as well Butcher & Woytek 2018, 259) suggested that there might have been some overlap as both the mint of Lyons and the mint of Rome might have struck precious coins at the same time for a while in AD 63/64. This cannot be excluded as such an overlap also occurred between 15 and 12 BC, when *aurei* were struck both in Rome and in Lyons.

The pivotal importance of the mint of Lyons under Augustus is beyond doubt, as it is documented by literary and epigraphic evidence.⁵¹ There is not a full agreement about the real extent of the centralization of gold coinage in Lyons however. Some scholars have suggested that some other mints also operated in the Empire, issuing gold (and silver) coins with the same types as the mint of Lyons, maybe as subsidiary mints (that is, dependent on Lyons). This idea has been prompted by the huge quantity of coins issued with Lyons types, most notably under Augustus and Tiberius, by some differences in styles, and by the discovery of dies in various places of the Empire.⁵² Other scholars prefer the traditional view that a unique mint located in Lyons provided the whole Empire with gold and silver coinage until the reform of Nero, on the grounds that the dies found outside Lyons do not prove that other mints existed, as they could have been easily moved from Lyons or even duplicated, and that later coinages show that it is not necessary to postulate subsidiary mints to account for different styles and large output.⁵³ Preliminary research has also shown that gold and silver coins from the beginning of the 1st century AD had a fairly homogeneous chemical composition, which would tend to indicate a single mint.⁵⁴ It has even been suggested that it was a desire to benefit from the proximity of silver mines that triggered Augustus' decision to locate the mint in Lyons.⁵⁵ What is certain anyway is that under Augustus, gold was struck in Lyons in large quantities and on a regular basis.⁵⁶

After Augustus, the Emperors were apparently content with the mint organization for gold as it was, perhaps for practical reasons, perhaps out of respect for Augustus, or perhaps out of conservatism. Nero's momentous decision to return the minting of gold (and silver) to Rome in AD 64 had probably both technical and political reasons.⁵⁷ Recently, it has been suggested that the huge recycling of older gold and silver coins ordered by the Emperor entailed the decision to move the mint back to Rome, as it was easier to call in old coinages there, where good infrastructure were also available (fig. 10).⁵⁸

After the outbreak of the Civil War, the different factions struck gold coins in various places of the Empire,⁵⁹ mostly in the West (fig. 11); a few years after Vespasian's final victory, the mint of Rome became again the only mint for gold coinage.⁶⁰

So the mint organization for gold coinage between Augustus and the Year of the Four Emperors can be summarised as follows: first, many mints operated in various places of the

51 Suspène 2014; Martin 2015, 279; Butcher & Woytek 2018. On the coinage of the mint of Lyons, Giard 1983 (with several supplements).

52 Giard 1983; Wolters 2012, 351, 1; Martin 2015, 279-286. For a case study under Caius, see Hostein in this volume.

53 Estiot & Aymar 2002.

54 See Suspène *et al.* 2011 (for Augustan gold); Butcher & Ponting 2014 (for early imperial silver).

55 Most recently Butcher & Woytek 2018.

56 This is very clear when *quinarii* are taken into account: for instance, there are no *aurei* for Augustus' 11th *salutatio*, but gold *quinarii* were struck this year in Lyons. The production of gold *quinarii* continued in Lyons until Nero.

57 Wolters 1999, 83-85; Suspène 2014.

58 Butcher & Ponting 2014; Butcher & Woytek 2018.

59 Bocciarelli *et al.* 2017.

60 Carradice 2012.

Mediterranean, including Rome (down to 12 BC); then, gold coinage was centralized in Lyons for almost eight decades (12 BC- AD 64); finally in AD 64, the Roman mint definitively took over gold coinage, apart from the fragmented minting of the civil wars of AD 68-69, which Vespasian quickly put to an end.



Fig. 10. Post-reform aureus of Nero RIC 63; BNC II 231; IMP-6611.



Fig. 11. Aureus of Galba RIC 164; BNC III Galba 72; IMP-7042.

AN ARCHAOMETRIC APPROACH

Our aim here is to use the LA-ICP-MS analysis of the Bibliothèque nationale de France Roman gold coins to investigate imperial gold coinage from the age of Augustus to the Year of the Four Emperors. Pt/Au and Pd/Au ratios should enable us to tell if and when different gold stocks were used, and so to shed light on the Empire's monetary organization.

The Bibliothèque nationale de France has a large sample of early imperial gold coins. Of course, it does not include each and every imperial issue. There is no LEGES ET IVRA aureus in the trays of the BnF, for instance, as is to be expected for an issue known from only two coins, discovered (or identified) at the very end of the 20th century. Many other issues are also represented by very few coins. But the Paris collection is very representative and some parts of it are especially rich (the Augustan section, for instance, is admittedly the most important in the world⁶¹). In some (rare) cases, we could supplement the BnF collections thanks to coins from other collections. In fact, and unlike what was done for the Republican and triumviral periods, we did not analyse all the gold coins kept in Paris: chemical analysis was performed on all the Augustan coins (138 coins) and on all the coins of the Civil War of AD 68-69 (60 coins), but we had to focus on a selection of gold coins struck in between for practical reasons (84 coins). Nevertheless, the large size of this sample guarantees that we stand on firm ground when drawing conclusions (fig. 12).

Emperor	Augustus	Tiberius	Caius	Claudius	Nero	Anonymous	Galba	Otho	Vitellius	Vespasian
Coins analysed	138	22	11	23	28	11	18	8	21	2

Fig. 12. Number of coins analysed per emperor.

61 See Burnett 2002, 426 (commenting on the third edition of the catalogue of the Augustan coins in the Paris collection by J.-B. Giard).

An overview of gold supplies in the early Empire (30 BC-AD 69)

Where could the gold bullion used to strike imperial gold coins come from?

Under the Empire, Rome got control of new resources,⁶² for instance mines, such as the gold mines of northern Spain after 19 BC.⁶³ The landscapes of the corresponding areas of modern Spain bear conspicuous traces of the exploitation of the mines in the early Empire,⁶⁴ and literary evidence suggests that these mines yielded large quantities of gold.⁶⁵ Although the gold output from Spain, as estimated by the archaeologists, is markedly lower than the figures given by Pliny,⁶⁶ modern research has confirmed that the scale of mining increased in Northern Spain under Augustus and his successors.⁶⁷ This was one clear source of supply for the Roman mints. But, besides northern Spain, gold could still come from many other areas under the Julio-Claudians and the importance of these other supplies should not be underestimated.⁶⁸ Mines existed in the Alpine belt,⁶⁹ and Florus and Pliny both mention the presence of gold in rivers and in mines in Dalmatia under Augustus⁷⁰ and under Nero.⁷¹ And Gaul had many mines:⁷² recent research has definitely shown that gold was already exploited by the Gauls themselves. It has been suggested that in some well-studied areas (Limousin for instance) exploitation ceased under Augustus,⁷³ but we do not know exactly when and we do not know either if mining stopped elsewhere.⁷⁴ A. Hirt recently emphasized that the precise chronology of mining activity, in many cases, is still quite uncertain, as reliable archaeological data is scarce.⁷⁵ Hirt even suggested that new mining areas could have been exploited in Gaul after the old mines were abandoned.⁷⁶ Later on in the 1st century AD, mining is even attested in Britain.⁷⁷ Other mines also existed in the East,⁷⁸ although there is no indication that the

62 For a general approach of the different ways to get bullion for coinage, see Howgego 1990, 4-7 and 1992.

63 See Domergue 1990; Domergue 2008; Hirt 2020. For administrative and territorial aspects, see for instance Sánchez-Palencia *et al.* 2017.

64 See for instance Domergue 2008, pl. 2-4, 6-8 and 12 for suggestive illustrations.

65 Plin., *HN*, 33.77-78. See as well Stat., *Sibv.*, 3.3.90: *Quicquid ab auriferis eiecat Hiberia fossis*.

66 Pérez-García *et al.* 2000, 227; Domergue 2008, 209-210.

67 Domergue 2008, 141-2; Hirt 2020, 112, 116.

68 See Butcher, ed. 2020, 8.

69 Domergue 2008, 189; Hirt 2020, 117. Rome had had access to these reserves since the 2nd century BC (Str. 4.6.7), but the military operations led by Terentius Varro in 26-25 BC and by Drusus, Tiberius and Silius Nerva in 16-15 BC led to a far greater control of this zone.

70 Flor. 2.25.

71 Plin., *HN*, 33.67 (confirmed by Stat., *Sibv.*, 1.2.152-153; 4.7.13-16 and most notably 3.3. 90: *Dalmatico quod monte nitet*; see also Mart. 10.78). For a careful assessment of the literary and archaeological evidence, see Glicksman 2018.

72 Cauuet 2005.

73 Cauuet 1999, 39; Cauuet 2005, 244-250.

74 See Howgego 1992, 6-7 on the many uncertainties about mine output; Cauuet 2005 for current perspectives; Cauuet *et al.* 2018 for an estimation of the total production of the Limousin mines.

75 Hirt 2020, 118.

76 Hirt 2020, 118, drawing from Butcher & Ponting 2014, 177-179 (for silver). Hirt suggests that after the discontinuation of gold mining in Limousin, out-of-work competent workers could have been used in the Massif Central for instance.

77 In the South of Wales in the second half of the 1st century AD, see Cauuet 2005, 257-265; Hirt 2020, 116-117.

78 See the useful chart in Domergue 2008, 81 for the different mines and their period of exploitation.

mines in Macedonia or in Egypt, for instance, were still exploited under Roman rule, at least in the current state of research.⁷⁹

Moreover, if gold fresh from the mine could be used to mint *aurei* or gold *quinarii*, it was not the only supply available. Gold produced before the Roman period⁸⁰ was still available in the form of bars, jewellery, ingots, and also coins, all of which could be melted down to strike Roman gold coins. It might have been all the more necessary to use all this gold as the annual output of ancient mines was probably not very high.⁸¹

Last but not least, another very important source for imperial gold coinage is the recycling of old Roman gold coins. Recycling probably took place quite early in Imperial times: as weight standards changed,⁸² old coins were regularly recalled, even before Nero's reform. Recycling is indeed a very important feature of the production of gold coinage under the Empire. To use an example from the Civil War of 68-69, let us recall that Galba used to keep beside himself 10,000 gold coins in a carriage.⁸³ These were obviously Neronian coins. When he rebelled, Galba may have distributed these coins as such, but it is more likely that he melted them down and struck new coins bearing new types.

As well as archaeology, ancient texts also give evidence about some of the sources available under Augustus and the Julio-Claudians. Thus, according to Cassius Dio, the procurator Licinus was notorious for his rapacious collection of silver and gold from his fellow countrymen in Gaul in 16 BC. He only evaded punishment from Augustus by arguing that he had made sure that the Gauls could not use this money to defect from the Empire.⁸⁴ This was a very strong statement: it means that there was enough bullion in Gaul to sustain a war against Rome and that it was possible for a well-connected and crafty Gaul like Licinus himself to get hold of it. A ghastly perspective from a Roman point of view, all the more so since this anecdote supposedly took place when Augustus was in Gaul in 16 BC, the very year

79 See for Egypt Faucher 2018 (calling for caution, p. 2) and Faucher 2020, and Vaxevanopoulos *et al.* 2020 for an archaeometallurgical survey of Pangaeon Mountain in Macedonia.

80 Gaul is not the only area where gold mines were exploited before the coming of Rome: see Domergue 1990, 166-170 and 172-173; Domergue 2008, 82; Sánchez-Palencia *et al.* 2018 and Hirt 2020 for Northern Spain; Olesti Vila 2017 for the Pyrenees; Domergue 2008, 81, 83 for Southern Spain etc. In the East, mines had been run for centuries.

81 Conspectus of outputs by mine in Domergue 2008, 209-210.

82 Plin., *HN*, 33.47 and Green in this volume for instance.

83 Suet., *Galb.*, 8, 1 (*ne ad gestandum quidem umquam iter ingressus quam ut secum uehiculo proximo decies sestertium in auro efferet*). One million *sestertii* in gold amount to 10,000 *aurei*.

84 D.C. 54.21.2-8 (esp. 7-8): ...καὶ πολλοὺς μὲν καὶ ἀργυρίου καὶ χρυσίου θησαυροὺς πολλὰ δὲ καὶ τῆλλα σωρηδὸν συννημένα αὐτῷ δεΐξας, ἔξεπίτηδες, ἔφη, ταῦτα, ᾧ δέσποτα, καὶ ὑπὲρ σοῦ καὶ ὑπὲρ τῶν ἄλλων Ῥωμαίων ἡβροῖσα, ἵνα μὴ τοσούτων χρημάτων ἐγκρατεῖς οἱ ἐπιχώριοι ὄντες ἀποστῶσιν. ἀμέλει καὶ ἐτήρησά σοι πάντα αὐτὰ καὶ δίδωμι. Καὶ ὁ μὲν οὕτως, ὡς καὶ ὑπὲρ τοῦ Αὐγούστου τὴν τῶν βαρβάρων ἰσχὺν ἐκνευρικός, ἐσώθη. ... "And showing him many treasures of silver and gold and many other valuables piled up in heaps, he said: "I have gathered all this purposely, master, for you and for the rest of the Romans, lest the natives, by having control of so much money, should revolt. At any rate, I have kept it all for you and now give it to you". Thus Licinus was saved, by pretending that he had sapped the strength of the barbarians in order so serve Augustus" (trans. Cary). The verb ἐκνευρίζειν, in Greek, recalls the famous definition of money as νεῦρον πολέμου (see App., *BC*, 4.99).

of the *clades lolliana*. This is nearly four decades after Caesar's extensive pillaging of Gaul and the beginning of *tributum*. The gold collected by Licinus came in various forms, as Dio's description clearly shows. It could contain gold fresh from the mine and Celtic gold coins,⁸⁵ but most probably, it mainly consisted of uncoined bullion⁸⁶ and jewellery.⁸⁷

The gold wealth of Julio-Claudian Gaul is confirmed by different authors. Quintilian mentions a golden torque weighing 100 pounds offered to Augustus by the Gauls.⁸⁸ Pliny, who probably quotes official *tituli*, also acknowledges the resources of the Gallic provinces: when Claudius triumphed over Britannia, he received a larger amount of *aurum coronarium* from Gallia Comata than from Hispania Citerior (where gold mines were located).⁸⁹ We may also add that it is very likely that on the occasion of his triumph, Claudius also brought back to Rome gold seized in *Britannia* itself.⁹⁰

Literary evidence also indicates that jewellery and furniture could be sent to the mint: according to Plutarch, when Galba, the governor of Hispania Citerior, finally took arms against Nero, the governor of Lusitania, Otho, rushed to his aid and gave him all his silver and gold drinking-cups and tables to be turned into coins.⁹¹ This recalls dramatic episodes of Republican history, when powerful aristocrats contributed their jewellery to fund the *Aerarium*.⁹² But it also raises an important question: where did this gold come from in the first place? The best guess is that Otho had brought his gold and silver cups and tables from Rome. What is sure at least is that, if they were indeed sent to the mint, the coins made out of them would not have the same chemical composition of gold from the mines of Northern Spain, even if they were struck by the *legatus pro praetore* of Hispania Citerior on provincial soil. Suetonius also writes that Galba received in Tarraco a gold crown made with bullion from the local temple of Jupiter.⁹³ We cannot know what kind of gold is meant here: the gold could already have been in the temple under the Republic.

