

# Influence of striking praxis and chemical corrosion in weight variations of a big sample of Syracusan bronze coins

Benedetto Carroccio<sup>1</sup>

<sup>1</sup> *University of Calabria, Dipartimento di Studi Umanistici, via P.Bucci, cubo 28/b, 87036 Arcavacata di Rende (CS), Italy, bencarroccio@iol.it*

**Abstract** – The Poseidon’s head/Trident “small flan” bronze coins of Hieron II of Syracuse (275-215 BC) had different proposals of chronology. 2 big hoard of 2,229 pieces overall of these coins were analytically studied. Their weights have great fluctuations but this is not a sign of a long time issue because the same fluctuations are frequent in pieces produced in the same time from the same pair of dies. Parallels to the different conservation of the coins of the 2 hoards are little variations of their medium weights and also a respectful cleaning not produced relevant variations in their weights. The fluctuations of the weights of contemporaneous coins are signs of “al marco” striking. Their chronology was very restricted, probably in 215-214 BC.

What calculations are really helpful to determine the real striking rhythm, the economic reasons and the chronology, which are the basic problems to solve studying an ancient coin issue? And what special circumstances, or variables (in mathematic terms) must be considered to come to affordable results?

The answers to these questions help to make coins essential “guide fossils” to understand ancient ages or state policy, or to come to more accurate chronologies of the archaeological strata in which coins were uncovered.

Hieron II ruled 60 years on Syracuse, from 275 BC until his death on spring 215 BC [1].

During his reign the political and military background of Ancient Italy and Sicily varied considerably, from a dissimilar group of great or little autonomous states in struggle, or alliance, or relations of neutrality, with a still regional Roman state, to a number of Hellenistic cities or little states, all involved in the Hannibalian war as Rome or Carthage allies.

We know, as result of previous analytical researches [2], that Hieron II’s gold and silver coins were issued only during his involvement in the wars from 275 to 263 BC and during the initial phase of the II Punic War (217-214 ca. BC), but usually scholars think differently that his sometimes very abundant bronze coins were issued during all the years of his reign, as normal token coinage

for daily commerce.



*Fig. 1. Small flan Trident with AY from Megara 1967 Hoard*

One of these issues, with Poseidon’s head/Ornamental trident, two dolphins and Hieron’s name (*Fig. 1*), issued in 2 modules (22 or 18 mm.) and average weights (8.5 or 6.2 g), is very common (the small flan issue) indeed, and constantly uncovered in all ancient Sicilian sites. In *Girgenti* (ancient *Akragas*, now Agrigento) in 1901 was uncovered a pot hoard of 60,000 of these coins, now dispersed or perhaps melted, except for 60 in Syracuse “P. Orsi” Regional Archaeological Museum, and maybe some in Palermo “A. Salinas” Regional Archaeological Museum [3].

Apart from that, we have reports of other hoards of 1,000-3,000 pieces from this issue [4], sometimes still preserved in museums, and other 1900 ca. pieces were uncovered in the ancient city of *Morgantina* (Sicily) during American excavations which started in 1955 [5].

The abundance of these coins findings in Sicilian archaeological strata encouraged M. Bell to apply a statistical approach to their chronology, dividing proportionally the number of “Trident” coins of the 2 issues uncovered in a stratum at *Morgantina* among the 60 years of Hieron’s rule. As result of this procedure applied to a single context, he suggested to date the wide flan issue in 275-256 BC and the small flan issue in 256 or 240-215 BC [6].

Moreover, the issue of coins with Hieron’s rather than Syracusans name (which would have been the praxis in every ancient republican state) would have been possible only after his proclamation as *basileus*, king (269 BC) [7], and Bell and his pupils hypothesis have the absolute

not demonstrated presuppositions – nowadays highly disputed [8] - of a constant striking rhythm of an ancient Greek mint, and of a datation of the majority of Morgantina buildings during all the Hieron's reign, rather than in its last decades, or after the conquest in 211 BC.

If we observe the coins of the small flan issue, they appear to have very different weights, from 7.91 to 4.09 grams in the bigger sample previously observed [9]. This difference can be a problem if we aim to a metrological definition, since we know that the silver and bronze standard of the coined *litra* in IIIrd century BC underwent to still discussed reductions [10]. Many past scholars thought that these variations in the weights of bronze coins (particularly in the Roman *aes grave* series of the IIIrd century BC [11]) were signs of a slow progressive decline of their weight and coin standard and thought that it was therefore sign of an issue prolonged for a great number of years. P. Marchetti also assumed that the

ground corrosion produced a great weight loss of bronze coins, until to a 20% compared to the original weight in the case of some Roman Republican cast coins [12].

