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# Problems with Analyzing Nero's Debasement

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### Problems with Analyzing Nero's Debasement

The exact nature of Nero's debasement fooled numismatic scholars for over one hundred and fifty years before finally being quantified. Research techniques had to be improved continually and it was not until recently that scientists had developed the technology necessary to study the coins without doing considerable harm to them. This compositional enigma was due to the processes through which Nero's minters treated their debased denarii blanks before striking them. I conducted my own research, using an x-ray fluorescent spectrometer to measure the elemental composition of the surface of the coins, to illuminate the difficulties with working with these debased denarii. In doing so, I looked at three aspects of Nero's debasement: the historical context, the methods used throughout history, the Roman's production process, and my own research.

One of Augustus' early reforms was to improve the coinage of his fledgling empire; specifically, he sought to restore the fineness of the silver denarius. The denarius had a fineness of around 98-percent for most of the entirety of the Republic, but toward the end of its life, the fineness standards were gradually reduced, eventually going as low as 92-percent fine.<sup>1</sup> Augustus reversed this debasing trend by returning the denarius to its former 97.5 - 98-percent fineness in 30 BCE. All of the Julio-Claudians held this finer standard until Nero's debasement in 64 CE; Tiberius even slightly improved the fineness as he gathered his infamous hoard of 675

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<sup>1</sup> Harl, Kenneth W. *Coinage in the Roman Economy, 300 B.C. to A.D. 700*. 5th ed. Baltimore: The John Hopkins University Press, 1996. 75. Print.

million denarii.<sup>2</sup> However, this all changed in 64 CE with Nero's debasement. He reduced the fineness from the Augustan 97.5 - 98-percent to the less fine standard of 80-percent.<sup>3</sup> He also reduced the weight of the denarius by 12.5-percent; he lowered the weight standard of forty-to-the-pound to forty-five-to-the-pound. This allowed him to create forty-five debased denarii for every forty non-debased that were paid in taxes. The value of the denarius was debased by about 20-percent due to these two lessenings. This first great debasement opened the way for further debasements by later emperors; the fineness was debased as low as 43-percent by the end of the Severan dynasty.<sup>4</sup>

This initial Neronian debasement displayed several very important aspects of the Roman economy. Primarily, the debasement showed how strong the public faith for imperial coins was. Even though the intrinsic value of the denarius was debased by 20-percent, they were still accepted as having the same monetary value as the pre-debasement denarii. Nero used this to his advantage by dictating that taxes must be paid with the un-debased denarii while issuing debased denarii. This meant that he was able to take in the finer, heavier denarii, melt them down and re-strike them into the less fine, lighter denarii. Using this method, he was able to gain five new denarii per pound of pre-debasement denarii.

There are several theories as to why Nero debased his silver, an act unprecedented. One theory was because he needed extra money to pay for the growing Armenian war debts and the

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<sup>2</sup> Harl 90.

<sup>3</sup> Ponting, Matthew. "Roman Silver Coinage: Mints, Metallurgy, and Production." *Quantifying the Roman Economy: Methods and Problems*. Ed. Alan Bowman and Ed. Andrew Wilson. New York: Oxford University Press, 2009. 274.

<sup>4</sup> Harl 127.

rebuilding of Rome after the Great Fire, among other expenses.<sup>5</sup> As shown above, debasing the silver and then requiring the payment of taxes to be in the pre-debasement coins allowed Nero to make a profit out of nothing. Another possible explanation is that the silver supply was diminishing.<sup>6</sup> I think that this is unlikely the reason behind Nero's debasement because Gaul's silver mines, from which Nero's denarii were made, were still the primary mines for Rome's mint for the next two hundred years. A third possibility is that he did it to combat deflation.<sup>7</sup> By debasing the denarius, Nero effectively made it worth less, which would in turn raise prices. A fourth reason is that Nero's minters had invented the blanching process, which is discussed in detail later. In this theory, the reason why the previous emperors had not debased their own coinage was that they could not do it without the public noticing, which blanching hides. One run of coins that could possibly support this claim is Nero's *corona civica* run of 60-1CE.<sup>8</sup> This run was the first intentional Neronian debasement but appears to have been limited to only one run. The copper added to the silver bullion was minimal, which seems to me that Nero's minters were testing their debasement process. The final possibility is that Nero was simply greedy; he saw an easy way to make a huge profit and went for it.

Scholars have long sought to determine the exact composition of imperial denarii and, accordingly, their methods of doing so have changed over time as the sophistication of the Romans' denarii production have thwarted their attempts. This avenue of research began in 1834 with Ernst von Bibra's accurate but destructive work.<sup>9</sup> Von Bibra used wet-chemical techniques,

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<sup>5</sup> Harl 90.

