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Jahrgang 16 August 1966 Heft 63

SCHWEIZER MÜNZBLÄTTER

Gazette numismatique suisse

Herausgegeben von der Schweizerischen Numismatischen Gesellschaft
Publiée par la Société suisse de numismatique

Redaktionskomitee
Dr. Colin Martin/Lausanne, Prof. Dr. D. Schwarz/Zürich, Dr. H. A. Cahn/Basel, Prof. H. Jucker/Bern
Redaktion der Schweizer Münzblätter: Münzkabinett des Bernischen Historischen Museums, Helvetiaplatz 5, 3000 Bern
Administration: Ch. Lavanchy, 14, av. Rambert, 1000 Lausanne, Compte de chèques 10 - 23071

Erscheint vierteljährlich · Abonnementspreis: Fr. 20.– pro Jahr (gratis für Mitglieder der Schweiz. Numismatischen Gesellschaft) · Insertionspreis: Viertelseite Fr. 30.– pro Nummer, Fr. 90.– im Jahr. Die Mitglieder der SNG erhalten gratis: Münzblätter, Numismatische Rundschau und Münzkataloge. Beitrag für lebenslängliche Mitgliedschaft Fr. 400.–, Jahresbeitrag Fr. 30.–

Revue trimestrielle · Prix d'abonnement: fr. 20.– par an (envoi gratuit aux membres de la SSN) · Prix d'annonces: Un quart de page fr. 30.– par numéro, fr. 90.– par an. Les membres de la SSN reçoivent gratuitement: Gazette Numismatique, Revue de Numismatique, Catalogues des monnaies suisses. Cotisation de membre à vie fr. 400.–, cotisation annuelle fr. 30.–

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THE QUALITY OF NERO'S ORICHALCUM

David W. MacDowall

Earle Caley's study [1] of the composition of orichalcum coins of the Roman Empire has drawn attention to the interesting fact that while the proportion of zinc is reasonably constant in orichalcum coins from Augustus to Claudius, the average proportion of zinc under Nero is lower, and there is a progressive decline in zinc content under subsequent emperors. Caley suggests [2] that this progressive decline was probably due to worn coins from earlier reigns being remelted for the manufacture of new ones. He further suggests that the consistent composition of the

[1] Earle R. Caley, Orichalcum and Related Alloys, NNM no. 151.
[2] Ibid., 99 f.

orichalcum from Augustus to Claudius indicates that the alloy was always newly manufactured by a single standardised procedure during this period without the use of any secondary metal or scrap; that the subsequent decline in zinc content was probably due to worn coins from earlier reigns being remelted; and that the wide range in the zinc content of sestertii and dupondii under Trajan, and to a lesser extent under Hadrian and Antoninus Pius was probably due to the use of both new and secondary metal for the fairly extensive orichalcum coinage of those emperors. As this progressive reduction in zinc content is first apparent under Nero, the composition of Nero's orichalcum coins clearly warrants further study.

To the material published by Caley, we can now add the results of four new analyses that have been carried out at my request by the Oxford Research Laboratory for Archaeology and the History of Art. The four coins were first analysed by optical spectrometry. Copper values were not determined absolutely by the optical spectrometer, but the line intensity for copper on the photographic plate was taken to represent the copper percentage given by the subsequent chemical analysis, and the determination of the optical spectrometer results for all the other elements were worked out relative to copper. The accuracy of these results is ± 10% on the figures given. The same four coins were then analysed chemically, and the chemical analyses are the average of about three determinations. These should be correct to ± 2% of the figures given. I am indebted to Dr. Hall, Miss Emeleus, Mrs. Richards and Mrs. Blin-Stoyle for their painstaking work. To these Oxford analyses we can add the chemical analysis published by Prof. Agostino Oglialoro of the Accademia Reale, Naples [3].

Coins analysed

Oxford 1. NERO Sestertius — Mint of Lugdunum
MacD. Issue L. VI.[4] no. 389.
Obv. IMP NERO CAESAR AVG P MAX TR POT PP
Head of Nero laureate right, globe.
Rev. DECVRSIO S C in Field.
Nero on horseback riding right, followed by a soldier on horseback.