So we end up with many different supplies, coming from different parts of the Empire, and in different forms.⁹⁴ As a consequence, it would be very bold indeed to postulate without

85 van Heesch 2005.

86 On gold bullion in Gaul, Moret 2012, with previous bibliography.

87 See Suspène *et al.* in this volume.

88 Quint., 6.3.79.

89 Plin., *HN*, 33.16.53: *Claudius successor eius, cum de Britannia triumpharet, inter coronas aureas VII pondo habere quam contulisset Hispania citerior, VIII quam Gallica comata, titulis indicauit* (ed. Zehnacker).

90 Tac., *Agr.*, 12.6.

91 Plu., *Galb.*, 20.2: ἀποστάντος δὲ Γάλβα πρώτος αὐτῷ προσεχώρησε τῶν ἡγεμόνων, καὶ φέρων ὅσον εἶχεν ἐν ἐκπώμασι καὶ τραπέζαις ἄργυρον καὶ χρυσὸν ἔδωκε κατακόψαι ποιουμένῳ νόμισμα... "When Galba revolted, Otho was the first of the provincial governors to go over to him, and bringing all the gold and silver that he had in the shape of drinking-cups and tables, he gave it to him for conversion into coin" (trans. Perrin).

92 See for instance during the Second Punic War (Suspène *et al.* in this volume).

93 Suet., *Galb.*, 12 (*Praecesserat de eo fama saeuitiae simul atque auaritiae...quodque oblatam a Tarraconensibus e uetere templo Iouis coronam auream librarum quindecim conflasset...*).

94 We may even add a few more possible supplies, such as trade, although there is little precise evidence (see Howego 1992).

clear and strong evidence a direct link between a given issue of *aurei* and a precise mine, or even a precise mining area, as we may be tempted to do.

This is all the more true as we lack information about the chemical fingerprints of ancient mines. Sometimes, the data is simply not available. Sometimes, research has shown that there were many different mines in the same area, and that, even within a given mine, several chemical fingerprints can be found.⁹⁵ Even when conditions seem to be favourable, like in Egypt, some discrepancy can be found between the chemical analyses of gold from the mines and gold artefacts from the same zone.⁹⁶

This complicated picture of different sources of gold need not lead us to downplay the possibility of tracing particular gold stocks, but it serves as a useful reminder that caution and an eye to complexity are strongly recommended when interpreting archaeometric results, and that a broader approach is needed. Archaeometry can identify changes in the chain of supply, reveal differences, resemblances and long-term trends, and sometimes new inputs. The next step then is to propose hypotheses that fit the historical data, by bringing together different kinds of evidence.

The results of the chemical analyses

Augustan coins

Let us start with Augustan coins. They demand much of our attention because the situation under Augustus is more complicated than it is later, and because the Augustan Principate had a strong influence on Julio-Claudian practice. Fortunately, it is also for Augustus that our sample is the most representative.⁹⁷

Roughly speaking, if one considers Pt/Au and Pd/Au ratios, Augustan gold coins can be placed in three main groups (fig 13):

– one group of coins which has the same chemical composition as most of the Caesarian and post-Caesarian western gold coins. This “Caesarian western chemical pattern” is represented by the two red straight lines on the graph. The solid straight line represents the largest Caesarian issues. The Augustan coins that share this chemical pattern are all the coins located along this line (in green and grey, mostly). They are mostly coins from Rome and from the Uncertain western mints.

95 See Standish *et al.* 2023 and the methodological paper by Blet-Lemarquand in this volume.

96 See the results for Ptolemaic coins and gold from the mines of Samut in Faucher 2020, 18-19.

97 For methodological aspects and preliminary results on the coinage of Augustus, see Blet-Lemarquand *et al.* 2015.

– a second group of coins which have more dispersed chemical patterns, corresponding mostly to various issues struck in the East (the sphinx, victory, heifer, capricorn and candelabrum types, see fig. 13) and to some *aurei* struck by the *IIIvirii monetales*. The Augustan coins of this group are shown separately on the graph as they were not struck together or at the same time. As to their Pt/Au and Pd/Au ratios, they are similar to coins struck in the East under the Republic and in the triumviral period, such as Brutus and Cassius' coins and the issues struck for Antony, Labienus or Domitius Ahenobarbus. These earlier issues have been added as well, and are represented by yellow dots (Brutus and Cassius) and blue crosses (Antony, Labienus, Ahenobarbus). Most of them are included in the orange ellipse.

– a third group of coins which have low Pt and Pd contents, struck mostly in Lyons after 15 BC (blue triangles). This group is also characterised by low concentrations for all the gold impurities (silver, copper, tin, antimony, etc.).

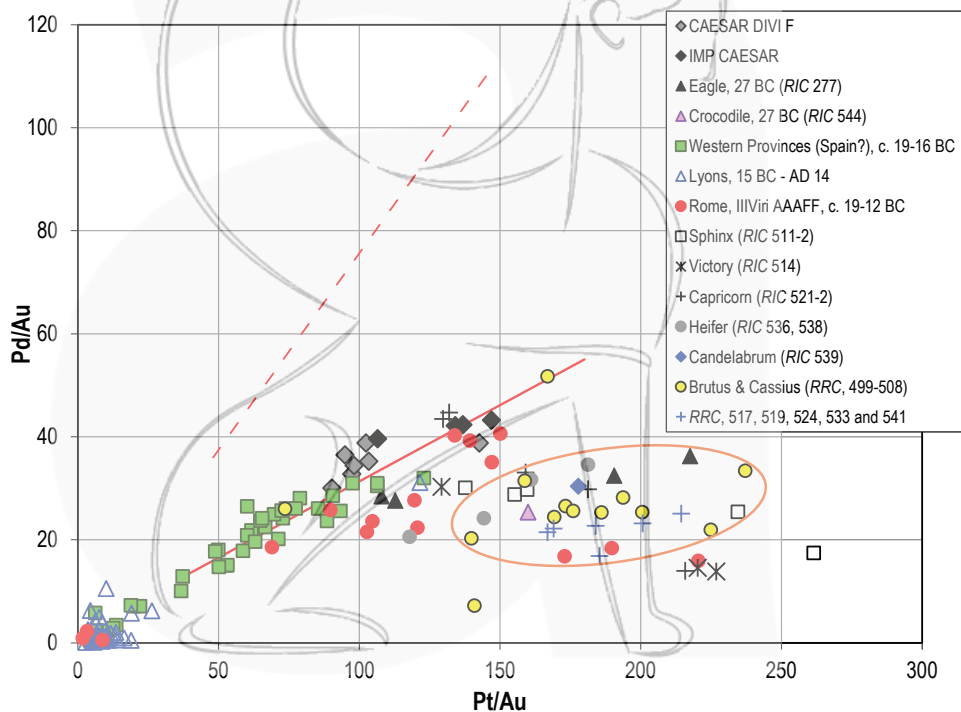


Fig. 13. 138 Augustan gold coins analysed by LA-ICP-MS and comparison with earlier trends. The two straight line segments show the trends obtained for Caesar's coins.⁹⁸ The orange ellipse includes the bulk of the Eastern coins before Augustus.

All in all, Augustan coinage reflects the same chemical fingerprints as were observed during the 1st century BC, and adds an extra one (the third group). There is also a clear chronological development: the coins with low Pt and Pd contents come later and gradually replace the previous ones.

⁹⁸ On Caesar's gold, see Suspène *et al.* in this volume.

Let us now have a more detailed look.

IMP CAESAR and CAESAR DIVI F coins, coins of the seventh consulate

As previously observed,⁹⁹ the latest triumviral *aurei*, which did not have the legend AVGVSTVS but only IMP CAESAR and CAESAR DIVI F, share the same chemical composition with previous western issues, regularly struck by *triumviri monetales* and warlords from Caesar onwards (fig. 13).

This is an important fact for two reasons. First, it confirms that CAESAR DIVI F and IMP CAESAR coins were issued in the West, as they differ markedly from previous eastern *aurei*. The results of the analyses also show that the chemical composition of the CAESAR DIVI F and IMP CAESAR is very consistent. Their Pt/Au and Pd/Au ratios do not vary much at all. They all range from 80 to 150 for Pt/Au and from 30 to 45 for Pd/Au, although the IMP CAESAR coins seem to have slightly higher Pd/Au ratios (fig. 13).

The RIC 277 coins from Augustus' seventh consulate (27 BC) have an interesting chemical composition. Some of them belong with the IMP CAESAR and CAESAR DIVI F coins (with slightly lower Pd contents). So they also reflect the same chemical composition as the western gold stock first noticed for Caesar's coinage. Some however have higher Pt/Au ratios, which suggest that a different gold stock was also used, one with some resemblances to that used for the *aurei* struck in the East in Republican times or in the 20s and down to 16 BC (see below). These coins, struck only in gold in 27 BC to celebrate the honours received by Augustus in January, were probably made at the same mint as the IMP CAESAR and CAESAR DIVI F issues, to which they also bear close resemblance from a stylistic and iconographic point of view,¹⁰⁰ but from a more mixed gold supply. This could be explained by the structure of the *Aerarium*, where different gold stocks could be kept at this time. We might also hypothesize that they were struck after the IMP CAESAR and CAESAR DIVI F coins, when another gold stock became available and was added to the stock initially used for the IMP CAESAR and CAESAR DIVI F coins. This would be a further indication that the IMP CAESAR and CAESAR DIVI F were struck some time before 27 BC.



Fig. 14. *Aureus* AEGVPT(O) CAPTA of the seventh consulate RIC 544; BNC I 0935; IMP-4567.

Unfortunately, we were able to analyse only one coin of the other gold issue of the seventh consulate, the RIC 544 *aureus* with a crocodile and the legend AEGVPT(O) CAPTA,

99 See the papers by Suspène *et al.* in this volume.

100 See Burnett 1978.

which makes any generalization quite hazardous (fig. 14). This coin was not struck with the same stock as the CAESAR DIVI F and IMP CAESAR *aurei* and most RIC 277; it is closer to the “eastern” fingerprints already observed for some RIC 277 gold coins (fig. 13 and 16a). Its higher Ag (0.7%) and Cu (0.11%) content, maybe to be explained by poor refining, also distinguish it from the bulk of Augustan gold coinage (see fig. 18). It could have been struck in the East, or with gold from the East. The uncertainty concerning the place of minting of these coins cannot be solved, but the connection with eastern gold coins is interesting.

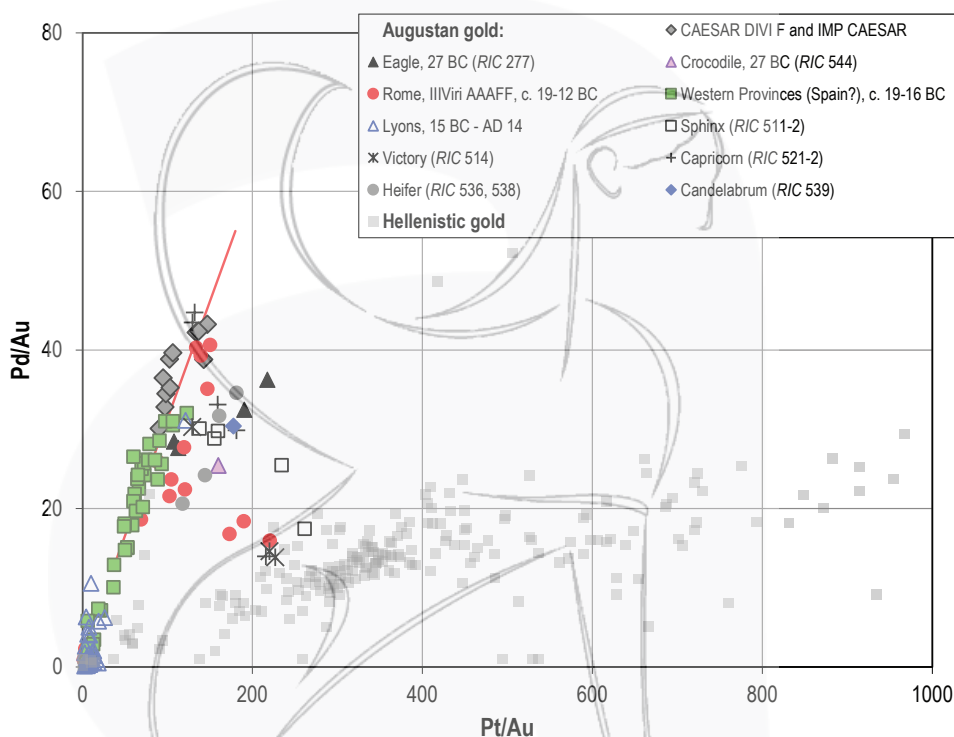


Fig. 15. Augustan gold compared with Hellenistic (Antigonid, Seleucid, Ptolemaic) gold coins. Some rare Hellenistic gold coins with Pt/Au higher than 1,000 have not been included.

At this point, we should also comment on a famous passage by Suetonius about the seizure of Cleopatra’s treasure in 30 BC and the effect that it had on the Roman gold coinage and economy the following year.¹⁰¹ As we recently studied this question in detail elsewhere,¹⁰² suffice it to say that there is no indication of a sudden change in the Roman gold supply around 30 BC from an archaeometric point of view. Neither the IMP CAESAR and CAESAR DIVI F *aurei*, nor most of the gold coins of 27 BC,¹⁰³ show a new chemical pattern that could

¹⁰¹ See for instance Suet., *Aug.*, 41.1-2.

¹⁰² Suspène 2020a.

¹⁰³ Only the “eastern” fingerprints of some coins of the 7th consulate (RIC 277) could be explained by the melting down of Ptolemaic gold.

