Counterfeit Shillings of George III 1816-1820
(ii) The Observed Metals

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The previous note presented details of the reference collection of 1,490 counterfeit shillings of George III dated 1816-1820.[(1)] This note will look at the metal composition and plating based on the data gathered in the previous spreadsheet. The table below separates the data by the observed core metal and the presence of any silver plating with the following notation:

- **A** Unidentifiable copper based alloy: copper, brass, bronze etc. Usually with a green/black oxide layer. **AS** shows some silvering.
- **B** Brass - yellow coloured. **BS** shows some silvering.
- **C** Copper - a definite pink colour. **CS** shows some silvering.
- **S** Silver coloured alloy – some may be genuine silver coins.
- **T** Tin - zinc, lead, and alloys such as white metal or pewter that go dull grey or black, often with blistering or powdery corrosion. **TS** shows some silvering

Metal	1816	1817	1818	1819	1820	Total	Total	%
A	17	2	2	10	7	38	83	5.6
AS	12	4	5	14	10	45		
B	206	124	72	190	151	743	1021	69.0
BS	63	46	29	89	51	278		
C	64	33	16	55	39	207	280	18.9
CS	17	17	11	11	17	73		
S	8	5	2	5	2	22	22	1.5
T	28	18	2	12	13	73	74	5.0
TS	1	0	0	0	0	1		
Total	416	249	139	386	290	1480	1480	100

Table 1. Sorting the reference collection into observed metal and presence of silver plating.

It is immediately clear that the collection is dominated by brass pieces (69.0%) and that the copper-based pieces make up 93.5% (A + B + C = 5.6% + 69.0% + 18.9%) i.e., the vast majority of the counterfeit shillings dated 1816-1820. The pieces that fall into the tin category make up just 5.0% of the total. This is a surprisingly small proportion, considering almost all of the contemporary counterfeits of the silver coins dated after about 1825 are made from such “white metals”, when the counterfeiting changed from industrial scale machine made to cottage industry casting. Just 1.5% of the counterfeits are made from a silver-coloured metal, and indeed, some may turn out to be silver and possibly genuine coins.

A common contemporary method for determining counterfeits was to measure the weight. The correct weight for a shilling was 5.655g. The table below gives details of the distributions of weights of the counterfeits, separated by the observed metal content. This table includes everything; holed, damaged corroded, silvered etc, and any subsequent damage, all making the weights less than the manufactured weight.

Metal	A	B	C	S	T
Maximum	5.529	5.795	5.672	5.589	5.370
Minimum	2.558	2.650	2.349	3.723	2.460
Average	4.538	4.640	4.620	4.902	4.094
Standard Deviation	0.474	0.441	0.487	0.581	0.438

Table 2. Summary of the weight distributions for the counterfeits of different metals.

It is immediately clear that virtually none of the pieces are close to the standard weight and those falling in the ‘tin’ category are systematically low.

Figure 1 plots a histogram of the weights of the counterfeits sorted by the observed metal.