Oxford 2. NERO Dupondius — Mint of Lugdunum
MacD. Issue L. III. no. 420.
Obv. NERO CLAVD CAESAR AVG GER PM TRP IMP PP
Head of Nero radiate right, globe.
Rev. VICTORIA AVGVSTI SC in field, $\overline{\text{II}}$ in exergue
Victoria walking left, holding wreath in right hand and palm in left.

Oxford 3. NERO Dupondius — Mint of Lugdunum
MacD. Issue L. V. no. 449.
Obv. IMP NERO CAESAR AVG P MAX TRP PP
Head of Nero laureate right, globe.
Rev. VICTORIA AVGVSTI SC in field.
Victoria walking left, holding wreath in right hand and palm in left.

[3] RIN 1895, 325 n. 35.

[4] The issues into which the *aes* of Nero is classified, are those which I have set out in my monograph «The Western Coinages of Nero» to be published by the ANS.

Oxford 4. NERO Copper As — Mint of Lugdunum
MacD. Issue L. V. no. 517.

Obv. IMP NERO CAESAR AVG P MAX TRP PP
Head of Nero bare right, globe.

Rev. S C
Victory flying left, holding shield inscribed SPQR.

Naples 1. NERO Orichalcum As — Mint of Rome
MacD. Issue III. no. 247.

Obv. NERO CLAVD CAESAR AVG GERMANI
Head of Nero radiate, right.

Rev. PONTIF MAX TRP IMP PP SC, $\overline{\text{I}}$ in exergue
Nero in the robes of Apollo Citharoedus.

Results of the analyses – Résultat des analyses

	Cu Cuivre	Sn Etain	Pb Plomb	Sb Antimoine	Ni Nickel	Bi Bismuth	Fe Fer	Zn Zinc	Ag Argent	Au Or	Mg Magnésium
(a) Spectrographic											
Oxford 1.		< .4	.14	< .2	< .04	« .015	.096	23	.076	–	.037
Oxford 2.		< .4	.25	< .2	< .04	« .015	.38	17.5	.08	–	.023
Oxford 3.		< .4	.15	< .2	< .04	« .015	.27	25	.087	–	.03
Oxford 4.		< .2	.126	< .1	.02	« .008	.0104	.268	.088	.08	.056
(b) Chemical											
Oxford 1.	73.9		–				trace	22.7			
Oxford 2.	79.8		–				trace	22.8			
Oxford 3.	74.4		--				trace	23.7			
Oxford 4.	99		--					–			
Naples 1.	82.28						0.41	17.31			

While these additional analyses reinforce the general conclusions of Caley that the average zinc content of Nero's orichalcum coins is lower than that of his Julio-Claudian predecessors, it will be seen from Table II that the eight orichalcum coin analyses fall into two distinct groups. Five of them fall into a group with a zinc content of 21–24 % and three fall into a second group with a zinc content of 16–18 %. The average figures for Nero in fact obscure these two distinct groupings; and in one group the zinc content is about a fifth or 20 % lower than in the other. The higher group has much the same percentage of zinc as five of the eight coins of Claudius. The lower group has the same zinc content as two of the three coins of Vespasian and Titus. It seems clear that although some of Nero's orichalcum coins were using newly manufactured alloy of the same composition that Claudius had done, others were probably using remelted alloy as the subsequent Flavian issues probably did.

If the difference between these two groups of Nero's orichalcum coins is in fact due to remelting the alloy, we are in a position to quantify how great the percentage loss of zinc must have been in the remelting process of the Roman mint. Caley has commented that in modern American foundry practice, the average loss of zinc that

commonly occurs in melting and pouring common yellow brass is about six per cent of that originally present. The further losses on subsequent treatment, such as annealing amount to about four per cent – to make up a total of about ten per cent. With alloys of lower zinc content similar to orichalcum the percentage loss is less with the same time and temperature of exposure, but Caley adds that with the smaller scale operations and cruder methods of the ancient founders the loss with alloys of lower zinc content may well have equalled or exceeded that encountered in modern practice with alloys of higher zinc content.