Éléments sous droit d'auteur - © Ausonius Éditions Octobre 2025 : embargo de 2 ans

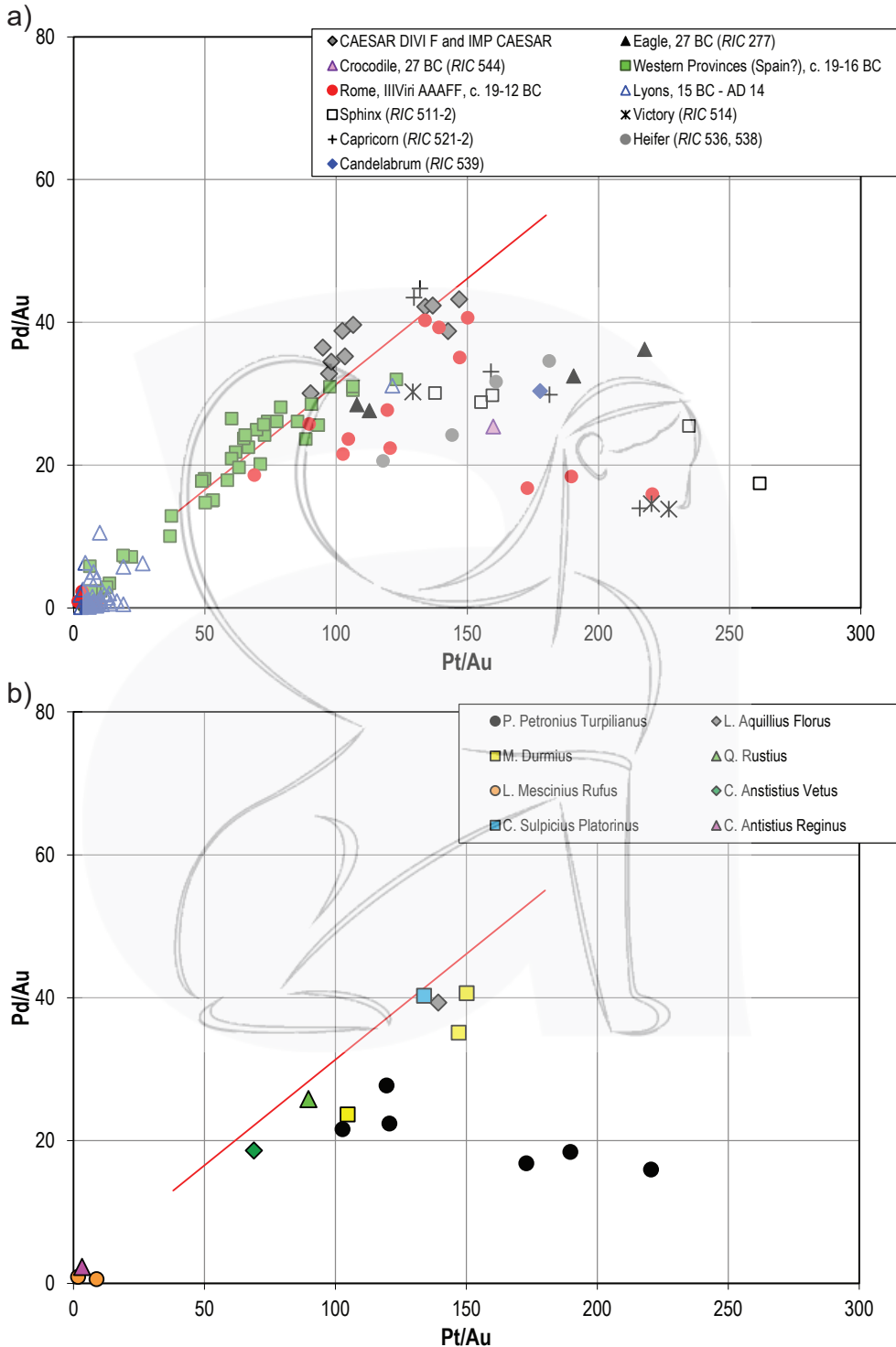


Fig. 16. a) All Augustan aurei; b) specific results for each of the *triumviri monetales* (Rome, c. 19-12 BC).

be accounted for by the minting of a sudden input from the Ptolemaic *regia gaza* (fig. 15). It is hard to be sure, however, as we do not know the chemical pattern of Ptolemaic gold jewellery under Cleopatra.¹⁰⁴ However, comparisons with earlier Ptolemaic coins (3rd-2nd century BC) suggest that Ptolemaic coined gold did not have the same Pt/Au and Pd/Au ratios as western Roman coins (fig. 15).¹⁰⁵ Moreover *aurei* were not issued on a very large scale between 30 and 29 BC.¹⁰⁶ So whatever happened to Cleopatra's treasure, and to whatever was in it, the consequences for Roman gold coinage were minimal.

Eastern Augustan issues (25 BC?-16 BC)

The issues traditionally attributed to Eastern mints (Pergamum and indistinct mints, see fig. 13 and 16) and dated between 25 (?) and 16 BC are clearly distinct from the earlier coins showing the “Caesarian western chemical pattern” and from later western coins (the “Uncertain western issues”). The gold stocks used to strike them are not the same as those for the West (except for two Pergamum coins *RIC* 521 and 522). Neither do they resemble the Hellenistic gold stock (see fig. 15 and Duyrat *et al.* in this volume), but rather only the Brutus and Cassius gold coinage. This makes sense: the coins struck in the East were mostly made out of eastern bullion. But, although this difference is clear, the overall impression for these Eastern series is diversity: for instance, it is impossible to find a common Pt/Au and Pd/Au ratio, or even a general evolution (see fig. 13 and 16). These issues were probably struck in different mints, and with different gold supplies, and do not add up to form a single, coherent coinage. Augustan gold coinage in the East does not, indeed, follow a clear pattern. The issues struck there between 25 (?) and 16 BC were not part of a “grand scheme”, but were rather sporadic productions, maybe on the occasion of imperial trips to the East (Augustus regularly stayed in the *pars orientalis* until 19 BC).¹⁰⁷ They were discontinued when the imperial government determined to mint gold centrally in the West for the whole empire, around 15 BC.

Coins of the Augustan *triumviri monetales*

Let us turn now to the coinage of the *triumviri monetales* (fig. 16b). The range of composition is larger, which is understandable for coins struck over a few years (19-12) by

104 We do know that some Ptolemaic gold jewellery was melted down by Augustus in Rome after 30 BC (see Suet. *Aug.*, 71 (ed. Ihm): *Item (refutavit) lautitiarum inuidiam, cum et Alexandria capta nihil sibi praeter unum murrinum calicem ex instrumento regio retinuerit et mox uasa aurea assiduissimi usus conflauerit omnia*); but it is unlikely that the gold was sent to the mint afterwards. See Faucher and Avisseau-Broustet in this volume for a few preliminary analyses of some Ptolemaic rings (and comparisons with coins): there are indeed some matches between the chemical pattern of Egyptian gold jewellery and that of Roman gold coins, but as the dates (and even attributions) of the rings are far from sure, it is impossible to draw conclusions.

105 This is true for all Hellenistic gold coinage, see Duyrat & Olivier 2010 and Duyrat *et al.* in this volume. Caution is needed as the chemical pattern of Ptolemaic coined gold seems to have undergone some change in the course of the 2nd century, but evidence is scarce (see Olivier 2012; Faucher 2018). Gold coinage stopped in Ptolemaic Egypt around 150 BC (Faucher & Olivier 2020, 106).

106 See Suspène 2020a.

107 A recent numismatic study of “the heifer issue” suggests as much (Rambach & Walker 2012, 41).

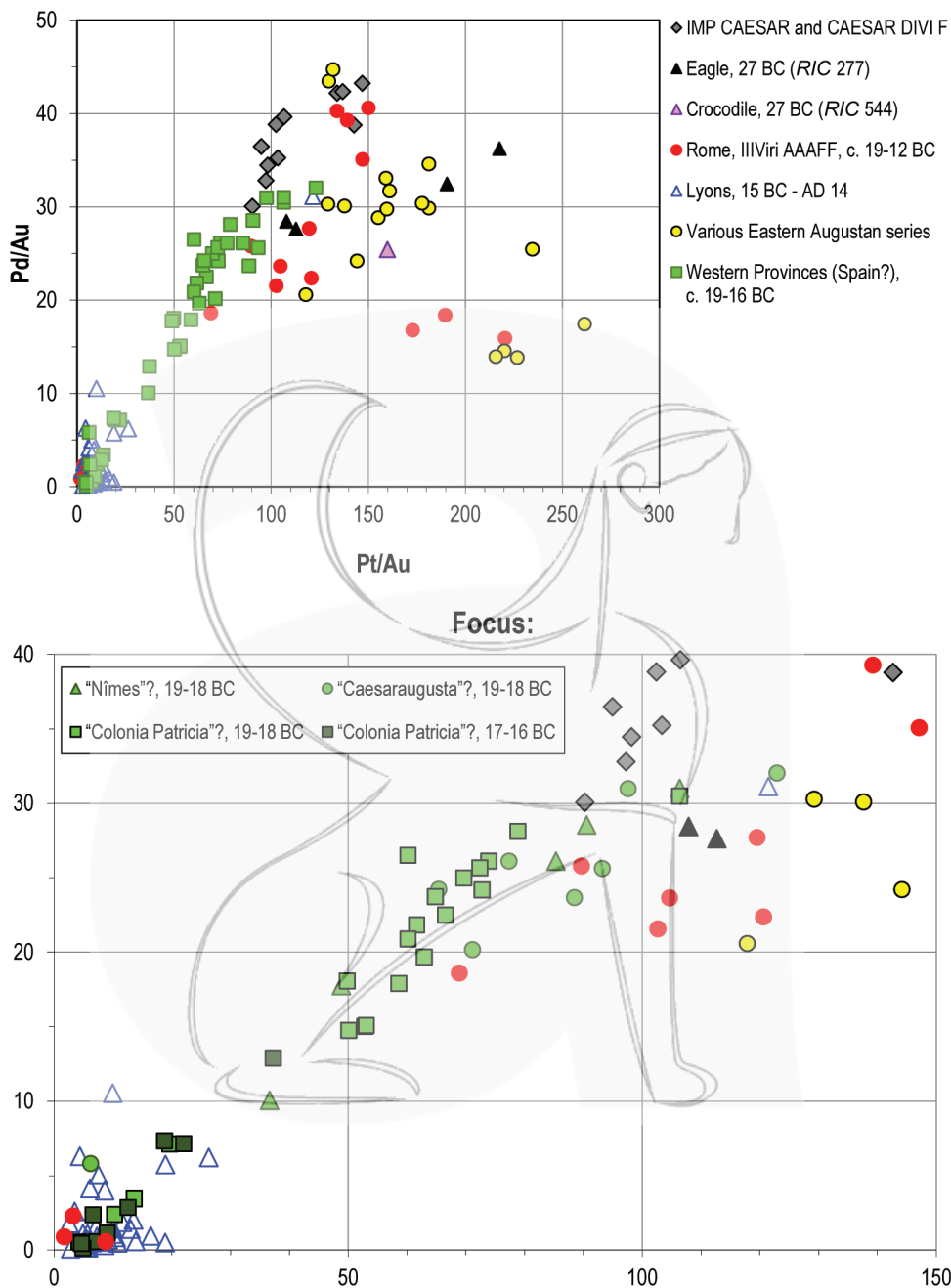


Fig. 17. Augustan gold coins, with a focus on the Uncertain western mints (Spain?), 19-16 BC.

different *triumviri*. Some coins have fingerprints which are very close to Republican and early Augustan gold coins (fig. 13), while others are similar to eastern coins. Some even show the same chemical composition as coins struck in Lyons after 15 BC. To put it briefly, coins from the mint of Rome show signs of being made from every gold stock available under Augustus, suggesting that the mint of Rome used different gold supplies rather than a single consistent one. The explanation might be that the *Aerarium* held a number of different gold stocks at that time, or that the mint used supplies in an opportunistic way. For instance, when the mint of Rome reopened for silver and gold in 19 BC (only the bronze was struck between 23 and 20 BC),¹⁰⁸ Augustus had just come back from the East. If gold was collected on this occasion, it could account for the “eastern” fingerprints of the triumvirs’ gold coinage, especially as the earliest coins struck in Rome by the triumvirs seem closest to the eastern Augustan coins (*RIC* 278 and 293, signed by P. Petronius Turpilianus in 19 BC, for instance). Conversely, the two coins that show the same chemical fingerprints as coins from Lyons are later coins (*RIC* 350 by L. Mescinius Rufus in 16 BC, *RIC* 411 by C. Antistius Reginus in c. 13 BC). When a new stock appeared, which was used first in the Uncertain western mints and then mostly at the mint of Lyons, the mint of Rome eventually got access to it.

The results for the western series struck in Spain or Gaul between 19 and 16 BC (fig. 13 green shapes) and for *aurei* struck in Lyons after 15 BC (fig. 13 blue shapes) are the most enlightening. The western series slowly shift from the traditional Caesarian and post Caesarian chemical composition that was still prevalent in the first years of Augustus’ rule, to a new one, characterized by low Pt and Pd contents, that will become the hallmark of the mint of Lyons for about three decades. Some major change in gold supply obviously took place between 20 and 15 BC in the western provinces. To describe it more accurately, we need to focus first on the Uncertain western mints.

“Uncertain western issues” (19-16 BC)

As shown on the graph (fig. 17), the Pt/Au and Pd/Au ratios of coins from the Uncertain western mints (green squares, dots and triangles) follow a straight line that goes from the Republican/early Augustan coins (grey diamonds, mostly) to the later Lyons coins (blue triangles). The chemical composition of the coins evolved in a linear trend, suggesting that an old gold stock was mixed with a new one, which became more and more important over time. The “old stock” should be identified with the Caesarian western gold stock, which had formed the bulk of Roman coinage for three decades; the new stock has lower Pt and Pd contents. The gradual mixing of the two gold stocks is confirmed by the fact that the latest coins (Uncertain western mint 2 “Patricia?” coins, struck in 17-16 BC, represented by dark green squares) all have very low Pt and Pd contents (the Pt/Au ratio is below 40, the Pd/Au ratio below 15).

