Counterfeit Round Pound Coins (i) Lead Alloy Issues

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Until the introduction of the dodecagonal bimetallic pound coin in March 2017, the round pounds had suffered extensively at the hands of counterfeiters. The problem began almost immediately after their introduction in 1983. Of the 1.5 billion or so round pounds in circulation in 2016 it was estimated that 3% were counterfeit. The increasing prevalence received much coverage in the press and also television news programmes typically showing how to identify the fakes[1,2]. Having trained my colleagues to spot counterfeits, almost every lunchtime brought some new pieces and it was easy to spot when a new counterfeiting operation had gone live by the sudden appearance of several pieces clearly from the same manufacturer.

The counterfeits fall into two main groups and several small issues as follows.

Cast lead alloy, often coated with a yellow substance such as a metallic paint.
Cast or struck yellow metal, rarely coated or plated.
A lead core with a metal foil and stamped design.
A lead core with a metallic resin outer layer that filled the mould.
A lead core with a plaster of Paris outer moulding and painted.
Two decimal pennies glued together and with a metallic resin outer layer that filled the mould.
Two large style five pence pieces soldered together, sometimes with the edge filed down.

Now that the coins are no longer circulating, and ceased to be legal tender in October 2017, this might be a useful time to make some observations about these counterfeits before they are forgotten and lost.

This short note will address the first type of counterfeits often referred to as lead alloy. The composition of several pieces will be presented below. The data is based on a small private collection (SN, 97 pieces), another larger private collection put together before 2003 (EN, 150 pieces) and a hoard that has recently been made available for analysis (Hoard, 903 pieces).

Figure 1 shows a photograph of the hoard and the SN collection.

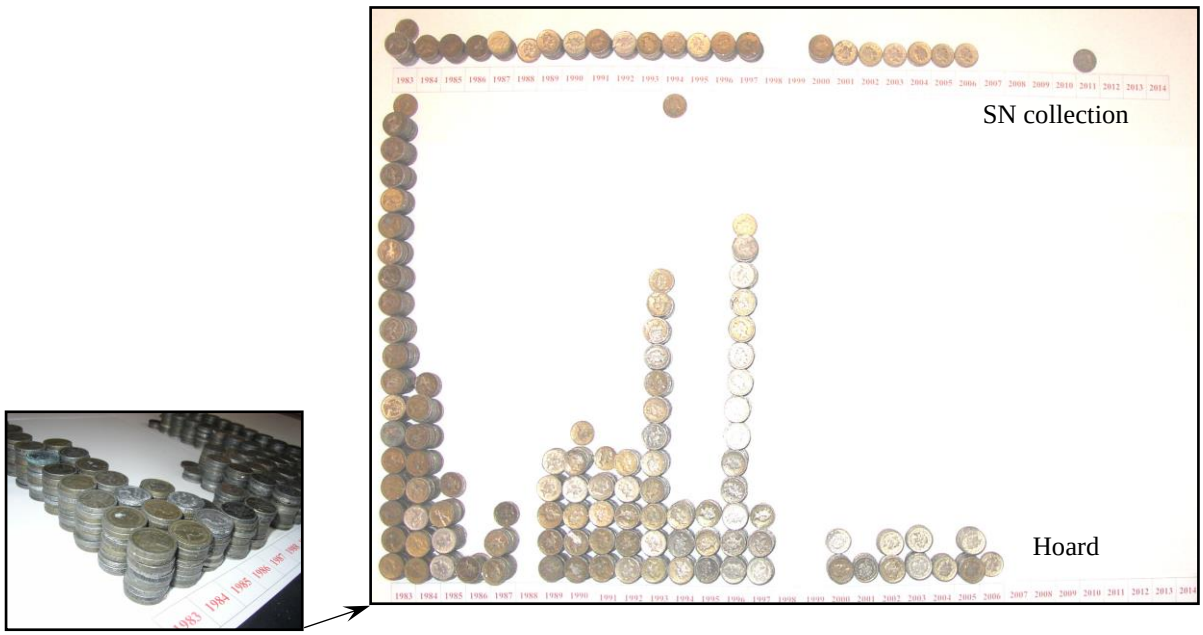


Fig. 1. An accumulation of counterfeit round pound coins. Each complete stack contains 10 pieces.

The table below summarises the collections and hoard by the date on the obverse of the coin. Mules are counterfeits that have an incorrect reverse design and/or edge reading for the obverse date.