Recently I was authorized to study 2 big hoards of “Trident” coins: 1) one pot hoard found during French excavations in Megara Hyblaea (1967), with 1,005 pieces – 1,001 of which of the small flan issue -, now in Syracuse (Fig. 1); 2) the more uncertain “Sicilia” IGCH 1252 hoard (or deposit), with 1,232 tridents – 1,228 of which of the small flan issue -, now in Palermo “Salinas” Museum [13]. This double big sample has allowed me to verify many open questions on small flan coins, regarding their weight variations, striking rhythm, chronology and influence of chemical or mechanical “restorations” in weight measurements.

Ancient coins were stroke from pairs of dies: 1 obverse fixed die and 1 reverse mobile die, more exposed to consumption, normally substituted early than the obverse. Little differences between the design of the dies are unavoidable because they were hand engraved and allow us to identify and quantify them ,and to reconstruct their sequence and the striking organization [14].

This inspection allowed me to identify 306 obverse dies, 506 reverse dies and 695 pairs of dies (101 with 5 or plus surviving coins) used by many workshops, signed by 13 alphabetical control-marks at least [15]. But the graphics of their sequence proof many cases of parallel massive contemporaneous strikings (Fig. 2), from at least 12 groups of workers (“anvils”) at the beginning [16]. We know furthermore that Rome in a single year (82 BC) used 525 reverse dies to strike their *denarii* [17] and this is a proof that the total number of coins or dies is insufficient to postulate a long chronology.

The weight oscillation of coins from different workshops is similar: for example, in the *lambda-ypsilon* group from 8.97 to 5.03 g, with a medium weight of

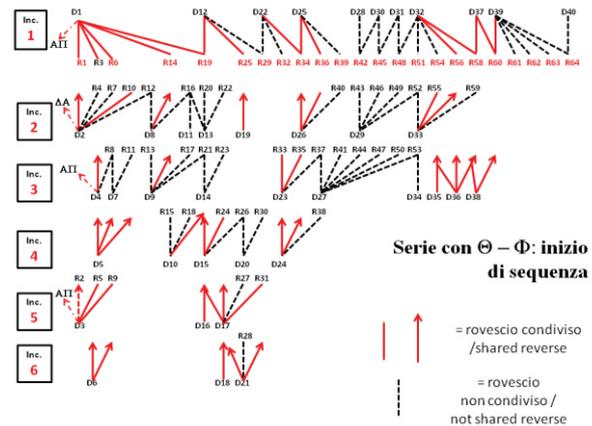


Fig. 2. Part of die-sequence of parallel striking of pieces with  $\Theta - \Phi$  control-mark



Fig. 3. pieces from the same pair of dies: 8.97 and 6.05 g (Palermo Museum)

6.43 g (Fig. 3); in the contemporaneous *delta-alpha* group from 7.78 to 5.19 g, with a medium weight of 6.32 g; in *alpha-pi* group, related to the same age, from 8.22 to 4.54 grams the medium weight is 6.29 g; in the similar *sigma-omega* group from 7.61 to 5.50 g with the medium weight of 6.36 grams; in the *theta* and *phi* group, slightly later [18], from 8.16 to 4.03 g and a medium of 6.29 g; in the analogous *alpha* and *tau* group from 8.39 to 4.83 grams, with the medium weight of 6.26 grams.

Moreover, weights in the 2 hoards appear to have little differences: from 8.39 to 4.83 g, with a medium of 6.31 grams in the Megara hoard; from 8.97 to 4.68 grams and a medium of 6.45 grams in the “Sicilia” hoard. Their conservation appears different also: the coins of the first were too drastically cleaned with acids which removed their patina, whereas the majority of the coins in Palermo had little ground incrustations, or a clear veiling patina with superficial atmospheric oxidizations. A light mechanical cleaning operated by the restorer Rossella Rizzari in accordance with modern criteria respectful of



Fig. 4. Soft cleaning of coin with heavy patina

the patina [19] (Fig. 4), on 400 coins of this hoard allowed me to verify if the weights of the “Megara” coins were sensibly reduced by the acid and the medium impact of cleaning. In effect, the modern more “respectful” cleaning produced weight losses only of 0.01-0.10 grams, with a medium of 0.03 grams, and probably also the more “hard” chemical cleaning damaged engraving details more than weights.

Consequently, we have to have prudence in accepting the big generalized medium loss of weight of the bronze coins supposed by Marchetti.

On the contrary, in our sample we have many cases of great fluctuation of the weights of coins produced by the same pair of dies, i.e. in a little period of time: fluctuations of ca. 2 or plus grams (30 % ca of the medium weight) in 28 cases, or of 1.5-1.95 g (25 % ca.) more frequently, in other 52 cases (and a greater number of cases considering coins from the same obverse die, which had an anyhow limited life).