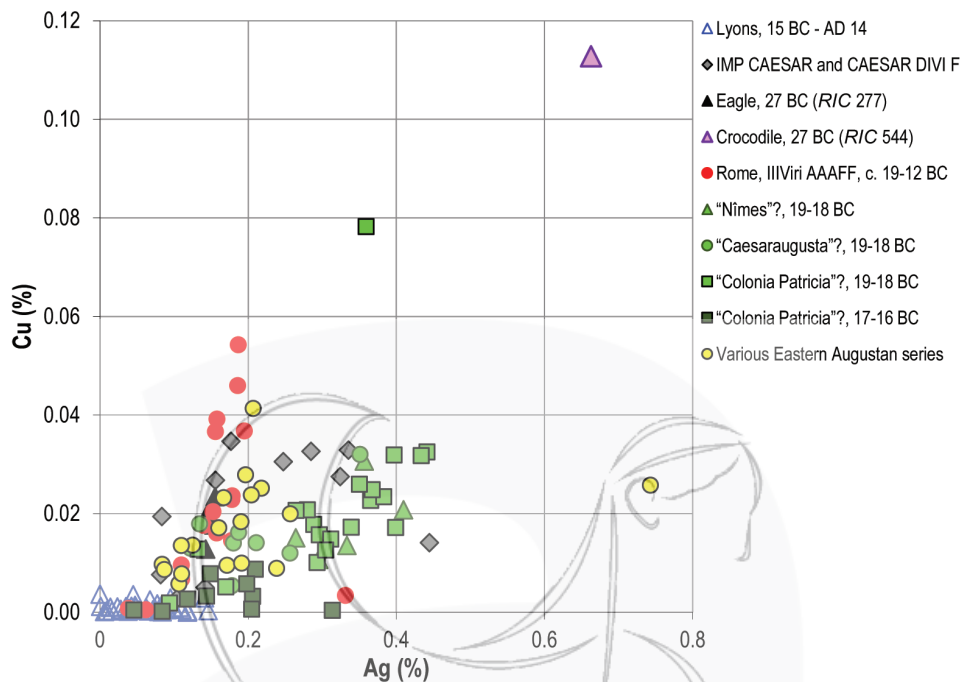


Fig. 18. Cu versus Ag (weight %) for all Augustan coins with a focus on Uncertain western mints (Spain?), 19-16 BC.

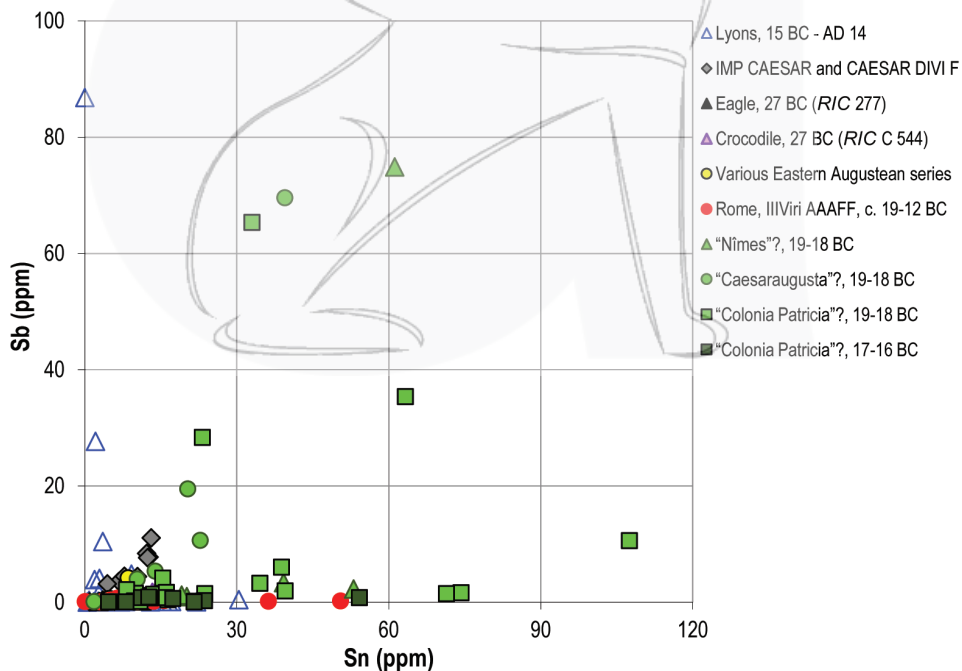


Fig. 19. Sb versus Sn (ppm) for all Augustan coins with a focus on Uncertain western mints (Spain?), 19-16 BC.

Additional confirmation is provided by silver and copper contents: the latest coins from the Uncertain western mint have lower Ag and Cu contents than the other coins belonging to this group and they tend to be closer to the Lyons group which is distinguished by low contents in all the gold impurities (see fig. 18). This is also true, to a lesser extent, for tin (Sn) and antimony (Sb): Sn and Sb contents are sometimes higher in the coins dated to 19-18 BC than in later coins, dated to 17-16 BC (fig. 19).¹⁰⁹

After 17 BC, the new gold stock seems to be prevalent.

Another interesting observation can be made: it is not possible to distinguish between the different “Uncertain western mints” operating before the opening of Lyons by their Pt/Au and Pd/Au ratios of the coins or by any other trace elements.¹¹⁰ “Uncertain mint 1/ Caesaraugusta (?)” and “Uncertain mint 2/ Patricia (?)” belong together: the chemical compositions of coins from these two mints show no differences, at least from coins struck in 19/18 BC (fig. 17 to 19). Moreover, the hypothesis of a third mint in Nîmes, as is sometimes put forward, is not supported by the archaeometric evidence (see the green triangles on fig. 17).¹¹¹ As far as the chemical analyses are concerned, there could perfectly well be just one mint (and not two or three)¹¹² that was responsible for the whole western gold coinage outside Rome between 19 and 16 BC. Archaeometry, of course, cannot provide all the answers, and numismatic and archaeological evidence must also be taken into account. But whatever the actual number of “Uncertain western mints”, they were all supplied with the same gold stocks.

Let us turn now to the coins from Lyons.

Coins from Lyons

The chemical composition of the coins struck in Lyons from 15 BC to the end of Augustus' principate shows one striking feature: all the coins have very low Pt and Pd contents (fig. 20). The Pt/Au ratio is below 20, the Pd/Au ratio below 10. This is true for the four main groups of *aurei* struck in Lyons (IMP X-XII coins between 15 and 10 BC; IMP XIII coins in 8 BC; C. L. CAESARES coins from 2 BC; Tiberius' TR P XV coins of AD 13-14; all the *quinarii*). However we notice that the highest Pt and Pd contents are to be found in the first group (IMP X-XII).¹¹³ After 8 BC, Pt and Pd contents drop even lower. The chemical composition of the *quinarii* (8 and 7 BC, AD 4 and 7) closely resembles that of the *aurei* and follows the same trend.

109 This feature (Sb above 10 ppm and/or Sn above 25 ppm) is not shared with any other Augustan coins. We do not have a definitive explanation for this trend. However Sb is one of the characteristic elements of Limousin gold ores (Baron *et al.* 2019) and Sn characterizes gold in a secondary position. The presence of these elements in purified gold might also represent the residues from the recycling and refining operations of Celtic gold objects, especially coins. These reasons may suggest that some of the gold of the Uncertain western mints could have a Celtic provenance (fresh ore or recycled gold).

110 See already Suspène *et al.* 2011.

111 For a full analysis of the hypothesis of a mint in Nîmes, see Suspène *et al.* 2011.

112 In the hypothesis of a single mint, the different styles of the coins could be explained by several *scalptores* working together in the same mint.

113 Chemical patterns (Pt/Au and Pd/Au ratios) of IMP X and IMP XII *aurei* are identical.

Another interesting feature of the Lyons coins is that the gold content is especially high, because all the impurities (silver and copper in particular) have low levels of concentrations when compared with the other Augustan coins (fig. 21a and fig. 21b).¹¹⁴ This suggests that the coins were refined very carefully.

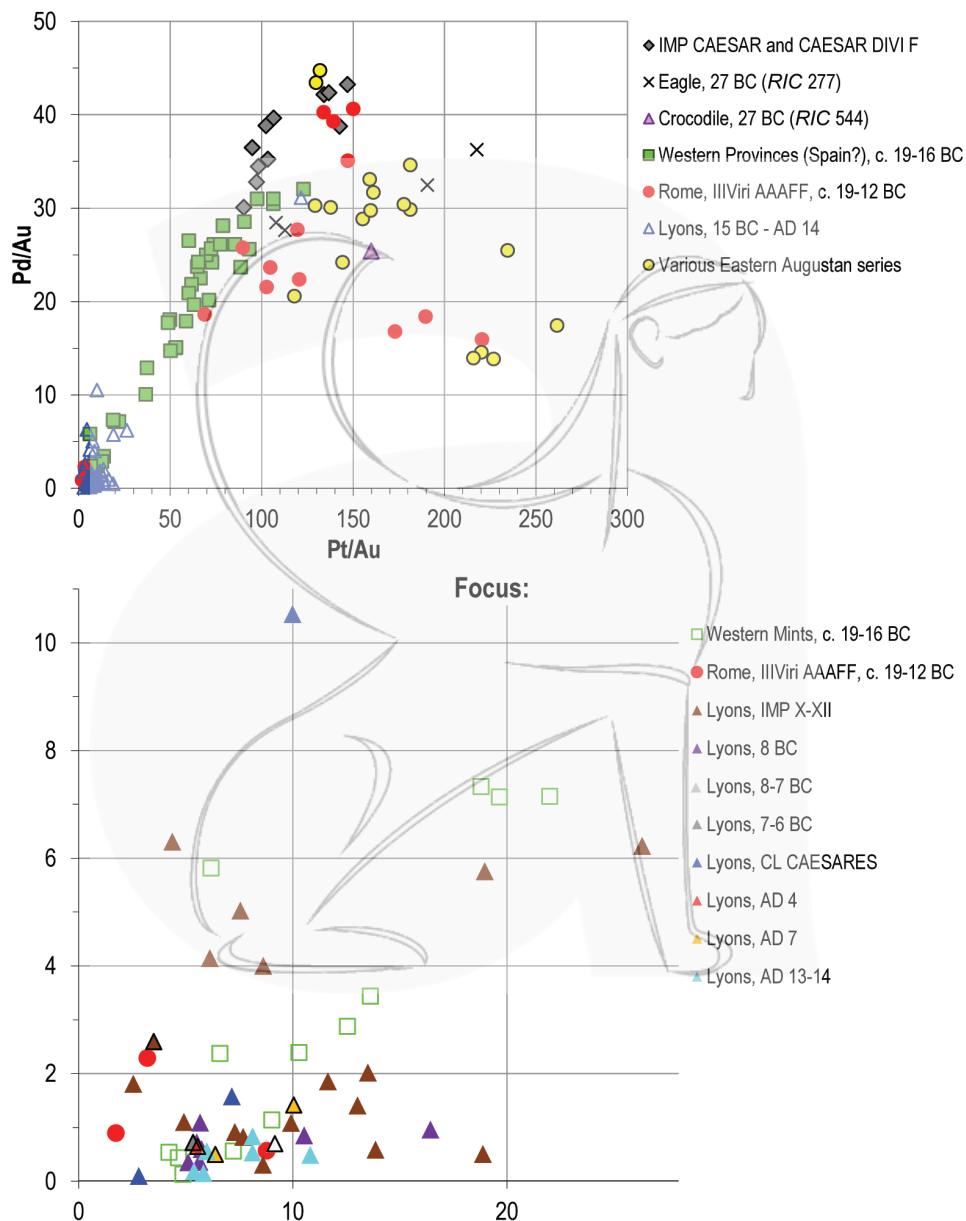


Fig. 20. Augustan gold coins, with a focus on gold coins from Lyons. *Quinarii* have a black border. A Lyons IMP X coin (BNC 1385) was not plotted (off the diagram, Pt/Au=121 and Pd/=30), see comments below.

¹¹⁴ Already noticed in Blet-Lemarquand *et al.* 2015.

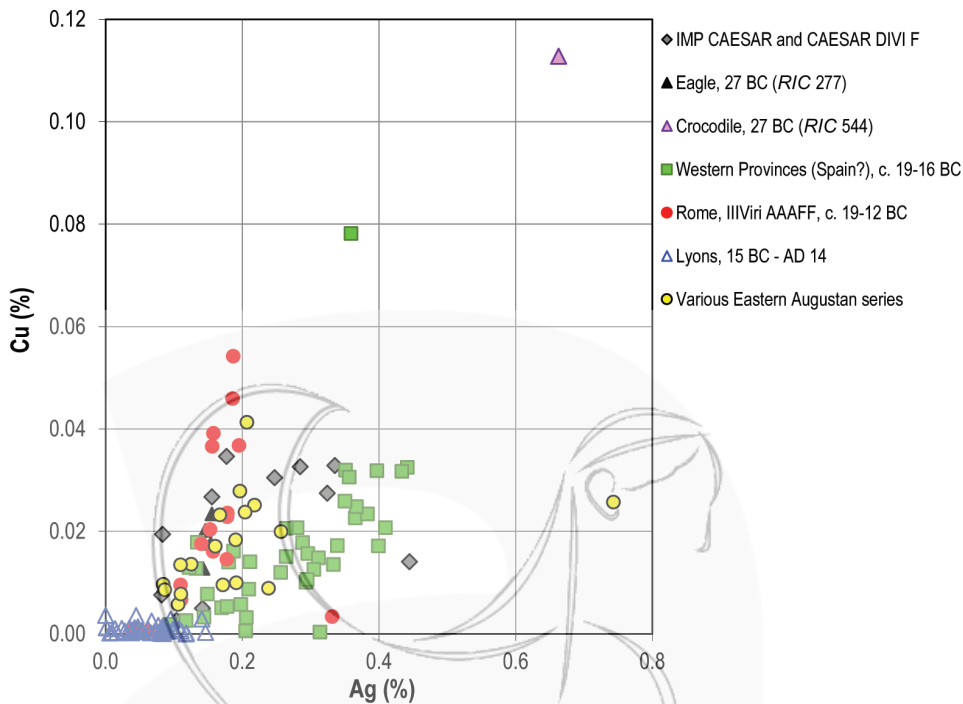


Fig. 21a. Cu versus Ag (weight%) for all Augustan coins.