Date	Official Rev Design	SN Collection		EN Collection		Hoard		Ratio Coll/ All	RM Issued Mintage
		Good	Mules	Good	Mules	Good	Mules		
1983	Royal Arms	11		22	1	181		**0.16**	443.1
1984	Thistle	5		7		73		**0.14**	146.2
1985	Leek	5		4	1	32		0.24	228.4
1986	Flax Plant	3		5		10		0.44	10.4
1987	Oak Tree	6		6		22		0.35	39.3
1988	Shield	1		4		0		**1.00**	7.1
1989	Thistle	7		10	1	43		0.30	70.6
1990	Leek	5		10	1	51		0.24	97.3
1991	Flax Plant	7		9	1	41		0.29	38.4
1992	Oak Tree	5		10		48		0.24	36.3
1993	Royal Arms	6		11		113		**0.13**	114.7
1994	Lion Rampant	5	1	7	1	30		0.32	29.8
1995	Dragon	5		12		23		0.43	34.5
1996	Celtic Cross	6		7		131		**0.09**	69.9
1997	Three Lions	5		7	1	22		0.37	57.1
1998	Royal Arms	0		0		0			0.0
1999	Lion Rampant	0		0		0			0.0
2000	Dragon	5		8		13		**0.50**	109.5
2001	Celtic Cross	2		3		7		0.42	64.0
2002	Three Lions	1		1		17		0.11	77.8
2003	Royal Arms	1				18		**0.05**	62.0
2004	Forth Bridge	2				8		0.20	39.2
2005	Menai Bridge	1				19		**0.05**	99.4
2006	Egyptian Arch	1				1		**0.50**	38.9
2007	Millenium Bridge								26.2
2008	Royal Arms								3.9
2008	Shield								43.8
2009	Shield								27.6
2010	Shield								57.1
2010	London Arms								2.6
2010	Belfast Arms								6.2
2011	Royal Arms	1						**1.00**	25.4
2011	Cardiff Arms								1.6
2011	Edinburgh Arms								0.9
2012	Royal Arms								35.7
	Totals	96	1	143	7	903	0		

Table 1. Totals by date for the SN, EN collections and a hoard lead alloy counterfeit pound coins.

The first observation from the photograph and table, as might be expected, is that the SN and EN collections significantly over represent the rare issues (e.g. 1988, 2000, 2006, and 2011) and mules. Conversely the collections under-represent the commoner issues when compared to the hoard (e.g. 1983, 1984, 1993, 1996, 2003 and 2005). With the exception of the single 2011 piece (see below), the production of these lead alloy metal counterfeits went into significant decline around 2000 when the counterfeiters changed to the use of a harder yellow metal thus eliminating the need for a coating.

Muled Designs

The majority (99.3%) of these counterfeits have the correct reverse design, edge legend and die axis for the date, suggesting that the moulds were made from a single coin. The mules require the moulds to be made from two different coins, a more laborious process, and explaining their rarity.

The table below summarises the known muled designs.

Date	Official Rev Design	Mule Rev	Edge	Seen
1983	Royal Arms	Leek	PLEIDOL/DECUS mix	1
1985	Leek	Royal Arms	PLEIDOL etc	1
1989	Thistle	Flax Plant	DECUS etc	1
1990	Leek	Oak Tree	PLEIDOL/DECUS mix	1
1991	Flax Plant	Thistle	No edge legend	1
1994	Lion Rampant	Welsh Leek	NEMO etc	1
1994	Lion Rampant	Royal Arms	NEMO damaged mould	1
1997	Three Lions	Celtic Cross	DECUS etc	1

Table 2. Known mules for the lead alloy counterfeit round pound coins.

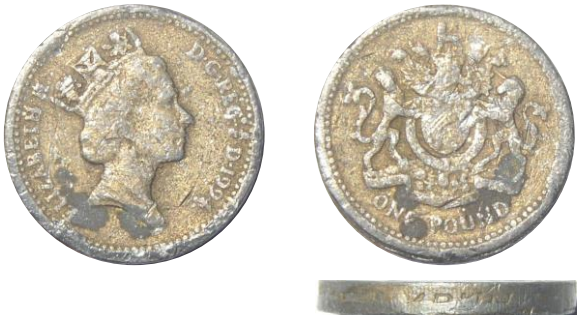
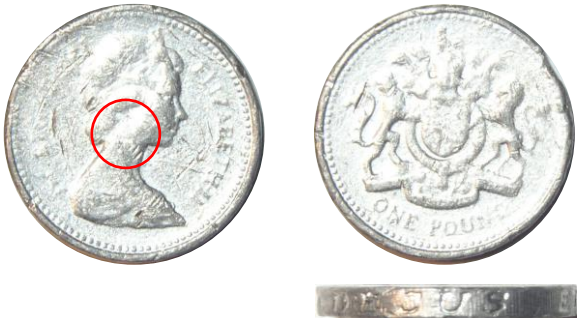


Fig. 2. 1994 mule with Royal Arms instead of Lion Rampant, NEMO edge, image 150%.