<sup>6</sup> Carson 221.

<sup>7</sup> Hitchner, Bruce. "Coinage and Metal Supply." *Quantifying the Roman Economy: Methods and Problems*. Ed. Alan Bowman and Ed. Andrew Wilson. New York: Oxford University Press, 2009. 283.

<sup>8</sup> Ponting 274.

<sup>9</sup> Ponting 269.

which required large slices of the coin to be clipped and then dissolved to determine its elemental composition; this renders the analyzed coin effectively ruined. Another flaw with this technique, which would not become apparent until 1989, is that wet-chemical analysis only gives a total average composition. What this means is that the analysis cannot determine if one section of the sample being analyzed has a different elemental composition from another, such as any difference between an enriched outer shell and a debased metal-heart; it can only determine the average composition of the total sample.

The next great step forward for this research came almost one hundred and fifty years later with David Walker's x-ray fluorescent spectroscopy research during the 1970's.<sup>10</sup> I chose to use this method in my own research and I ran into the same problems that Walker unknowingly ran into. X-ray fluorescent spectroscopy is a non-invasive method to determine the elemental composition of an object, in which the surface of that object is bombarded with x-rays and how those x-rays bounce back to the spectroscopic receiver determines the elemental composition; different elements will bounce back the x-rays at different and specific energy levels. To avoid surface enrichment, purposeful or accidental, Walker abraded the object's surface between readings until he had three consecutive readings that were identical.<sup>11</sup> The limitations with this mode of research are two-fold. First, since the only x-rays that are registered by the spectroscopic receiver are the rays that are reflected off the surface of the object, this method can only determine the elemental composition of the surface of the object; the metal-heart of the coins would be left unanalyzed. Second, the spectroscope that I used can only shoot x-rays at a

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<sup>10</sup> Ibid. 269-70.

<sup>11</sup> Ibid. 270.

region of the object that is roughly three millimeters squared. This means that it cannot always determine the composition of cracks or clippings in a coin that is smaller than three millimeters; the smaller the crack or clipping is the less likely the spectroscope is to give an accurate compositional analysis. Therefore, this more technologically advanced method developed the same problem that the more primitive wet-chemical analysis had; namely, it could not accurately analysis the difference between the metal-heart of a coin and the surface of the coin, although the reasons are slightly different. Whereas wet-chemical analysis averages out the elemental composition of an object, x-ray spectroscopy simply cannot analyze the metal-heart.

In 1989, Mike Cowell, of the British Museum, proposed that Walker's x-ray fluorescent spectroscopy did not give an accurate reading of the elemental composition of the metal-heart, his abrasions were not enough to penetrate the silver enriched shell of the denarii. Matthew Ponting's research in 1994 confirmed this proposal.<sup>12</sup> Ponting used atomic absorption spectroscopy, which is similar to von Bibra's original wet-chemical analysis in that it requires a sample of the object to be dissolved in acid, but the size of the sample required is much smaller, leaving the vast majority of the object intact. For his analysis, Ponting used a micro-drill to drill into the edge of a denarius and collected the shavings from that hole, after disposing of the shavings of the first two millimeters, which accounted for the silver enriched outer shell; this allowed Ponting to examine only the metal from the metal-heart of the denarius. In order to confirm or disprove Cowell's proposal, Ponting performed this atomic absorption spectroscopy on some of the same denarii, from the British Museum, that Walker used in his tests. The results

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<sup>12</sup> Ponting 270.

came back different, which was a confirmation that the elemental composition of the metal-heart is different from that of the outer shell.

Although much is known about Roman coins, their types, locales, minters, and so forth, very little is known definitively about their production. For this time-period, early imperial Rome, the most important region for mining metal for use as coinage was Spain; this lasted until the second century CE.<sup>13</sup> That much can be definitively known from the archeological record, but how that mined metal was turned into freshly minted coins is largely guesswork. Much of this enigma is due to there being no literary evidence for how this transformation took place.<sup>14</sup> There are three main theories as to how the silver blanks themselves were made; both are entirely possible and are not mutually exclusive. The first two are derived from the coins themselves, the third was created in a modern practical experiment. The first theory is that they were casted in molds. This method is highly evidenced in the coins themselves, especially in aes pieces, some of which show marks for where a casting channel along their edges had been cut off.<sup>15</sup> This channel is formed during the casting process if the two halves of the mold are not completely pressed together tightly and a small amount of the molten metal is allowed to seep into the gap formed. The second theory is that the blanks were sliced off a rod of metal of the proper circumference.<sup>16</sup> This is mostly conjecture, with the best evidence being of certain third century CE sestertii, which were mostly rectangular with slightly rounded corners and do not seem to be

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<sup>13</sup> Carson 221.