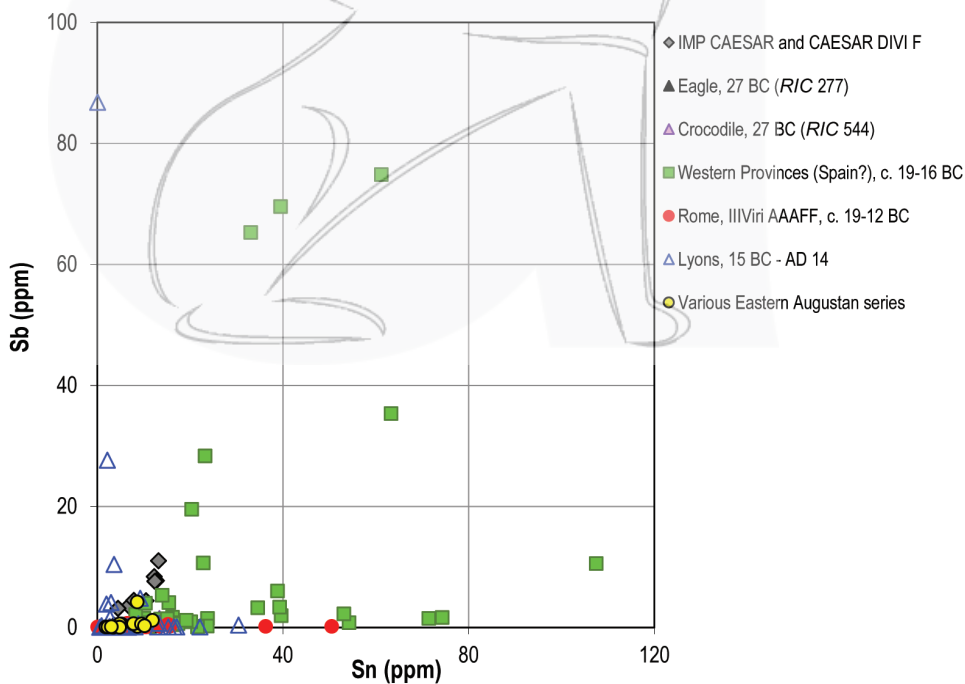


Fig. 21b. Sb (antimony) versus Sn (tin) in ppm for all Augustan coins.

The only gold coin from Lyons with high Pt and Pd contents¹¹⁵ is one of 15 BC (IMP X, BNC 1385), struck just after the opening of the mint of Lyons, and there seems no numismatic reason to doubt the authenticity of the coin. The best explanation is that this coin was struck with gold previously used in the western mints between 19 and 16 BC. As observed above, the fact that western coins between 16 and 15 BC have lower and lower Pt/Pd ratios, prefiguring the later composition of Lyons *aurei*, shows that the shift from a traditional western gold stock to a new one was gradual, with a phase when the old gold stock was still in use and could be blended with the new (low Pt and low Pd) gold.¹¹⁶ This is probably what accounts for the abnormal chemical composition of BNC 1385.

This new gold stock with low Pt and Pd contents is of course very intriguing, all the more so because it had never been seen in Roman coinage before. What can explain this dramatic change in the chemical pattern of Roman gold coins?

Recycling of older Roman coins seems excluded, precisely because Pt/Au and Pd/Au ratios are so low: since recycling cannot affect Pt/Au and Pd/Au ratios, if earlier *aurei* had been melted down to strike the Lyons coins, the new coins would show the same Pt/Au and Pd/Au ratios as the earlier ones. It is also probably better to exclude a mixing of different gold supplies, as these different stocks would all need to have had low Pt and Pd contents to match the chemical pattern of the Lyons gold coins, and this seems very unlikely. So the gold minted in Lyons must be from a new gold stock, never used before for Roman gold coinage.

In fact, gold with low Pt and Pd contents had been used in Macedonian coinage before Alexander the Great conquered the Persian Empire. But this gold was mixed with eastern gold later on to produce a new gold stock with higher Pt contents;¹¹⁷ moreover, Macedonian mines were apparently not exploited any more under the Empire.¹¹⁸ Thus it is unlikely that this Macedonian gold supply could have been used again in Lyons under Augustus. Julien Olivier also observed that some late Ptolemaic gold coins from the 2nd century BC can have lower Pt and Pd contents; he hypothesized that the Alexandrian mint got hold of a new gold stock at that time, due to a change of supplies in the course of the 2nd century BC (maybe gold from the mines in the desert).¹¹⁹ The data, however, is limited, and it is not very likely either that such a stock would have been used at the mint of Lyons after 15 BC. We would expect it to appear much earlier in Rome, when Ptolemaic gold was first seized, and at the latest under Caesar.¹²⁰

A more tempting explanation is to link this new gold stock to the reorganization of the western provinces under Augustus. The wars in Spain, to which Agrippa put an end in

115 Pt/Au = 121 and Pd/Au = 31.

116 See already Blet-Lemarquand *et al.* 2015.

117 Duyrat *et al.* in this volume.

118 See above.

119 Olivier 2012, 678.

120 Recent research on the Ptolemaic mine from Samut rather suggests that Pt and Pd contents in the gold ore from Samut were particularly low (Faucher 2020, 17-18). But this is just one mine, and Faucher himself cautiously refrains from drawing conclusions.

19 BC, gave the Romans access to new resources, including gold mines (see above). However, archaeologists rather think, with due caution, that the full exploitation of these mines started only late in the principate of Augustus or even under Tiberius.¹²¹ This seems to exclude that gold extracted from the mines of Northern Spain by the Romans could have been the source of Roman gold coins struck in Lyons from 15 BC on, let alone of coins struck even earlier in the Uncertain western mints. This is a strong argument, but we should keep in mind that it is difficult to be absolutely sure about the exact date of the beginning of the exploitation of the mines by the Romans,¹²² and it is possible that, before the intensive phase of mining in northern Spain, some kind of exploitation could have already taken place, leaving little or no archaeological evidence. We can at least be sure that the Romans were perfectly aware of the presence of gold in northern Spain well before the conquest and that they were ready to take advantage of these new resources as soon as they could (that is from 19 BC on).¹²³ As gold could be found in Spain before the Roman conquest, some of it was probably seized during the Cantabrian and Asturian wars.¹²⁴ This could also be an explanation for the new gold stock with low Pt and Pd contents in use in the West from 17 BC on (at the latest). In brief, this new gold stock with low Pt and Pd contents could be a Spanish gold stock, first introduced into Roman coinage right after the wars of Agrippa and brought regularly into use, in increasing proportion, until the end of Augustus' principate.

As suggested above, however, Spain was not the only source for gold. Augustus' provincial reorganization also affected Gaul. Therefore, it is not altogether impossible that another stock of gold was collected in Gaul and used in the western mints: the anecdote of Licinus (see above) is supposed to have taken place precisely in 16 BC, just before the mint of Lyons opened. There is one objection to this hypothesis: the Celtic gold seized by Caesar had a different chemical pattern from the Lyons coins, with higher Pt and Pd contents. So if the new gold stock was Gallic, it had to come from a different source from that of the gold that Caesar captured a generation earlier. But Celtic gold coins with low Pt and Pd contents do exist (see fig. 22 below), and this shows that this kind of gold was or had been available in Gaul at some point.¹²⁵

Lastly, the years around the opening of the mint of Lyons were also the time when the Alpine belt was definitively subjugated (see above), a victory celebrated by the iconography of some of the earliest coins in Lyons.¹²⁶ This conquest may have provided the Romans with gold supplies as well. This is, of course, only a guess, but it cannot be excluded.

121 Domergue 1990, 198 ff. and 2008.

122 See above and Hirt 2020.

123 Howgego 1992, 7-8 thinks that the exploitation of the mines of northern Spain shortly followed the Roman conquest, rightly pointing out that the Romans already had a good command of existing mining techniques. See also García-Bellido 2008, 289, commenting on Flor., 2.33.

124 See above for the presence of gold in different places in Spain before the coming of Rome.

125 See also Nieto-Pelletier and Olivier in this volume. We cannot exclude that new gold resources were mined in Gaul after the conquest, although there is no archaeological indication of it (see above).

126 *RIC* 162-165: *aurei* (and *denarii*) showing two soldiers, traditionally interpreted as Drusus and Tiberius, handing laurel branches to a seated Augustus and celebrating the Princeps 10th imperial *salutatio* (15-13 BC).

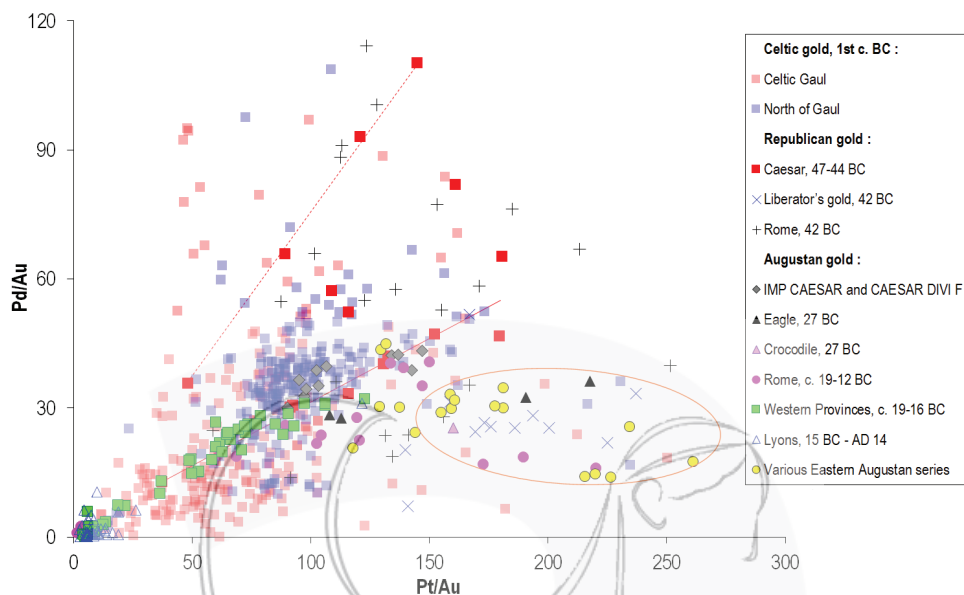


Fig. 22. Augustan gold coinage vs Celtic gold and Republican gold (Pd/Au and Pt/Au).

All in all, the hypothesis of a new supply, first appearing around 19 BC, quickly becoming prevalent and staying so for more than thirty years, is very hard to resist. It is difficult to single out a precise source for this new supply; Spain may seem the best candidate, but it cannot be proved in the current state of research.

The transition towards a new gold stock is very clear, and it cannot have happened by chance. Only a specific decision by the imperial authorities can account for such a change. The chain of supply for gold was obviously reorganized thoroughly, according to a conscious scheme. Agrippa was of course very active in the West at least in 19 BC, and he may have come up with the idea. But Augustus himself was back from the East since the summer of 19 BC and he stayed in Gaul and in Spain between 16 and 13 BC. He was most probably involved at least in the decision to open the mint of Lyons and we can be sure that he paid special attention to gold coinage.

Another point worthy of notice is that this change in gold supplies does not seem to affect the mint of Rome very much: the new gold stock was used occasionally in Rome, but rather later than in the western provinces (see fig. 16). The new organization of the gold supply focused on the western provincial mints rather than on the mint of Rome. This is in line with the consideration that it was the mint of Lyons that served as an imperial mint, while the mint of Rome kept to a more modest role.

The results of the analyses of coins from Lyons also shed light on the question of the existence of subsidiary mints in the second half of Augustus' principate. The chemical composition of all the *aurei* struck in Lyons is very homogeneous, at least regarding Pt and

Pd contents, which supports the view of a central mint, rather than a more complicated pattern with subsidiary mints (at least under Augustus). In any case, if there were indeed different mints at that time, it can be stressed that they all drew from the same gold supply.

In summary, the Pt and Pd contents of Augustan gold coins are very important. They show that a large variety of different gold stocks was used over time, with a gradual shift from gold stocks well attested in Republican times to a new stock, characterized by low Pt and Pd contents, which probably first appeared around 19 BC, and is overwhelmingly dominant in the mint of Lyons.

In a more global perspective, Augustan gold coinage drew from many sources. Fig. 22, that is limited to coins and excludes jewellery or gold fresh from the mine, clearly shows the overlap between Augustan gold and earlier Roman and Celtic coinages from the 1st century BC. Although the graph is far from complete and does not take into account all available supplies, it fits in perfectly with the literary evidence and emphasizes the gold transfers that took place before and under Augustus to give birth to the first imperial gold coinage.

The most striking feature of Augustan gold coinage, however, remains the centralization in Lyons: the results of analyses made in the course of the AVREVS program, combined with previous programs run at the IRAMAT-CEB Orléans, have shown that this centralization included a change in gold supplies that started right after the conquest of northern Spain. This suggests a deliberate and well-orchestrated reorganization of Roman gold supplies between 20 and 15 BC, of which the opening of the mint of Lyons was only the most conspicuous stage. This reorganization itself was part of the complex and manifold legacy Augustus left to his successors. We will now try and describe how the history of imperial gold coinage developed later and what became of the Augustan scheme.

Julio-Claudian gold coinage and the Augustan legacy

The most important fact in Julio-Claudian gold coinage after Augustus is the appearance of a new chemical pattern, characterized by low Pt but high Pd contents.

On fig. 23a, which was made using a larger scale than previous graphs, Augustan gold coins minted before 15 BC (grey crosses) clearly stand apart from later gold coins. Although the change was not as abrupt as what we observed between 19 and 15 BC, when low Pt and Pd gold stocks were introduced, the general tendency is clear. Starting with Tiberius, Roman gold coins sometimes show high Pd contents that cannot be observed before. This high Pd, low Pt gold can be seen throughout the 1st century AD, as shown on fig. 23b (only the coins of Caius have rather low Pd contents too).