Noting that the average zinc content is some ten per cent less for Nero than for Caligula and Claudius, Caley [5] suggests that 10 % may have been the zinc loss due to remelting at the Roman mint, and much of the orichalcum for the coins of Nero and subsequent emperors was obtained by remelting worn coins. In the light of these additional analyses we can now refine this view and distinguish one group of Nero's coins which seems to be using primary alloy, and another which seems to be using remelted alloy with a zinc loss more in the region of 20 %.

It is interesting to note that all the four coins of Nero from the mint of Lugdunum that have been analysed belong to the group with the higher zinc content; but that three of the four coins of Nero from the mint of Rome belong to the group with the lower zinc content. It is difficult to draw any definite conclusions when the sample is so small, but the evidence clearly suggests that there is an important distinction between the two mints – that the output of Lugdunum consisted mostly of primary alloy under Nero, whereas many of the coins produced at Rome were struck from secondary alloy derived from remelted old coins.

Such an explanation is certainly consistent with what we know of Julio-Claudian *aes* circulation. Italy was well supplied with Julio-Claudian *aes* and unofficial copies are seldom present in Italian finds. But there was an acute shortage of Claudian *aes* in Germany [6], Britain [7] and to a lesser extent in Gaul [8], and unofficial copies of Claudian *aes* are commonly found in those provinces. The problems faced by the mints of Nero were thus basically different. The mint of Rome merely needed to supplement and replace the adequate existing supply of *aes* in Italy. The Lugdunum mint on the other hand had the more difficult task of making good an extreme shortage of official coinage in these northwestern provinces of the empire.

Table I

Copper and zinc content of orichalcum denominations Caligula to Titus

Teneur en cuivre et en zinc des pièces d'orichalque de Caligula à Titus

			Percentage - Pourcentage Cu	Zn
Caligula	Caley XXXIII.	1. Dup.	72.63	26.71
		2. Sest.	77.52	22.20
		3. Sest.	78.19	21.11
		4. Dup.	79.3	20.7
		5. Dup.	80.3	19.7
		6. Sest.	81.03	18.55

[5] Op. cit., 100.

[6] cf. Annalen des Vereins für Nassauische Altertumskunde und Geschichtsforschung, 1904 and 1912.

[7] C. H. V. Sutherland, Romano-British Imitations of Bronze Coins of Claudius I, NNM no. 65.

[8] cf. Bulletin de la Société d'Archéologie, Sciences, Arts et Belle-lettres de la Mayenne, 1865, 31 f. C. M. Kraay, Die Münzen von Vindonissa, 1962, 6 f.

					Percentage - Pourcentage Cu	Zn
Claudius	Caley XXXIV.	1.	Dup.		72.20	27.7
		2.	Sest.		75.91	23.20
		3.	Sest.		77.9	22.1
		4.	Sest.		77.44	21.50
		5.	Sest.		76.85	21.33
		6.	Dup.		77.59	21.11
		7.	Dup.		81.4	18.6
		8.	Dup.		81.1	15.7
Nero	Caley XXXV.	1.	Dup.	Rome Issue III.	77.27	22.46
	Naples 1.		As.	Rome Issue III.	82.28	17.31
	Caley XXXV.	4.	Dup.	Rome Issue IV.	83.16	15.95
	Caley XXXV.	3.	Sest.	Rome Issue IV.–VI.	81.07	17.82
	Oxford 2.		Dup.	Lugdunum Issue L. III.	79.8	22.8
	Oxford 3.		Dup.	Lugdunum Issue L. V.	74.4	23.7
	Caley XXXV.	2.	Dup.	Lugdunum Issue L. V.	78.24	20.98
	Oxford 1.		Sest.	Lugdunum Issue L. VI.	73.9	22.7
Vespasian	Caley XXXVI.	1.	Sest.		81.4	16.4
		2.	Dup.		85.89	13.02
Titus	Caley XXXVII.	1.	Dup.		83.13	15.90

Table II

Percentage of zinc in orichalcum denominations

Teneur en zinc des pièces d'orichalque

Percentage Pourcentage	Caligula	Claudius	Nero Rome	Nero Lugdunum	Vespasianus–Titus
29					
28		D.			
27	D.				
26					
25					
24				D.	
23		S.		S. D.	
22	S.	S. S.	D.		
21	S. D.	S. D.		D.	
20	D.				
19	S.	D.			
18			S.		
17			A.		
16		D.	D.		S. D.
15					
14					
13					D.