Fig. 5. “Trident” and Hieronymos bronze coin with the same pair of single letter control marks

These fluctuations and other evidences – as the common use of some control-marks (Fig. 5) – therefore appear to me proofs of an “al Marco” striking – with care to respect only a fixed medium weight [20] – of the small flan “Tridents”, more than of slow standard reductions. They also proofs - together with our reconstruction of the die-sequence and the striking organization - a concentrated chronology of these coins, in the last Hieron’s year and, as posthumous coinage also - with aims to legitimate the succession to the kingship -, in the 13 months of reign of his young nephew Hieronymos (215-214 BC) [21]

## REFERENCES

- [1] For his history and chronology see G.De Sensi Sestito, “Gerone II. Un monarca ellenistico in Sicilia”, Palermo 1977; B.Carroccio, “La monetazione aurea ed argentea di Ierone II”, Circolo Numismatico Torinese, Torino 1994, pp.3-12; B.Carroccio, “Dal basileus Agatocle a Roma. Le monetazioni siciliane di età ellenistica (Cronologia, Iconografia, Metrologia)”, Pelorias 10, Di.Sc.A.M. Messina 2004, pp.22-24
- [2] B.Carroccio 1994 (see n.1); M.Caccamo Caltabiano, B.Carroccio, E.Oteri, “Il sistema monetale ieroniano. Cronologia e problemi”, in M.Caccamo Caltabiano (ed.), “La Sicilia tra l’Egitto e Roma. La monetazione siracusana dell’età di Ierone II” Atti del Seminario di Studi Messina 1993, suppl. 1 AaPel LXIX (1993), 1995, pp. 195-279; M.Caccamo Caltabiano, B.Carroccio, E.Oteri, “Siracusa ellenistica. Le monete “regali” di Ierone II, della sua famiglia e dei Siracusani”, Pelorias 2, Di.Sc.A.M. Messina 1997, B. Carroccio 2004 (see n.1), pp.83-85 and 127-131.
- [3] See A.Tusa Cutroni, “Vita dei Medaglieri. Il Medagliere del Museo Nazionale di Palermo”, AIN 3, 1956, pp.205-212 at pp. 209-210; M.Thompson, O.Mørkholm, C.M.Kraay, “An Inventory of Greek Coin Hoards” (IGCH), New York 1973, nr. 2222 and 2225.
- [4] See M.Puglisi, “La Sicilia da Dionisio I a Sesto Pompeo. Circolazione e funzione della moneta”, Pelorias 16, Di.Sc.A.M., Messina 2009, pp. 330-332 and 375.
- [5] See T.V. Buttrey, K.Erim, Th.D.Groves, R.R.Holloway, “Morgantina Studies II - The Coins”, New Jersey 1989, pp.146-147.
- [6] *Ibidem* and M.Bell, “The halved Poseidon Head/Trident Coins with a Note by R.Ross Holloway”, appendix to “Excavations at Morgantina, preliminary report, XII”, AJA 1983, pp. 340-342; M.Bell, “Monete ieroniche in nuovi contesti da scavo a Morgantina”, in M.Caccamo Caltabiano (ed.) 1995 (see n.2), pp. 289-293. See also A.Walthall, “The Central Shops at Morgantina, Sicily Chronology and Circulation of Bronze Coinage in Early Hellenistic Sicily”, in G.Pardini (ed.), “Numismatica e archeologia. Monete, stratigrafie e contesti. Dati a confronto”, Preatti del I Workshop Internaz. di Numismatica. Roma 28-30 settembre 2011, Roma 2011, pp.217-220.
- [7] B.Carroccio 1994 (see n.2), p. 40.
- [8] See T.Hackens, “Rythmes de la production monétaire: les monnayages archaïques et classiques de Grèce”, in G.Depeyrot, T.Hackens, G.Mouchartre (eds.), “Rythmes de la production monétaire de l’Antiquité à nos jours”, Louvain-la-Neuve 1987, pp. 1-10; B.Carroccio, “Parallel striking reconstruction