Composition

Very little has been published on the composition of fake pound coins[3]. The metal content of a few of the counterfeits has been determined using XRF analysis and the results are presented below. The approximate area of analysis is shown by a red circle.

(1) Some of the counterfeits (~2%) show no traces of a coating, even in the recesses, and these have remained quite bright.

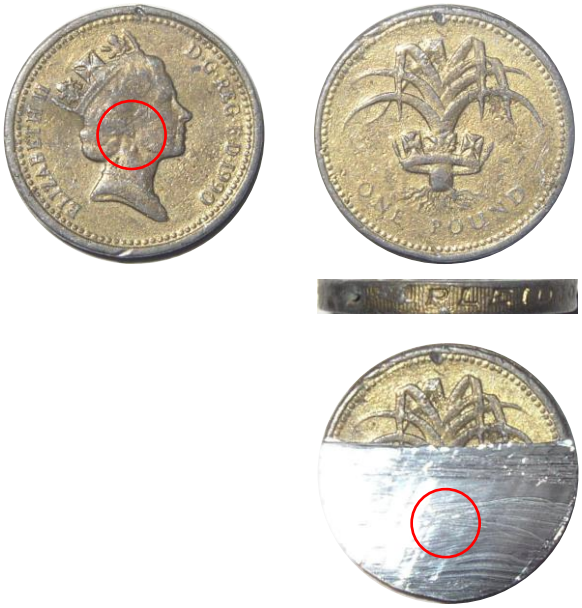


1983	8.481 g
Sn	53.94 ± 0.44 %
Pb	41.20 ± 0.28 %
Sb	3.49 ± 0.08 %
Si	1.29 ± 0.08 %
Nothing else	

Fig. 3. Analysis of a 1983 bright lead alloy counterfeit.

This piece is possibly made from a $Sn_{60}Pb_{40}$ solder, once commonly used in plumbing and electrical work, but now banned in many applications because of the lead content and the WEEE and other HSE regulations.

(2) Most pieces (>95%) have an obvious yellow coating and where worn through, the metal below has gone a dark colour. In many cases the coating has almost completely worn away. The reverse of one piece has been filed down to reveal the core and then that surface has been scraped off with a new scalpel blade to reveal the raw metal. The metal is very soft.



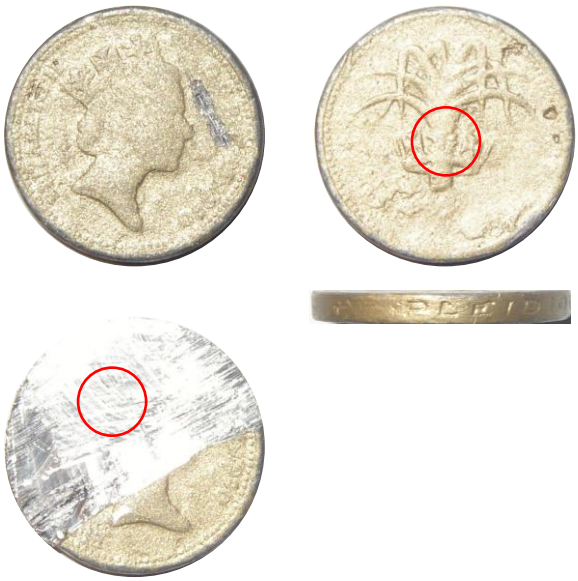
1990	10.263 g
Pb	80.92 ± 0.41 %
Sb	8.99 ± 0.15 %
Sn	4.00 ± 0.10 %
Cu	3.67 ± 0.08 %
Si	1.13 ± 0.07 %
Zn	0.818 ± 0.038 %
P	0.079 ± 0.030 %
And trace elements	

1990	9.461 g
Pb	83.93 ± 0.39 %
Sb	9.19 ± 0.15 %
Sn	4.32 ± 0.11 %
Cu	0.095 ± 0.021 %
Si	1.96 ± 0.10 %
Zn	< LOD
P	0.129 ± 0.042 %
And trace elements	

Fig. 4. Analysis of a 1990 coated lead alloy counterfeit.