S. Sestertius
D. Dupondius
A. As

Du titre des pièces de Néron en orichalque

Earle Caley, étudiant la composition de l'orichalque des pièces de l'Empire romain, observa que la teneur en zinc était constante d'Auguste à Claude, que sous Néron elle était inférieure, pour diminuer ensuite progressivement. L'auteur suppose que les pièces anciennes étaient refondues dans les ateliers monétaires. D'Auguste à Claude, l'alliage de l'orichalque aurait été préparé d'une manière rigoureuse, alors que plus tard, on aurait ajouté à la fonte des pièces anciennes.

E. Caley apporte quelques éléments nouveaux résultant d'analyses entreprises à Oxford – spectrométriques et chimiques.

L'auteur a constaté, dans une fonderie américaine moderne, qu'environ 6 % de l'étain disparaît à la fonte. Ce fait ne devait pas être connu des anciens, ce qui expliquerait la baisse du taux en zinc lorsque les ateliers jetaient à la fonte des pièces anciennes.

L'auteur a remarqué également que trois des quatre pièces qu'il a examinées, pièces pauvres en étain, provenaient de l'atelier de Rome. Il est difficile de conclure sur de si petites quantités. Il n'en reste pas moins que l'on constate une grande différence dans les alliages des ateliers de Rome et Lyon. L'auteur a conclu que la quantité des pièces refondues était plus grande à Rome. Cette observation confirmerait ce que nous savons de la circulation des bronzes de la période julio-claudienne, qui semble avoir été suffisante en Italie alors qu'en Germanie, en Bretagne, et, dans une moindre mesure en Gaule, on a retrouvé une quantité de frappes non-officielles, ce qui s'expliquerait par l'insuffisance des pièces en circulation.

Résumé par Colin Martin

VIER SELTENE RÖMISCHE MÜNZEN IM BERNER MÜNZKABINETT

Balázs Kapossy

Unter dem Titel *Quatuor nummi romani rarissimi* veröffentlichte Franciscus Ludovicus Hallerus in seinem *Catalogus numismatum veterum, graecorum et latinorum, maxime vero imperatorum, augustorum, caesarumque romanorum, quae exstant in Museo Civitatis bernensis* (1829)[1] an bevorzugter Stelle die folgenden vier römischen Münzen, die eine nähere Betrachtung, ja eine Reedition verdienen. Welch große Bedeutung Haller ihnen beimaß, wird daraus ersichtlich, daß er sie dem *Lector benevolens* in einem Sonderkapitel, sogar mit Illustration, gleich am Anfang seiner gelehrten Arbeit vorlegte (Abb. 1).

Sein Bestreben, die Aufmerksamkeit der Fachwelt auf die Berner Zimelien zu lenken, blieb leider ohne Erfolg. Die Wissenschaft scheint von seinem Buch keine Kenntnis genommen zu haben, die Schätze des einstigen *Nummophylacium Bibliothecae Bernensis* – nunmehr Münzkabinett des Bernischen Historischen Museums – blieben der Forschung fast unbekannt und so zwangsweise unerschlossen. Dabei

[1] Die Arbeit ist die weitgehend revidierte und erweiterte Fassung der *Enumeratio numismatum veterum graecorum atque romanorum ex omni metallo et forma, quae extant in scriniis Bibliothecae publ. bernensis* (1789) vom selben Verfasser. Zur Geschichte der Münzsammlung mit schöner Würdigung der Tätigkeit Hallers vgl. die Einleitung zum Katalog von Wegeli-Hofer (unten Anm. 3).