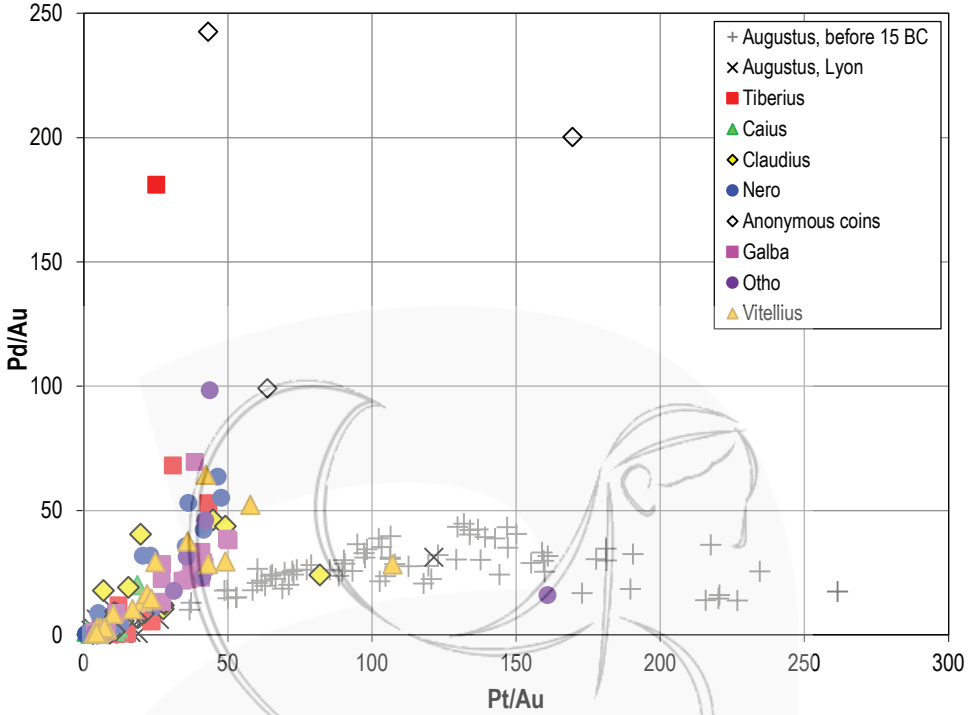
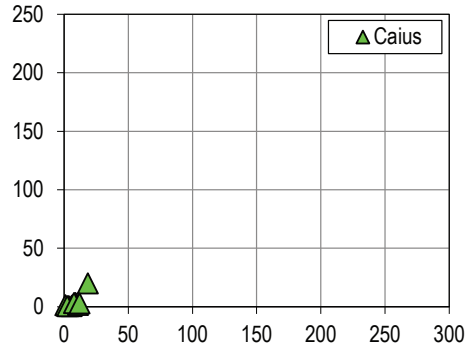
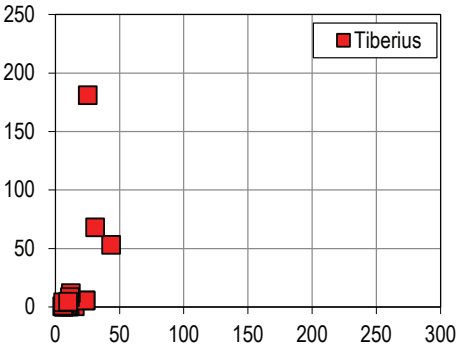
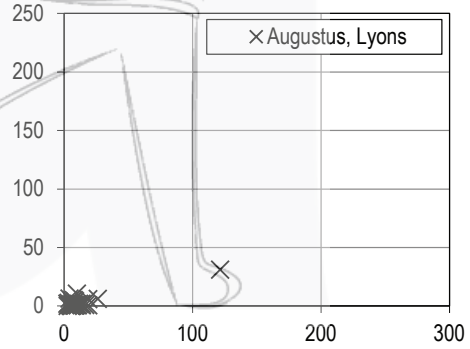
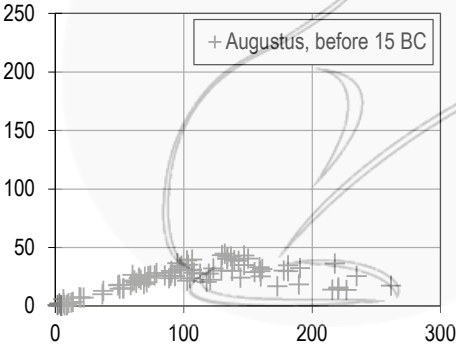


Fig. 23a. Gold coins from Augustus (138) to AD 69 (144 coins).



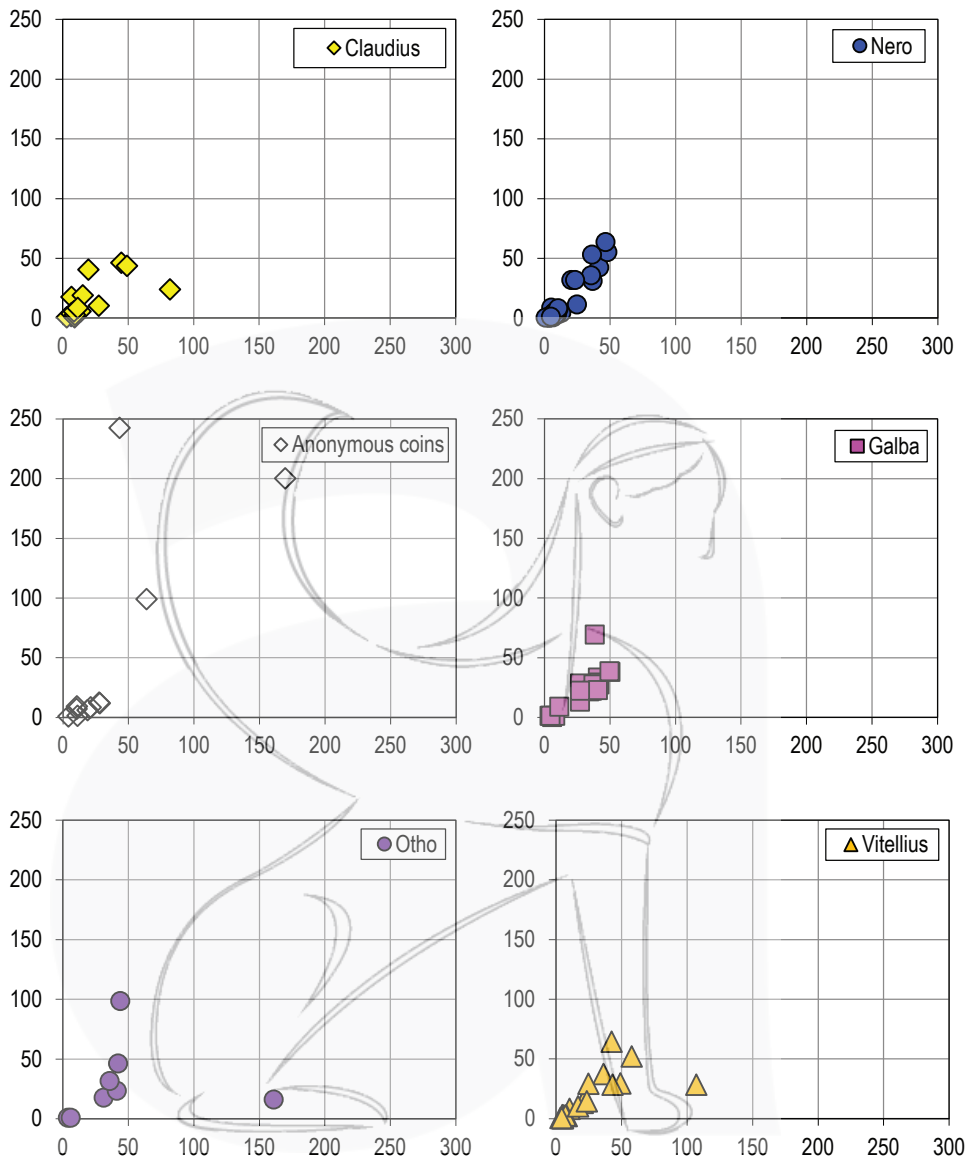


Fig. 23b. Gold coins from Augustus (138) to AD 69 (144 coins), by emperor.

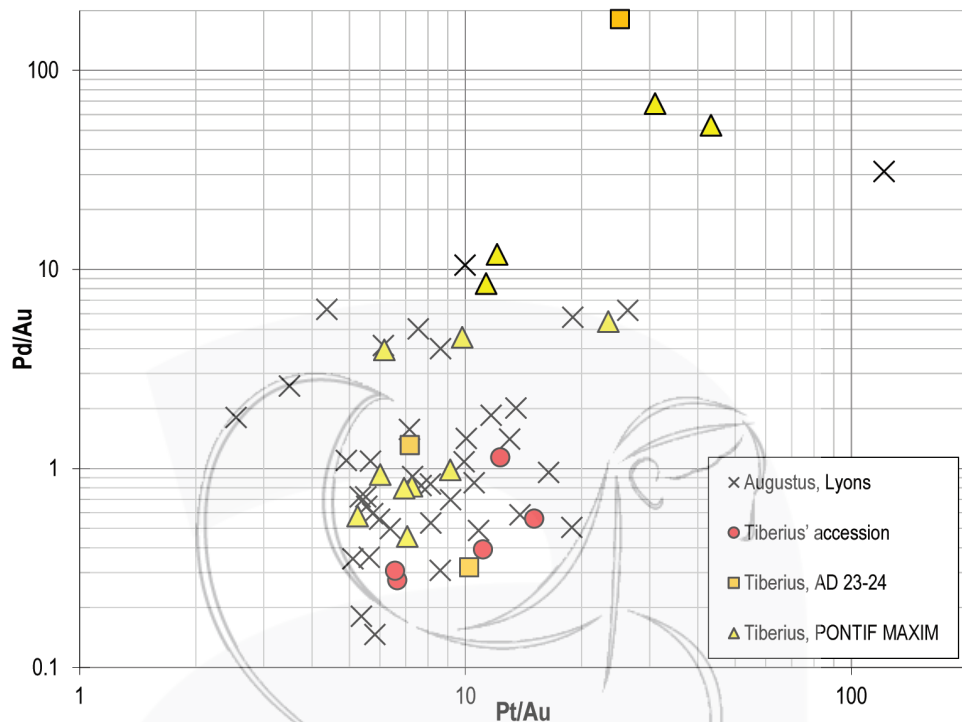


Fig. 24. Tiberius vs late Augustan gold coins (logarithmic scales).

To understand better what happened, let us focus on late Augustan and Tiberian gold coins, at the time when this new transition took place.

As we can see on fig. 24, the gold with low Pt and Pd that characterized the last stages of Augustan coinage was still used under Tiberius, especially in the early years of his principate (red dots). In fact, it is not really possible to distinguish between late Augustan and early Tiberian issues from an archaeometric point of view. The chemical analyses show that the same gold was minted before and after the imperial succession, and care must have been taken to secure the gold supplies for the mint of Lyons to ensure that the supply of coinage was not interrupted at the death of Augustus. There is also a strong sense of continuity between the typology of late Augustan and early Tiberian coins.¹²⁷ This is best explained by political reasons: the first imperial succession was a perilous change (as the first books of Tacitus' *Annales* eloquently show), and everything was done to make things go smoothly. The coin designs emphasized on legitimacy and dynastic filiation, but the issues struck in AD 13-14 were also meant to reassure the most important sponsors of the empire, and especially the troops, regarding the continuation of their financial advantages.¹²⁸

¹²⁷ Butcher & Woytek 2018. See above.

¹²⁸ Suspène 2018.

As time goes by, we notice under Tiberius an increasing amount of high Pd content gold. While coins dating to the beginning of Tiberius' rule retain the chemical pattern of Augustan gold, later coins have markedly higher Pd contents. This is true for coins dated to AD 23-24 (fig. 24, orange squares) and for part of the PONTIF MAXIM gold issues (fig. 24, yellow triangles). These later issues do not bear any indication of date and were struck in large numbers at the beginning of Tiberius' principate but also at different times later on. As a consequence, the fact that they show different chemical patterns makes perfect sense.¹²⁹ It also suggests that a new gold supply appeared, that would become more important in years. This new gold stock could consist in part of recycled coins, but as former Roman coins had little Pd and as foreign gold coinages were now almost non-existent, it is better to assume that the new stock came rather from jewellery or bullion, or from mines newly acquired by the Romans. Indeed, this change of gold supply is more or less contemporary with the intensive exploitation of the mines of northern Spain that started in the last years of Augustus' principate but increased under Tiberius.¹³⁰ Far from being the idle, cruel and misanthropic Emperor that Tacitus depicts, Tiberius was a very active *Princeps* (at least before his exile to Capri in AD 26). He may have implemented or improved Augustus' strategy for gold supplies, or come up with his own views. The fact that he confiscated Spanish mines owned by a powerful aristocrat, Sex. Marius, the richest man in Spain,¹³¹ probably testifies to his determination to reinforce his control of gold production.

Whether this reconstruction is correct or not, we cannot but notice that in the short time span of about 50 years (from 15 BC to AD 40), two new gold stocks were introduced into the Roman gold coinage. Although other sources cannot be excluded, one at least is probably linked to the gold mines of northern Spain.

Under Caius, Claudius and Nero, gold supplies seem to be stable and no major change is to be observed: the two gold stocks are still present, although the new high-Pd gold stock tends to supersede the old low-Pt and low-Pd one, except under Caius (see fig 23). The presence of the low-Pt and low-Pd gold stock, that is the late Augustan stock, can be accounted for by the continued use of the same supplies as under Augustus, or by the recycling of older coins, mostly the Augustan and early Tiberian coins from the mint of Lyons. Augustan C. L. CAESARES and Tiberian PONTIF MAXIM coins from Lyons were struck in large numbers. When it was necessary to strike new gold coins, for political reasons, such as an imperial succession or a *donativum*, it was probably handier to recycle older coins than to use other metal supplies, that needed at least refining. As to the increasing importance of the high-Pd gold stock in later coins, Pliny and the archaeological evidence emphasize that the exploitation of the mines in Spain went on after Tiberius, and so gold fresh from the mine could have been delivered to the mint regularly. This could account for the higher Pd content

129 It would be too bold to interpret this fact as a sign that there was actually more than a single mint under Tiberius (see below for more suitable explanations). It might be so, but the structure of gold supply under Tiberius cannot prove it.

130 See above

131 See Tac., *Ann.*, 6.19 (*Sex. Marius, Hispaniarum ditissimus, ... saxo Tarpeio deicitur... aurarias aerariasque eius ... sibimet Tiberius seposuit*).

gold over time. But recycling of late Tiberian *aurei* probably occurred too. Some rare coins minted between Tiberius' principate and AD 69, and especially under Claudius, can also be distinguished by their high Sb and Sn contents (Sb above 10 ppm and Sn above 50-100 ppm, see fig. 25)¹³².

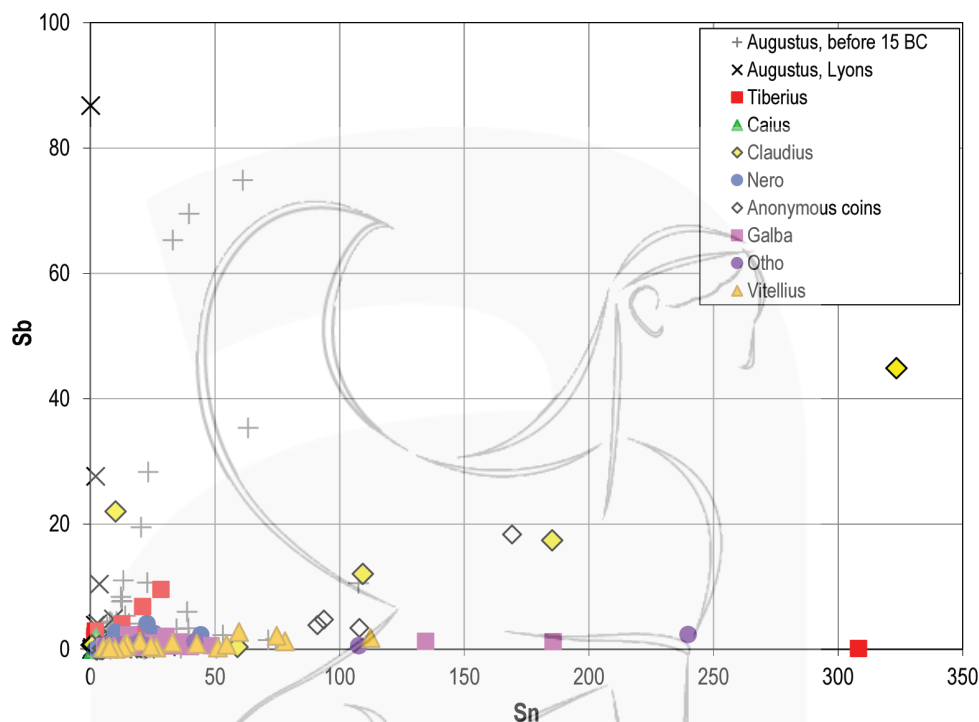


Fig. 25. Sb versus Sn (ppm) for coins from Augustus to AD 69.