It is thus concluded that the core is mostly lead and the coating has a metallic component including copper and zinc. The copper and zinc are essentially absent from the cleaned surface, the copper having dropped from 3.67 % to 0.095% and the zinc from 0.818 % to below the LOD (limit of detection).

(3) A few pieces are very poor castings with a thick coating making the design even less distinct.



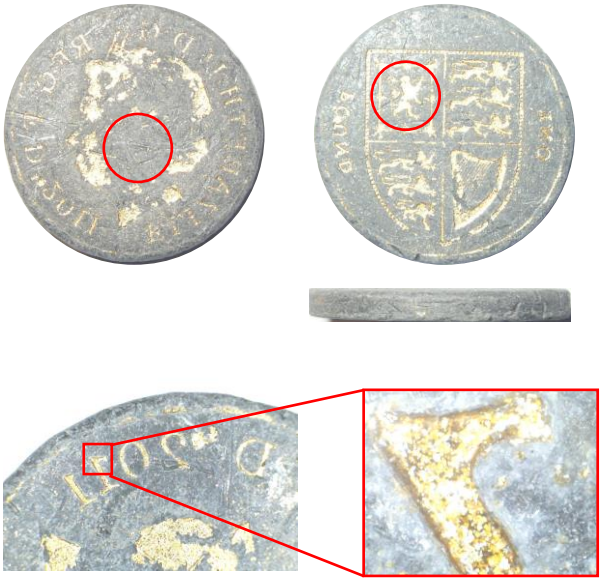
1990	9.127 g
Pb	50.63 ± 0.29 %
Sn	28.96 ± 0.29 %
Al	17.37 ± 0.42 %
Fe	6.20 ± 0.037 %
Sb	0.65 ± 0.020%
Si	0.533 ± 0.051
And trace elements	

1990	8.620 g
Pb	58.98 ± 0.30 %
Sn	39.02 ± 0.36 %
Si	1.09 ± 0.08 %
Sb	0.808 ± 0.048%
Nothing else	

Fig. 5. Analysis of a poor quality 1990 coated lead alloy counterfeit.

It would appear that the core is a $Pb_{60}Sn_{40}$ high lead solder and the coating has a significant aluminium and iron content.

(4) The 2011 counterfeit is anomalous in several aspects; it is a very late date and also both obverse and reverse are incuse as if made by squeezing a blank between two genuine coins. The edge shows some marks and traces of a yellow coating, but no discernible legend. The counterfeit was given in change by a Cambridge taxi driver in 2015. The XRF measurement takes an average of an area about 6 mm in diameter. Measurements were taken at two locations, the first trying to avoid the coating and the second in a location where some coating remains.



2011	12.919 g
Pb	96.96 ± 0.41 %
Si	1.94 ± 0.10 %
Al	0.845 ± 0.313 %
P	0.113 ± 0.041 %
Cu	0.093 ± 0.020%
Nothing else	

2011	12.919 g
Pb	93.66 ± 0.43 %
Al	4.01 ± 0.35 %
Si	1.52 ± 0.08 %
Fe	0.492 ± 0.062%
Cu	0.127 ± 0.036%
P	0.113 ± 0.041 %
Nothing else	

Fig. 6. Analysis of a 2011 incuse counterfeit.

It would appear that the core is almost pure lead and the coating is aluminium based, possibly a yellow anodized aluminium foil. The close-up images suggest that the coating has a granular structure, though may have been a foil that has aged badly.

References and Acknowledgements

(1) R.W. Matthews. The development of a classification system for modern UK £1 coin forgeries. Paper presented to the *Counterfeiting (Ancient and Modern) Symposium* organized by the British Museum & Royal Numismatic Society. Held at the Society of Antiquaries 14-15 September 2000.

(2) K. Peters. *The Cheat in Your Change – How to Spot Fake Pound Coins*. 2005.

(3) C.R. Gagg & P.R. Lewis. Counterfeit coin of the realm. *Engineering Failure Analysis* 14(6) September 2007 pp114-152.

Many thanks to EN for sharing his analysis and to other fellow collectors of these pieces for useful discussions over the years. Also thanks to the contributors to the *Counterfeit* – the journal of the Counterfeit Coin Club v4n1-v18n4, 1999-2014, where new and unusual counterfeit pound coins regularly featured.

Postscript

Though it is only a few years since these counterfeits were in circulation, they have been rapidly forgotten. I think it is important that they are recorded before they are lost completely. I expect some readers to have significantly larger collections and a more detailed analysis and conclusions which they may like to contribute to the BNS blog.