<sup>14</sup> Carson 225.

<sup>15</sup> Carson 225.

<sup>16</sup> Caron 225.

cast.<sup>17</sup> The third theory, created through modern experiment, is that the molten metal was molded into a thin bar of metal, which was then cut into portions of a given size; the bar was cut into thirty-two portions in the experiment. The separate sections were then re-melted down and formed round droplets, which could then be struck into coins.<sup>18</sup> There is no evidence for this method being used in the historical record, but it requires only technology and materials that would have been available to the Romans, which means that it is entirely possible that they could have used it. In addition, this method, or a method similar, would account for why the majority of the coins found do not have any evidence of a casting channel on their edges.

However, it is important to remember that the Roman minters were not limited to striking fresh blanks in their pursuit of making coins; one of their most evidenced techniques was simply to re-strike older, already existing coins that had been taken in by the government, either by taxes or by bill payments. R.A.G. Carson makes the argument that this practice was "exceptional rather than regular", due to the rarity of coins that show evidence for it.<sup>19</sup> I am not sure I agree with him; I think it is possible that the coins that show evidence for this are simply the coins that were improperly re-struck. If this were true, the coins, which were properly re-struck, would be indiscernible from the coins that were not re-struck.

The reason why Nero's minters, and later minters, were able to fool numismatic scholars for over one hundred and fifty years with the fineness of their silver is that they used a technique in their denarii production called 'blanching'. The copper in the outer-shells is stripped away,

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<sup>17</sup> Carson, R.A.G. *Coins of the Roman Empire*. New York: Cambridge University Press, 1990. 221-226. Print.

<sup>18</sup> *Ibid.* 225.

<sup>19</sup> *Ibid.* 226.



leaving the coins appearing to be almost pure silver through this process.<sup>20</sup> The blanks are left in a furnace at a red heat for a prolonged period, and then left in the open air for a period afterward. While they are in the open air, the copper in the outer shell of the coins would begin to oxidize, forming a black film. The longer a coin was left exposed, the heavier the black film would have been. Once this film was sufficiently in place, the coins would have been placed in a dilute acid bath, stripping away the oxidized film. The resulting coin would appear shinier and more silvery than a debased coin that did not go through this process. The reason for doing this was two-fold. First, as copper is added and silver is taken away from the debased denarii, they would begin to appear more and more pinkish; thus, since the copper is stripped away, the debased denarii would appear to be the same as the non-debased denarii.<sup>21</sup> Second, since the copper additions were disguised, this process allowed Nero and later emperors to continually lower the fineness of the silver in their denarii without it being immediately apparent. It is not known whether the general Roman populace knew about the debasement or, at least, whether they knew to what degree the denarii were debased. This process is still being used today, especially for commemorative coins, but the Roman minters lacked the sophistication that modern minters have and were unable to control the precise amount of copper oxidized.<sup>22</sup>

For my research, I used x-ray fluorescent spectroscopy and analyzed four post-debasement denarii of Nero. These are the only denarii of Nero that Vassar College's Frances Lehman Loeb Museum has in its collection and are in its on-line database. Three of these

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<sup>20</sup> Ponting 272.

<sup>21</sup> *Ibid.* 272.

<sup>22</sup> *Ibid.* 272.

denarii are from the same run, Sutherland Nero 64 (CC.59.2.0356; CC.59.2.0357; CC.59.2.0366);<sup>23</sup> the other is from a run that was produced a year or two earlier, Sutherland Nero 55(CC.59.2.0364).<sup>24</sup> Both of these two runs were struck in Rome; the first was Nero-55, between 64-65CE, and the second was Sutherland Nero 64, between 66-67CE. From these dates, it is evident that all four of these denarii are post-debasement; the Nero-64 run is clearly after the debasement of 64CE and it is probable that the Nero-55 run is after debasement as well. The obverse of the Nero-55 denarius depicts Nero's bearded and laureate head facing right, with the legend "NERO CAESAR AVGVSTVS" inscribed around with, reading clockwise. The reverse depicts "Roma, helmeted and dr[aped], seated l[eft] on a cuirass, r[ight hand] holding Victory, l[eft] parazonium by side, r[ight] foot resting on helmet; round and oblong shields, with greaves, behind."<sup>25</sup> The reverse legend is "ROMA", reading clockwise. The obverses of the Sutherland Nero 64 denarii depict Nero's bearded and laureate head facing right, with the legend "IMP NERO CAESAR AVGVSTVS", reading clockwise. This legend expands out to "IMPERATOR NERO CAESAR AVGVSTVS". The reverses depict "Jupiter, bare to waist, seated l[eft] on throne, r[ight hand] holding thunderbolt, l[eft hand holding] long sceptre."<sup>26</sup> The legend reads "IVPPITER CVSTOS", Jupiter the protector.