Nero's coinage shows some interesting features. As already observed, the reform of AD 64 brought about a drop in the weight of gold coins, but did not affect fineness.¹³³ As to Pt and Pd contents, the situation is more complicated (fig. 26). Although, there is also a clear continuity between coins struck before and after the reform of AD 64, post-reform coins tend to show somewhat higher Pt and Pd contents. Moreover, the variability calculated for both these parameters is high and there is a lot of overlap between the two groups (fig. 27). This ties in well with the idea, often put forward,¹³⁴ that the reform of Nero was largely based on the intensive recycling of old coins. The trend towards more and more high-Pd gold reflects

132 This might indicate that there were significant amounts of Sn and Sb in the original gold ore, or that an alloyed gold, rich in Sn and Sb, was melted down and refined to strike the coins (see above note 109 about the Limousin mines). Under Claudius, new gold stocks were seized in Britannia where traces of refining have been found (see Bayley 2009).

133 Suspène *et al.* 2020.

134 Wolters 2012; Butcher & Woytek 2018.

the overall evolution of gold stocks, which also suggests that there was no major change in the chain of supply at the time of Nero.¹³⁵

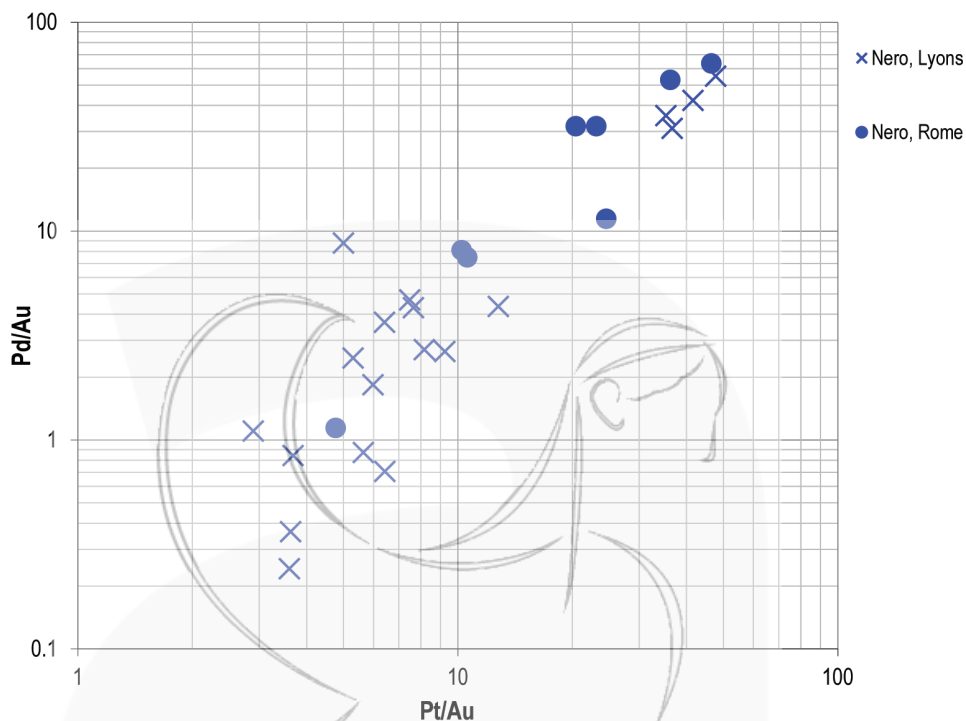


Fig. 26. Pt/Au and Pd/Au ratios in gold coins of Nero (logarithmic scales).

	Number of coins	Pt/Au			Pd/Au		
		Mean	Standard deviation	Median	Mean	Standard deviation	Median
Nero, Lyons	20	13	15	6	10	16	3
Nero, Rome	8	22	14	22	26	23	22

Fig. 27. Pt/Au and Pd/Au ratios in coins of Nero. The Pt/Au and Pd/Au ratios in post-reform coins tend to be higher than in coins minted before the reform. However the variability calculated for both these parameters is high and there is a considerable overlap between the two groups.

The civil wars of AD 68-69 tell a more intricate story. This was a time of chaos and complexity.¹³⁶ The Augustan centralization was forgotten and the different factions struck where they wanted. The greater variety of gold contents in the coins (with gold contents dropping sometimes to values unattested in normal times, see *supra* fig. 1) confirms that mints were under stress.

¹³⁵ Input from mines in Dalmatia, mentioned in ancient sources (see above), did not change the general pattern.

¹³⁶ Bocciarelli *et al.* 2017 for more in-depth analysis of the gold coinages of AD 68-69.

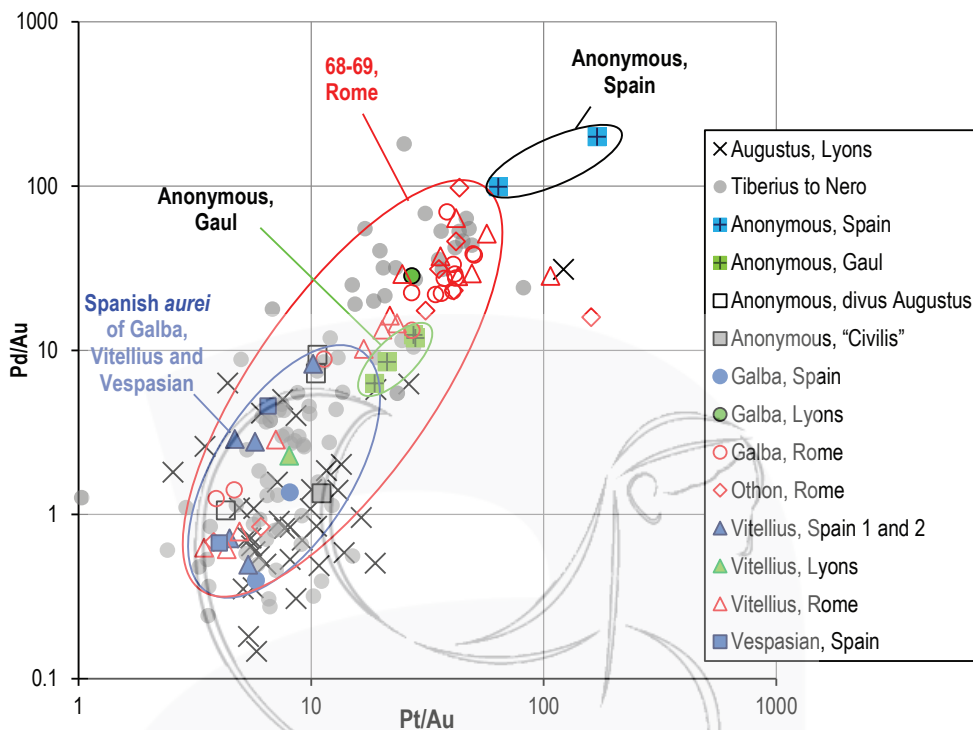


Fig. 28. The *aurei* of AD 68/69 and previous Imperial *aurei* (logarithmic scales); ex. Bocciarelli *et al.* 2017.

We can also observe a large range of Pt/Au and Pd/Au ratios. As fig. 28 illustrates, the coins struck by the contenders for power in AD 68-69 show all the chemical patterns already described for Roman imperial gold coinage, whether it be the low Pd and Pd contents gold observed in Lyons under Augustus (black crosses), or the high Pd gold that gradually emerges from Tiberius onwards (grey dots).

This variety suggests that an extensive programme to strike gold was put forward by the belligerents, who collected resources wherever they happened to be. This ties in well with literary sources that depicts intense minting activity.¹³⁷ The gold used to strike the *aurei* could come from different sources, and the recycling of older coins probably played an important role.¹³⁸

We must also conclude that different gold stocks were still available in the West at this time, as different chemical patterns can also be distinguished depending on where the coins were struck. Thus, Galba's, Vitellius' and Vespasian's gold coins struck in Spain belong together (Pt/Au and Pd/Au below 10), and they can be often easily distinguished from the coins struck in Rome by Galba, Otho and Vitellius. Moreover, a peculiar chemical pattern is shown for two anonymous gold coins struck in Spain slightly before. Accordingly, the

¹³⁷ See *supra*. Texts especially insist on Galba (Plu., *Galb.*, 20.2; Suet., *Galb.*, 8.1; Suet., *Galb.*, 12).

¹³⁸ Same observations have been made for silver by Butcher & Ponting 2014, 261-265.

most important conclusion of the situation in 68/69 at a global level is that, in spite of the recycling of ancient coins and of the regular melting down of gold artefacts (which entailed a gradual change in favour of high Pd gold stock in Roman coinage), it is still possible to make out different gold stocks through the Pt/Au and Pd/Au ratios in coins struck at about the same time. Even in AD 68-69, after about a century of imperial gold coinage, there was not a fully homogeneous gold stock for the whole Empire.

CONCLUSION

The Julio-Claudian period constituted an important stage of the monopolization of Mediterranean gold supplies by Rome, and this can be seen in the chemical pattern of imperial gold coins. The first years of the Augustan principate, from 30 to 20 BC, are only the continuation of a long trend that started with the emergence of a western gold stock in the time of Caesar, and the occasional use of an eastern gold stock that can be noticed at different times in the 1st century BC. In the following years, however, at least two new gold stocks can be distinguished: the first one appears in the western mints from 19 BC on and becomes prevalent in Lyons after 15 BC; the other one is first used under Tiberius. This second gold stock, at least, should probably be linked to the exploitation of the mines of northern Spain. It became predominant through the exploitation of these mines throughout the 1st century AD, but also through the regular recycling of older coins that took place at the mint.

Although the general trend is clear, it does not mean that all differences in gold stocks disappear in the 1st century AD. As the Year of the Four Emperors clearly proves, there were still different gold supplies in the West (see fig. 23a).

Lastly, one gets the feeling that a careful organization of Roman gold coin production was set up at the very beginning of the Empire. This has maybe received too little attention as reliable data was not available until now. The dramatic change that took place under Augustus suggests that overseeing the metal supply and making sure that the gold content remained high were important in the Emperor's eyes. Following in Caesar's footsteps, Augustus included gold coinage in his political legacy.¹³⁹ His successors, at least Tiberius and even more so Nero, took up this legacy and helped shape a currency that was a fixture of the ancient economy and one of the most powerful symbols of the Empire: the Roman *aureus*.

BIBLIOGRAPHY

- Amandry, M. and Aubin, G. (2001-2002): "Le trésor d'aurei augustéens de la Gaumont/Saint-Martin à Angers (Maine-et-Loire), 1991", *TM*, 20, 43-56.
- Amandry, M., dir. (2017): *La monnaie antique. Grèce et Rome (VII^e siècle av. J.-C. - V^e siècle apr. J.-C.)*, Paris.
- Assenmaker, P. (2007): "CAESAR DIVI F et IMP CAESAR. De la difficulté de dater des émissions monétaires", in: Moucharte *et al.*, ed. 2007, 159-178.
- Baron, S., Tamas, C. G., Rivoal, M., Cauuet, B., Télouk, P. and Albarède, F. (2019): "Geochemistry of gold ores mined during celtic times from the North-Western french Massif Central", *Nature, Scientific Reports*, 9, 17816. Doi :10.1038/s41598-019-54222-x.
- Bayley, J. (2009): "The discovery of precious metal refining in roman Chichester", in: Moreau *et al.*, ed. 2009, 425-432.
- Baechler, J. and Soutou, G.-H., ed. (2016): *Guerre, Économie et Fiscalité*, Paris.
- Bernholz, P. and Vaubel, R., ed. (2014): *Explaining Monetary and Financial Innovation: A Historical Analysis*, New York.
- Bland, R. and Loriot, X. (2010): *Roman and Early Byzantine Gold Coins found in Britain and Ireland (with an Appendix of new finds from Gaul)*, London.
- Blet-Lemarquand, M., Suspène, A. and Amandry, M. (2015): "Augustus' gold coinage: investigating mints and provenance through trace elements concentrations", in: Hauptmann & Modarressi-Tehrani, ed. 2015, 107-113.
- Blouin, K. and Burnett, A. (2020): "From kings to emperors: the development and integration of the Egyptian monetary system into the Roman Empire", in: Faucher, ed. 2020, 233-287.
- 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.
- Brun, J.-P., Faucher, T., Redon, B. and Sidebotham, S., dir. (2018): *Le désert oriental d'Égypte durant la période gréco-romaine : bilans archéologiques*, Paris.
- Burnett, A. (1978): "Catalogues, coins and mints", *JRS*, 173-178.
- Burnett, A. (1987): *Coinage in the Roman World*, London.
- Burnett, A. (2002): "Review of *Monnaies de l'empire romain, I : Auguste. Troisième édition, augmentée et mise à jour*, by Jean-Baptiste Giard", *RN*, 158, 426.
- Butcher, K., ed. (2020): *Debasement. Manipulation of Coin Standards in Pre-Modern Monetary Systems*, Oxford.
- Butcher, K. and Ponting, M. (2014): *The Metallurgy of Roman Silver Coinage: from the Reform of Nero to the Reform of Trajan*, Cambridge.
- Butcher, K. and Woytek, B.E. (2018): "The grand scheme of things. Modelling coin production and coin distribution in the Roman Empire in the first and second century AD", in: Woytek, ed. 2018, 253-281.
- Callu, J.-P. and Loriot, X. (1990): *L'or Monnayé II. La dispersion des aurei en Gaule romaine sous l'Empire*, Paris.
- Carradice, I. (2012): "Flavian coinage", in: Metcalf, ed. 2012, 375-390.
- Cauuet, B., ed. (1999): *L'or dans l'Antiquité : de la mine à l'objet*, Bordeaux.
- Cauuet, B. (1999): "Exploitation de l'or en Gaule à l'âge du Fer", in: Cauuet, ed. 1999, 31-70.
- Cauuet, B. (2005): "Les mines d'or antiques d'Europe hors péninsule Ibérique. État des connaissances et travaux récents", *Pallas*, 67, 241-291.
- Cauuet, B., Tămaş, C. B., Boussicault, M. and Munoz, M. (2018): "Quantités et contrôle de l'or produit à l'âge du fer en Gaule du Centre-Ouest", *MCV*, 48.1, 13-42.
- Crawford, M. (1985): *Coinage and Money under the Roman Republic*, London.
- Daguet-Gagey, A. and Lefebvre, S., ed. (2018): *L'Empereur Auguste et la mémoire des siècles. Actes des Journées d'études de Dijon (28 novembre 2014) et Arras (23 mars 2015)*, Arras.