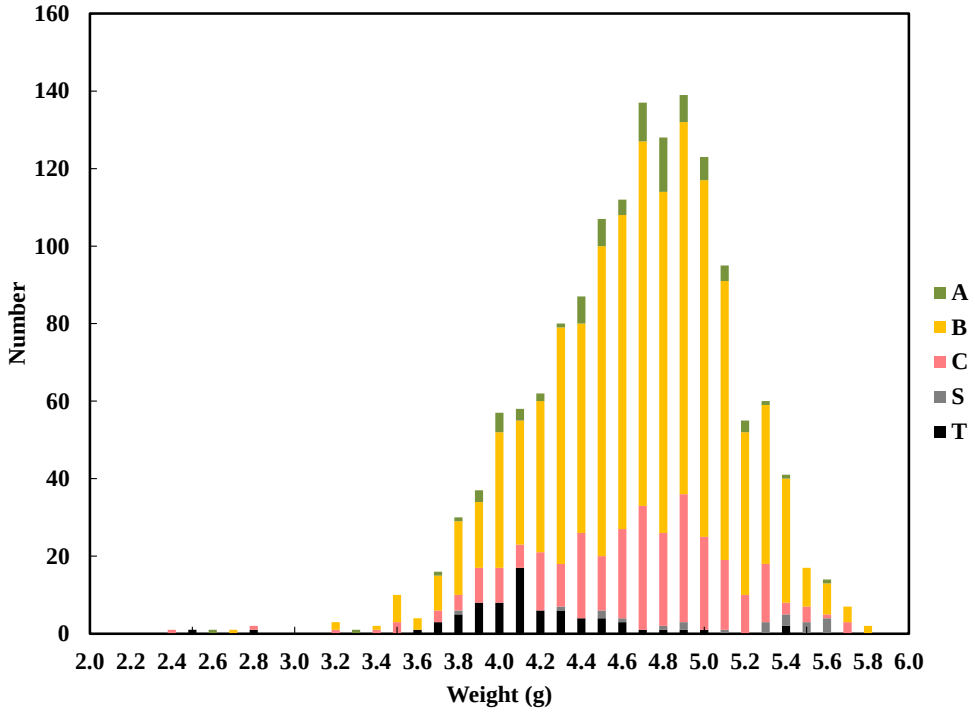

Fig. 1. Counterfeit weights sorted by observed metal.

Figure 2 takes the same data and superimposes the weights of an official silver shilling and also what an official shilling would weigh if it was made of various metal and alloys, based on the density differences of the materials.[(2)]

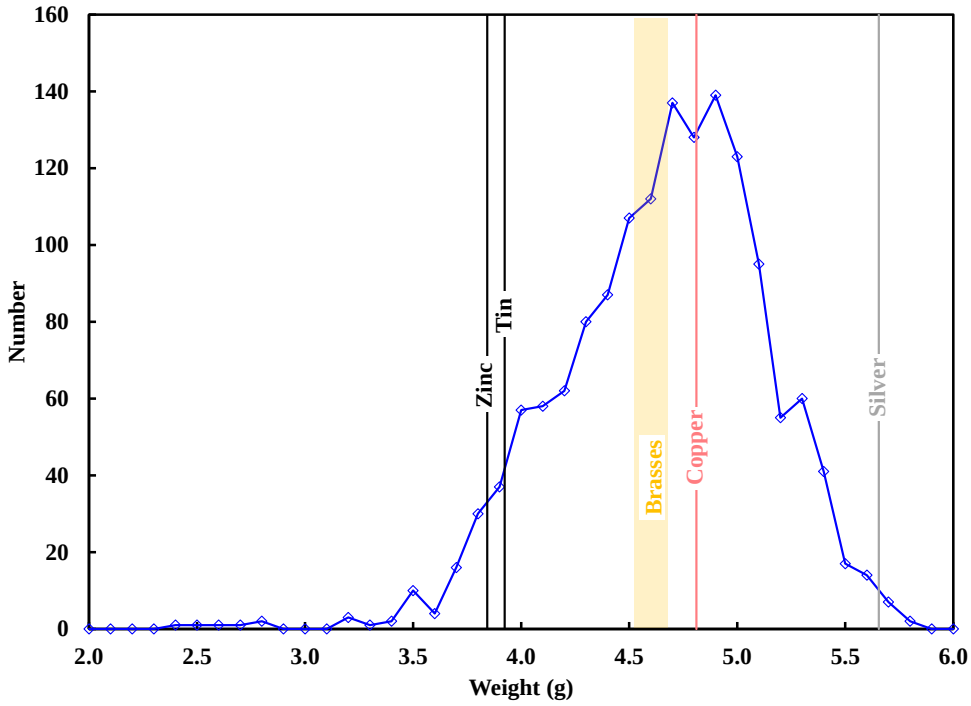

Fig. 2. Comparing counterfeit weights with silver and other metal and alloy weights.

Figure 1 further confirms how few of the counterfeits are around the correct weight. It is also interesting to note that there is a cluster of 'silver' pieces close to the full weight around 5.4-5.6g and the 'tin' pieces are mostly in the region 3.6-4.6g. Figure 2 makes this clearer in that the 'tin' pieces have weights close to that expected of tin and zinc. Similarly the copper and brass counterfeits are just about the correct weight volume for volume as the silver coins that they have copied. It is also noted that the density of a metal can depend on the method of manufacture, with rolled and stamped metal tending to have a higher density than that of cast metal of the same alloy.

For each of the counterfeits, figure 3 plots the density measured using Archimedes' method against the measured weight.