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<sup>23</sup> Sutherland, C.H.V. "Nero." *Roman Imperial Coinage*. Rev. ed. 1. Midsomer Norton: Bookcraft, 1999. 154. Print.

<sup>24</sup> *Ibid.* 153.

<sup>25</sup> *Ibid.* 153.

<sup>26</sup> Sutherland 153.



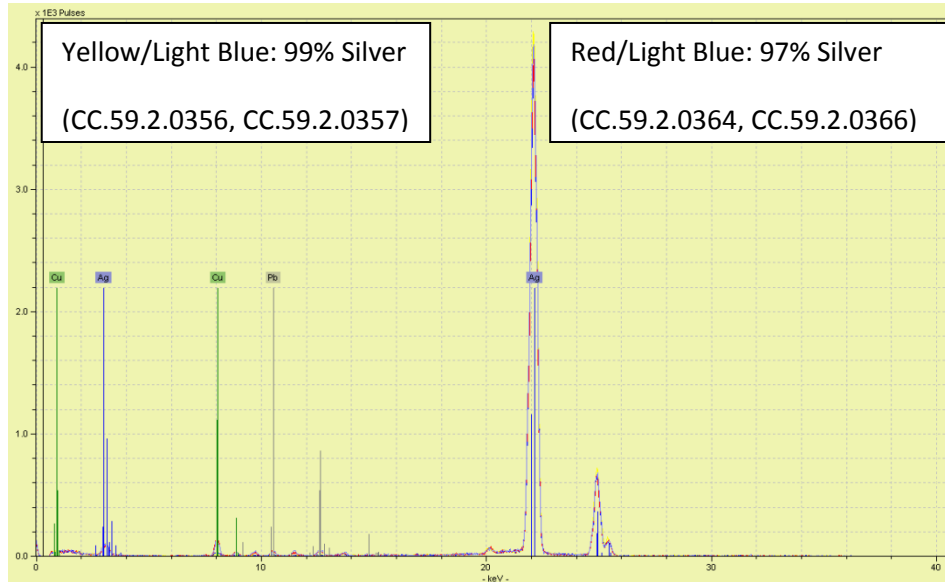
Figure 1: Jupiter Custos Denarii (CC.59.2.0356; CC.59.2.0357; CC.59.2.0366)



Figure 2: Roma Denarius (CC.59.2.0364)

With the assistance of Professor Joseph Tanski, of the Vassar College Chemistry Department, I was able to perform x-ray fluorescent spectroscopy on these denarii. Professor Tanski used a Bruker Tracer handheld X-ray fluorimeter for these tests, which allowed for a semi-quantitative analysis of the data it received. The results were that the outer shells of the post-debasement denarii were of a silver content equal to or finer than the pre-debasement Augustan standard, 97 - 98%. The quantitative analysis is accurate down to a percentage point,

but is not accurate enough to give reliable data for fractions of a percent.<sup>27</sup> The four denarii examined fell equally into two groups: 99% silver and 97% silver. CC.59.2.0356 and CC.59.2.0357, both from the Jupiter Custos run, belonged to the 99% group. This leaves



CC.59.2.0364 and CC.59.2.0366 in the 97% group; the elemental composition for these two coins was nearly identical: 97% silver, >2% copper, and

<1% lead. This is interesting because these two denarii belonged to different runs and were struck in different years, as many as three years apart, while CC.59.2.0366, which belonged to the Jupiter Custos run, is noticeably different from the other two denarii from that same run, which would have been struck at roughly the same time. The most likely reason for this is that, although belonging to the same run, these denarii were made in different batches and, as I already said, the Roman minters were not able to precisely control the exact amount of copper to be stripped away. Roman denarii were made in multiple batches, which, between their ingredients and their time spent being heated and cooled, allowed for slight variation in their surface compositions.

<sup>27</sup> Personal Communication, 5 Dec 2011.

Nero's debasement in 64CE has been a conundrum for scholars for over a century and a half; they have known that it occurred, for it is attested in literature, but they have been unable to find proof of it in the denarii themselves. Every new technological advance, up until the last decade or so, seemed to solve this problem, but unforeseen problems always arose. One of these fooled technologies is x-ray fluorescence spectroscopy. Even though x-ray spectroscopy failed to analyze the extent to which Nero debased his denarii, it does provide some useful data. It provides proof that blanching was used by Nero's minters. Earlier experiments had pointed to this process being used but could not quantify the exact numbers as x-ray spectroscopy successfully does.

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