- Domergue, C. (1990): *Les mines de la péninsule Ibérique dans l'antiquité romaine*, Rome.
- Domergue, C. (2008): *Les mines antiques. La production des métaux aux époques grecques et romaines*, Paris.
- Duncan-Jones, R. (1994): *Money and Government in the Roman Empire*, Cambridge.
- Duyrat, F. and Nieto-Pelletier, S., dir. (2021): *Le luxe en Gaule*, Bordeaux.
- Duyrat, F. and Olivier, J. (2010): "Deux politiques de l'or. Séleucides et Lagides au III^e siècle avant J.-C.", *RN*, 166, 71-93.
- Estiot, S. and Aymar, I. (2002) : "Le trésor de Meussia (Jura). 399 monnaies d'argent d'époque républicaine et julio-claudienne", *TM*, 20, 69-160.
- Faucher, T. (2018): "L'or des Ptolémées : l'exploitation de l'or dans le désert Oriental", in: Brun *et al.*, dir. 2018, 1-6.
- Faucher, T. (2020): "Les analyses des minerais et de l'or de Samut", in: Redon & Faucher, ed. 2020, 15-19.
- Faucher, T., ed. (2020): *Money Rules ! The Monetary Economy of Egypt from Persians until the beginning of Islam*, Cairo.
- Faucher, T. and Olivier, J. (2020): "From owls to eagles. Metallic composition of Egyptian coinage (fifth-first centuries BC)", in: Butcher, ed. 2020, 97-109.
- Ferrary, J.-L. [2017] (2020): "Loi Iulia peculatus - Loi Iulia de residuis", in *Lepor. Leges Populi Romani*, online. URL: <http://www.cn-telma.fr/lepor/notice454/>. Last accessed 11/09/2020.
- Flecker, M., Krmnicek, S., Lipps, J., Posamentir, R. and Schäfer, T., ed. (2017): *Augustus ist tot – Lang lebe der Kaiser! Internationales Kolloquium anlässlich des 2000. Todesjahres des römischen Kaisers vom 20.-22. November 2014 in Tübingen*, Rahden.
- France, J. (2016): "De Marc-Aurèle à Constance II, le système financier de la paix romaine à l'épreuve de la guerre", in: Baechler & Soutou, ed. 2016, 71-84.
- García-Bellido, M. P. (2008): "From "imperatores" to "imperator": the beginning of the Augustan "military" coinage in Hispania (27-15 B.C.)", in: García-Bellido *et al.*, ed. 2008, 279-294.
- García-Bellido, M. P., Mostalac, A. and Jiménez, A., ed. (2008): *Del Imperium de Pompeyo a la auctoritas de Augusto: homenaje a Michel Grant*, Madrid.
- Giard, J.-B. (1983): *Le monnayage de l'atelier de Lyon. Des origines au règne de Caligula (43 avant J.-C. - 41 après J.-C.)*, Wetteren.
- Giovannini, A., ed. (2000): *La Révolution romaine après Ronald Syme*, Vandoeuvres-Genève.
- Glicksman, K. (2018): "Metal mining in Roman Dalmatia", *Opvscola archaeologica*, 39 (1), 261-283.
- Gómez Barreiro, M. (2018): *La ceca de Caesaraugusta. Producción y circulación monetaria*, Madrid.
- Harris, W. V., ed. (2008): *The Monetary Systems of the Greeks and Romans*, Oxford.
- Hauptmann, A. and Modarressi-Tehrani, D., ed. (2015): *Archaeometallurgy in Europe III*, Bochum.
- Hirt, A. M. (2020): "Gold and silver mining in the Roman Empire", in: Butcher, ed. 2020, 111-124.
- Holmes, N., ed. (2011): *Proceedings of the XIVth International Numismatic Congress Glasgow 2009*, London.
- Howgego, C. (1990): "Why did ancient states strike coins?", *NC*, 150, 1-25.
- Howgego, C. (1992): "The supply and use of money in the Roman world 200 B.C. to A.D. 300", *JRS*, 82, 1-31.
- Hurlet, F. and Mineo, B., dir. (2009): *Le Principat d'Auguste. Réalités et représentations du pouvoir. Autour de la Res publica restituta. Actes du colloque de l'université de Nantes (1^{er}-2 juin 2007)*, Rennes.
- Küster, A. (2014): *Zwischen Republik und Kaiserzeit. Die Münzmeisterprägung unter Augustus*, Berlin.
- Lo Cascio, E. (2008): "The function of gold coinage in the monetary economy of the Roman Empire", in: Harris, ed. 2008, 160-173.
- Loriot, X. (2011-2012): "Vingt ans après... Supplément à l'inventaire des trouvailles de monnaies d'or isolées faites en Gaule romaine (44 av.-491 apr. J.-C.)", *TM*, 25, 257-339.
- MacDonald, D. (2005): *An Introduction to the History and Coinage of the Kingdoms of the Bosphorus*, Lancaster-London.
- Martin, S. (2015): *Du statère au sesterce. Monnaie et romanisation dans la Gaule du Nord et de l'Est (III^e s. a.C./1^{er} s. p.C.)*, Bordeaux.
- Metcalf, W. E., ed. (2012): *The Oxford Handbook of Greek and Roman Coinage*, Oxford.

- Metcalfe, W. E. (1989): "Rome and Lugdunum again", *AJN*, 1, 51-70.
- Metzler, J. and Wigg, D.G., ed. (2005): *Die Kelten und Rome: neue numismatische Forschungen*, Frankfurt am Main.
- Moucharte, G., Borba Florenzano, M. B., de Callataÿ, F., Marchetti, P., Smolderen, L. and Yannopoulos, P., ed. (1997): *Liber amicorum Tony Hackens*, Louvain-la-Neuve.
- Molinari, M. C. (2015): "Adnotationes sulla cronologia delle serie in metallo vile dei monetieri di Augusto", in Serra, ed. 2015.
- Molinari, M. C. (2017): "A rare gold *quinarius* of Augustus from the Treasure of via Alessandrina (Rome). Observations on the meaning of coin types of the so called 'uncertain mint 1 and 2'", in: Flecker *et al.*, ed. 2017, 63-69.
- Moreau, J.-F., Auger, R. Chabot, J. and Herzog, A., ed. (2009): *Proceedings Acts ISA 2006: 36th International Symposium on Archaeometry, 36^e Symposium International d'Archéométrie, 2-6 May 2006*, Quebec.
- Moret, P. (2012): "Posidonius et les passions de l'or chez les Gaulois", *Pallas*, 90, 143-158.
- Olesti Vila, O. (2017): "Augusto y el control de los territorios pirenaicos", *Gerión*, 35, 163-190.
- Olivier, J. (2012): *Archè et Chrèmata en Égypte au I^{er} siècle avant J.-C. (204 - 81 av. J.-C.)*. Étude de numismatique et d'histoire, Unpublished PhD, Orléans university.
- Pérez-García, L. C., Sánchez-Palencia, F. J., Torres-Ruiz, J. (2000): "Tertiary and quarternary alluvial gold deposits of Northwest Spain and Roman mining (NW of Duero and Bierzo Basins)", *Journal of Geochemical Exploration*, 71, 225-240.
- Powell, A. and Burnett, A., ed. (2020): *Coins of the Roman Revolution (49 BC-AD 14). Evidence without Hindsight*, Swansea.
- Rambach, H. and Walker, A. (2012): "The "Heifer" issue of Augustus", *SNR*, 91, 41-62.
- Reddé, M., dir. (2014): *De l'or pour les braves ! Soldes, armées et circulation monétaire dans le monde romain*, Bordeaux.
- Redon, B. and Faucher, T., ed. (2020): *Samut Nord. L'exploitation de l'or du désert Oriental à l'époque ptolémaïque*, Cairo.
- RIC*: Sutherland 1984.
- Rich, J. W. and Williams, J. H. C. (1999): "Leges et iura P.R. restituit : A new Aureus of Octavian and the settlement of 28-27 B.C.", *NC*, 159, 169-213.
- Sánchez-Palencia, F. J., Romero, D. and Beltrán, A. (2018): "Geoarqueología del oro en la zona minera de Pino del Oro (Zamora)", *MCV*, 48-1, 63-87.
- Sánchez-Palencia, F. J., Sastre Prats, I., Orejas Saco del Valle, A. and Ruiz del Arbol, M. (2017): "Augusto y el control administrativo y territorial de las zonas mineras del Noroeste hispano", *Gerión*, 35, 863-874.
- Sear, D. R. (1998): *The History and Coinage of the Roman Emperors*, London.
- Serra, A., ed. (2015): *Humanitas. Studi per Patrizia Serafin*, Rome.
- Sheedy, K. and Davis, G., ed. (2020): *Metallurgy in Numismatics 6: Mines, Metals and Money: Ancient World Studies in Science, Archaeology and History*, London.
- Speidel, M. (2014): "Roman army pay scales revisited: responses and answers", in: Reddé, dir. 2014, 53-61.
- Speidel, M. A. (2000): "Geld und Macht. Die Neuordnung des staatlichen Finanzwesens unter Augustus", in Giovannini, ed. 2000, 113-166 (= Speidel, M. A., *Heer und Herrschaft im Römischen Reich der Hohen Kaiserzeit*, Stuttgart, 2009, 53-84).
- Standish, C.D., Chapman, R.J., Moles, N.R., Walshaw, R.D. and Sheridan, J.A. (2023): "Archaeological applications of natural gold analyses", in: Torvela *et al.*, ed. 2023, 401-424.
- Suspène, A. (2009): "Aspects numismatiques de la respublica restituta augustéenne", in: Hurllet & Mineo, dir. 2009, 145-168.
- Suspène, A. (2014): "Les débuts de l'atelier de Lyon", *RN*, 171, 31-44.
- Suspène, A. (2017): "Les monnayages de l'Empire romain d'Auguste aux Flaviens (27 av. J.-C. - 96 apr. J.-C.)", in: Amandry, dir. 2017, 171-194.
- Suspène, A. (2018): "L'image monétaire d'Auguste sous les Julio-Claudiens (14-68 p.C.). Genèse, rythmes et fonctions", in: Daguet-Gagey & Lefebvre, ed. 2018, 75-95.

- Suspène, A. (2020a): “*Tanta copia nummariae rei*. Trésor lagide et monnaies romaines entre la chute d’Alexandrie et les trois triomphes d’Octavien (août 29 av. J.-C.)”, in: Faucher, ed. 2020, 287-307.
- Suspène, A. (2020b): “Entre innovation et tradition. Remarques sur le monnayage romain des origines à l’avènement de l’Empire”, *De la drachme au bitcoin. La monnaie, une invention en perpétuel renouvellement*, Besançon, 35-53.
- Suspène, A. (2021a): “Les premiers *aurei* en Gaule romaine : une manifestation du luxe imperial (fin de la République-Haut Empire) ?”, in Duyrat & Nieto, dir. 2021, 181-192.
- Suspène, A. (2021b): “Caius et Lucius César sur les monnaies impériales d’époque augustéenne”, in: *L’empereur romain, un mortel parmi les dieux*, Nîmes, 35-39.
- Suspène, A., Blet-Lemarquand, M., Amandry, M. (2011): “Les monnaies d’or d’Auguste : l’apport des analyses élémentaires et le problème de l’atelier de Nîmes”, in: Holmes, ed. 2011, 1073-1081.
- Suspène, A., Bocciarelli, D., Blet-Lemarquand, 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.
- Suspène, A. and Chausserie-Laprée, J. (2020): “The significance of imagery in coin hoards from the time of the Roman revolution: reflections on the *aurei* deposit from Martigues”, in: Powell & Burnett, ed. 2020, 145-156.
- Sutherland, C. H. V. (1984): *The Roman Imperial Coinage*. Vol. I^{er}: *From 31 BC to AD 69*, London.
- Torvela, T., Lambert-Smith, J.S. and Chapman, R.J., ed. (2023): *Recent Advances in Understanding Gold Deposits: From Orography to Alluvium*, London.
- van Heesch, J. (2005): “Les Romains et la monnaie gauloise: laisser-faire, laisser-aller ?” in: Metzler & Wigg, 229-245.
- Vaxevanopoulos, M., Vavelidis, M., Malamidou, D. and Melfos, V. (2020): “Metal Production Chain at Pangaeon Mountain, Eastern Macedonia, Greece”, in: Sheedy & Davis, ed. 2020, 75-83.
- Volk, T. R. (1997): “Hispania and the gold and silver coinage of Augustus”, in: *La moneda en temps d’August. Curs d’Història monetària d’Hispania, Gabinet Numismàtic de Catalunya, Museu Nacional d’art de Catalunya*, Barcelona, 59-90.
- Wolters, R. (1999): Nummi Signati. *Untersuchungen zur römischen Münzprägung und Geldwirtschaft*, Munich.
- Wolters, R. (2000-2001): “Bonze, silver or gold? Coin finds and the pay of the Roman army”, *Zephyrus*, 53-54, 579-588.
- Wolters, R. (2012): “*The Julio-Claudians*”, in Metcalf, ed. 2012, 335-355.
- Woytek, B. E. (2014): “Monetary innovation in Ancient Rome: the republic and its legacy”, in: Bernholz & Vaubel, ed. 2014, 197-226.
- Woytek B. E. and Blet-Lemarquand M. (2017): “The C.L. CAESARES denarii RIC I^{er} Augustus 208. A pseudo-Augustan unsigned restoration issue. Corpus, die study, metallurgical analyses”, *RN*, 174, 183-248.
- Woytek, B. E., ed. (2018): *Infrastructure and Distribution in Ancient Economies. Proceedings of a Conference held at the Austrian Academy of Sciences, 28-31 oct. 2014*, Vienna.

**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 épheores 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 fictitious 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 Callataj

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 connaître 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 celtique 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 II^e 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 II^e 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 III^e 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 évidence 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 1st 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 évidence 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 III^e 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 reassessed 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 1^{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 1^{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.