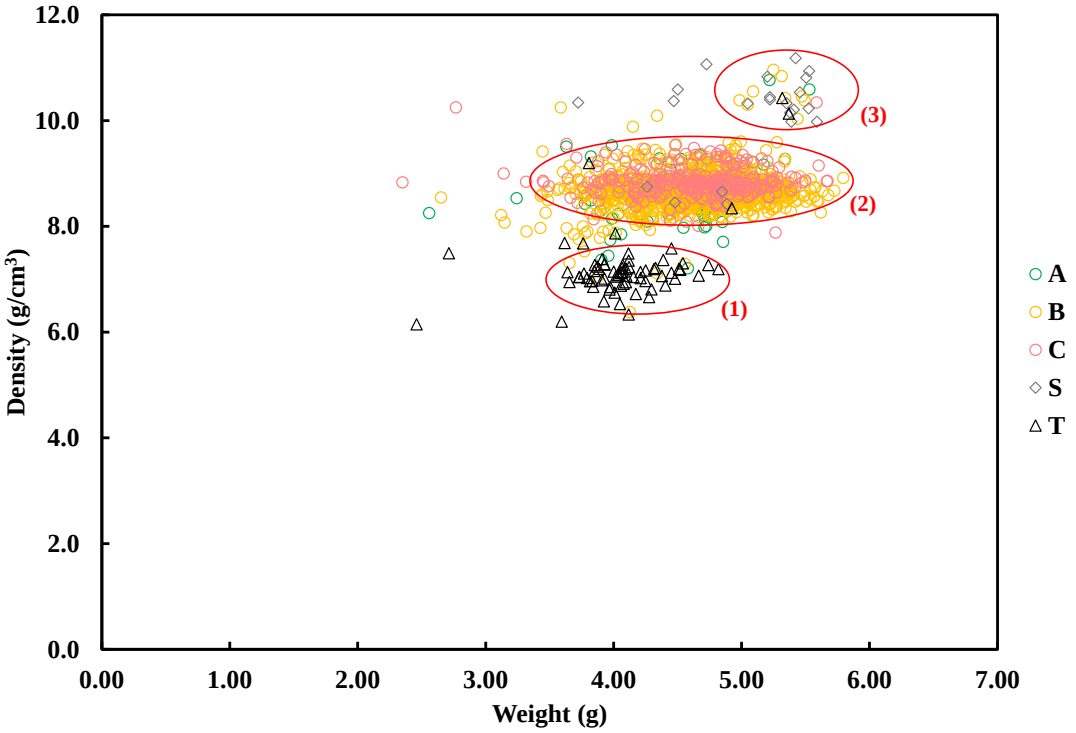

Fig. 3. Cross plot of density vs weight for the counterfeits, sorted by visual estimate of metal.

It is immediately clear that the counterfeits fall into three distinct groups roughly consistent with the appearance of the metal. (1) the 'tin' pieces with weight ~ 4.2 g and density ~ 7.0 g/cm^3, (2) The copper alloys, brass and copper pieces with weight ~ 4.5 g and density ~ 9.0 g/cm^3, and (3) a group that contains most of the 'silver' pieces, along with a few pieces of the other metals with weight ~ 4.5 g and density ~ 9.0 g/cm^3.

As a final check on the clustering by metal type, a cross plot will be made of the density as determined from the measured weight and volume estimated from the diameter and thickness of the counterfeit against the density determined via Archimedes' method.

That the thickness is determined on a single diameter, and based on the high points only, means that the estimate of thickness is systematically high and hence the estimated density is systematically low. To make the measurement correctly the whole surface profile would have to be measured and averaged. The error is sketched in Figure 4. Using a calliper to measure the thickness of the counterfeit and assuming a cylinder of that height to estimate the volume is very primitive, but worth a try, and the results are shown in Figure 5.

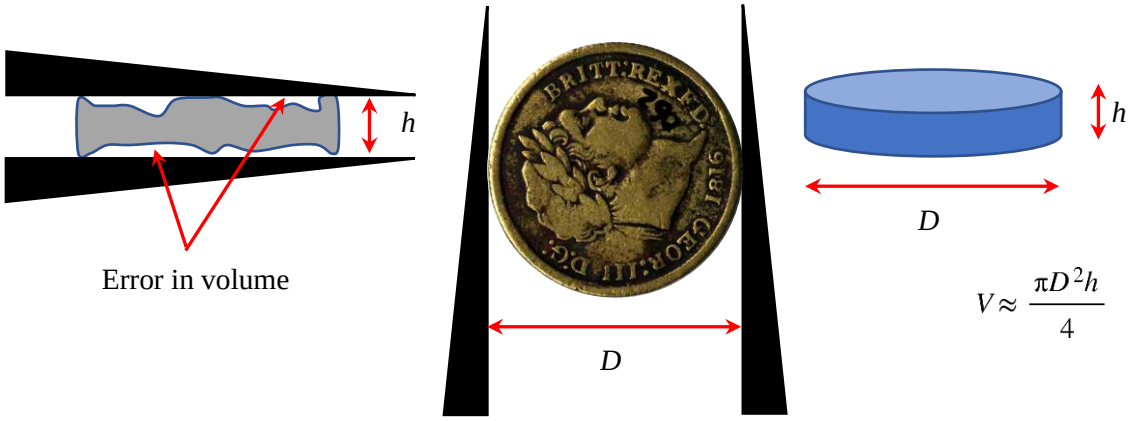

Fig. 4. Errors incurred by using callipers to measure the thickness of a counterfeit and then calculating the volume.