- and chronological numismatic interpretation”, in F. De Callataÿ (ed.), “Quantifying Monetary Supplies in Graeco-Roman Times”, *Pragmateiai* 19, Edipuglia, Bari 2011, pp. 81-103
- [9] M.Caccamo Caltabiano, B.Carroccio, E.Oteri 1995 (see n.2), p. 225; B.Carroccio 2004 (see n.1), p. 86, no. 75; T.V. Buttrey, K.Erim, Th.D.Groves, R.R.Holloway 1989 (see n.5)..
- [10] Scholars generally accepted two or three main weight reductions (from 8.7 grams to 7, later 6.6 and finally 5.66 grams) of the Syracusan, Tauromenitan and Magno-graecan silver “Pegasus” staters (*nomoi* of ten *litrai* in Sicily and at *Lokroi Epizephyrioi* and *Tarentum*, see Aristot. ap. Poll. Onom. 4, 174-175 and 9, 80-81; P. Marchetti, “La Sicilia, Locri e la monetazione romana”, in M.Caccamo Caltabiano (ed.), 1995, see n. 2, pp. 345-354), or of their multiples, during the reigns and expeditions of Agathocles (306-289 BC) and Pyrrhus (281-272 BC), see S.Garraffo, “Considerazioni sui cavalieri tarantini del VI periodo Evans. Magna Grecia e Sicilia nella prima età di Pirro”, *DArch* s.3, 7/2, 1989, pp. 21-29; M.Taliercio Mensitieri, “La riduzione ponderale in Magna Grecia e, in particolare, gli stateri ridotti di Heraclea, di Thurii e di Crotona”, *DArch* s.3, 7/2, 1989, pp.31-52. But we have many proofs or clues of more reductions and reforms of the weight and monetary Syracusan standard (similar to the more known reductions of the Roman Republican bronze standard) until the conquest of Syracuse in 211 BC, see B.Carroccio, “Dal Nomos Stater al Nummus Sestertius. Riflessioni sull’evoluzione dei metri sicelioti”, *RIN CVI*, 2005, pp. 67-108.
- [11] See *exempli gratia*, more recently, F.Barello, “Archeologia della moneta”, Roma, 2006, p. 189.
- [12] P. Marchetti, “Histoire économique et monétaire de la deuxième guerre punique”, Bruxelles 1978, pp. 281-297.
- [13] Their study is a part of a larger project of analytical study and publication of 16 bronze coin hoards of the IIIrd century BC. I am very grateful to the Museum directors and Coin Cabinet conservators of the two museums (B. Basile, G. Lamagna, F. Spatafora, M. Musumeci, L. Gandolfo, R.Amato, A.M. Manenti) for their kindly permissions and cooperation.
- [14] For a general survey on minting & die-sequence of coins see, *exempli gratia*, F.De Callataÿ in D. Gerin, C.Grandjean, M.Amandry, F.De Callataÿ, “La monnaie grecque”, Paris 2001, pp.22-28.
- [15] See M.Caccamo Caltabiano, B.Carroccio, E.Oteri 1995 (see n.2), p.225; B.Carroccio, “Tesoretti, corrosione, coniazioni parallele: i “Tridenti” di Ierone II”, Proc. of 15th International Numismatic Congress, 2015, in press.
- [16] See also B.Carroccio 1994 (see n.2), p.126 and B.Carroccio 2011 (see n.8), or F.Carbone, “Le monete di Paestum tra I sec. a.C. e I sec. d.C. Analisi dei conii”, Collana di Numismatica e Scienze Affini 8, Soc. Numismatica Italiana, Milano 2015 for proofs of generalization of this organization of coin production in Ancient Greek and Italic mints.
- [17] M.H.Crawford, “Roman Republican Coinage”, Cambridge 1974, p. 361; F.Barello 2006 (see n.11), p. 128.
- [18] Initially the Syracusan mint used single control-marks of two letters as probable initials of the name of a single mint workshop officer, but in 214 B.C., during the short (13 months) reign of Hieronymus, they were substituted in some bronze issues by two separated one letter control-marks, probably related to two officers. See R.R.Holloway, “The Thirteen-Months Coinage of Hieronymos of Syracuse”, *AMUGS I*, Berlin 1969 (less accurate than for gold or silver coins), at pp. 39, 42, pl.7-8; M.Caccamo Caltabiano, B.Carroccio, E.Oteri 1995 (see n.2), p.225; B.Carroccio 2005 (see n.10), pp.93-94; B.Carroccio in press (see n.15). The radically alternative hypothesis of control-marks as numerical signs of the number of coins issued in F.De Luca, “I numeri svelati. Alla scoperta delle notazioni numeriche riportate sulle monete greche”, *Nummus et Historia XXIX*, Diana, Cassino 2015 appears - for this mint at least – radically unfounded.
- [19] On them, see R.Rizzari, “Pulire a tutti i costi? L’importanza della ‘conservazione preventiva’ dei beni numismatici”, in B.Carroccio (ed.), “Incontrarsi con le monete. Stati, culture, popoli, studiosi nel ‘lago’ mediterraneo”, in press; A.France-Lanord, “À propos de la conservation des monnaies des fouilles”, in J.-M.Dentzer et al. (éds.), “Numismatique Antique: problèmes et méthodes”. Actes du colloque Nancy 1971, Nancy-Louvain 1975, pp.147-149.
- [20] B.Carroccio 2004 (see n.1), p.146.
- [21] M.Caccamo Caltabiano, B.Carroccio, E.Oteri 1997 (see n.2), pp.49-53 for similar silver posthumous issues; B.Carroccio in press (see n.15).