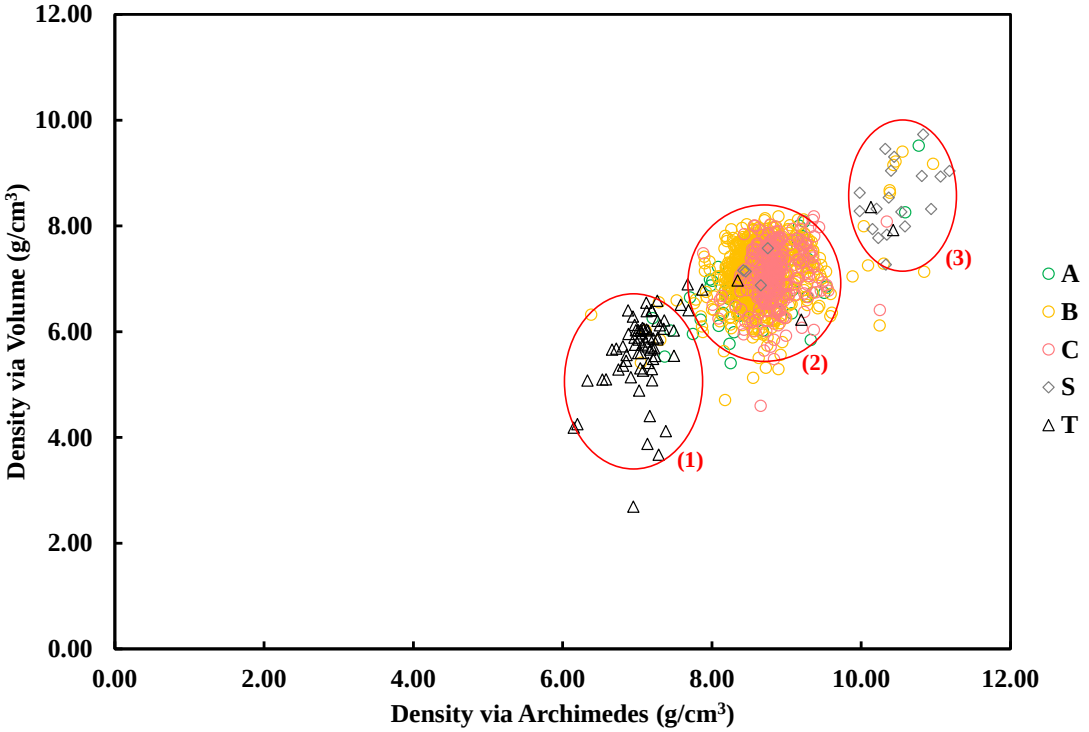

Fig. 5. Comparing density via estimated volume with density via Archimedes' method.

As before there are three distinct clusters of measurements consistent with the 'tin', 'copper alloys, brass and copper' and 'silver' counterfeits. The average underestimation of the density using the thickness-volume method is 18%.

Discussion and Conclusions

From the analysis of the weights and physical appearance of the metals, the collection is dominated by the brass pieces (69.0%). More generally the copper-based pieces make up 93.5% (A + B + C = 5.6% + 69.0% + 18.9%) i.e., the vast majority of the counterfeit shillings dated 1816-1820.

The pieces that fall into the 'tin' category make up just 5.0% of the total. This was a surprisingly small proportion considering the majority of counterfeit silver coins dated after about 1825 appear to be the tin, zinc, white metal, pewter etc. types.

Just 1.5% of the counterfeits are made from a silver-coloured alloy, and indeed, some may turn out to be silver and possibly genuine coins, but many are 'just not quite the right colour'.

Analysis of the density data has neatly separated the counterfeits into three distinct groups that are mostly consistent with the visible assessment of the metal content. The clustering of the groups by density is not perfect and the next note will use XRF analysis to look at some of the typical pieces along with some of the unusual entries and outliers for each of the clusters.

References

(1) G. Oddie. Counterfeit Shillings 1816-1820 (i) Reference Collection and Statistics. BNS Blog 5 September 2021. https://britnumsoc.files.wordpress.com/2021/09/193-counterfeit-george-iii-oddie-blog-001.pdf

(2) G.W.C. Kaye and T.H. Laby. *Tables of Physical and Chemical Constants*. Longman, 1992.