Numerical notations on Ptolemy I Soter's gold staters

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Abstract: The monograms reported on the Greek coins are often interpreted as a monetary magistrates' or engravers' signature but this explanation appears insufficient in the presence of issues that carry a multiplicity of different monograms. From an analysis taken from a specific issue full of monograms, Ptolemy I Soter's gold stater issue with on the obverse the king's first portrait and on the reverse an elephant quadriga, derive different answers: the monograms appear to be numerical notations, numbers that helped to bring the count of the coins minted and of those which are in process of being minted.

Keywords: Ptolemy Coinage, Monograms on Ptolemy I Soter's gold staters, Monograms on Greek coins, Greek coin size issues.

Ptolemy I Soter's gold staters with a quadriga drawn by elephants on the reverse were the first coins on which a Hellenistic king's aspects were represented[1].The portrait on them show Ptolemy I adorned by a royal diadem and his neck wrapped by aegis, a symbol that demonstrated his particular nearness to Zeus, this will be a great success and will appear stylized on all the coins belonging to the Ptolemaic dynasty up to Cleopatra VII. On the reverse Alexander the Great is the figure driving the quadriga drawn by elephants. He was commemorated for the conquest of India. Above all, Ptolemy I, claimed to succeed him as a sovereign thus defining himself on the coin (ΠΤΟΛΕΜΑΙΟΥ ΒΑΣΙΛΕΩΣ): in fact Ptolemy I, to reinforce his demand after Alexander's death, sent a contingent to intercept Alexander the Great's funeral procession which was marching from Babylon to Macedonia, and withdraw the embalmed body and carry it to Egypt.

These staters also present the particularity that they are minted with a reduced weight of 7.12 gr. and they constitute the first step towards a Ptolemaic standard implementation which will be introduced in an organic way in 295/4 BC[2].

It is a dominant opinion that the gold staters with the elephant quadriga were simultaneously coined in Alessandria, in Cyrene and in Eusperides around the 299-294 BC[3].

Until today in the numismatic literature, a fully convincing explanation about the complex monograms reported on the coins of this issue or those reported on other Ptolemaic issues have not

[1] Ptolemy I's gold stater issue with the elephant quadriga on the reverse is entirely reconstructed in the plates II-V.

[2] LORBER C. C. (2005), p.60, and more recently LORBER C. C. (2018), pp. 37-42, supposes the date 295/4 BC for the introduction of the Ptolemaic standard.

[3] For what specifically concerns the staters attributed to Cyrene's mint, MØRKHOLM O. (1980), p.154, from the consideration that Ptolemy I's first reign year was in 305/4 BC and that Cyrenaica was in rebellion against Ptolemy I from 305 to 300 BC comes to the consequence that they could not have been minted before 300 BC and supposes they were minted in the years 300-298 BC.

yet been provided[4]. For Zervos[5] studying Ptolemy I's issues "the chronological outline (…) is based on the assumption of an annual rotation of the magistrates at Alexandria. No specific evidence has been adduced, but in the absence of indications to the contrary, and in the light of the practice at other Greek mints, it is a reasonable assumption". Starting from this supposition Zervos suggests, for example, to consider Ptolemy I's tetradrachms which show the head of Heracles on the obverse and Zeus enthroned, with a fulmen symbol and ΔI monogram on the reverse as contemporaries of some of Philip III Arrhidaeus' gold staters which also show the same fulmen symbol and ΔI monogram. The minting date for both types of coins would be 321 BC. The presence of the same fulmen-ΔI monogram on two different types of coins therefore represents for Zervos a possible "check on the chronology".

But in other cases, Zervos cannot manage to clarify the relations between the monograms reported on different issues: "this preliminary survey of the early silver of Ptolemy I leaves many problems unsolved, notably the relationship between the gold and the silver. For example, the gold with Khnum symbol, like the silver, uses monogram Δ, but the Rose on the gold appears with A, ΔI, E or EY but not with ΔIO, the combination found on the tetradrachms. How can these monograms be accommodated?" [6].

Different explanations are then offered by Zervos for the small Δ reported on the obverse behind the elephant's skin headdress ear of some tetradrachms which depict on the obverse Alexander with the elephant's skin and on the reverse Athena Promachos: this Δ would be the "signature of the artist-engraver of the dies" [7]. But Catharine C. Lorber opportunely points out that this presumed signature that Zervos had assigned to the artist C, the author of several obverses, also appears on the obverse that Zervos himself had assigned to the artist B, a circumstance which leads to reject the signature thesis and to consider "that the letter must have had a control function of some sort" [8]. This point of view has been confirmed by Lorber in her last, monumental work on the Ptolemaic empire coinage: "it is more plausible that the letter Δ and other similar cryptic marks served some internal control function. They could, for example, designate die engraving workshops within the mint, or private contractors who provided dies to the mint, or the approval of an administrator" [9]. But this explanation references a lot what was said by R.T. Williams about the frequent repeating of the Ξ monogram on the dies of the Velia's mint, in Lucania, which was interpreted as the engraver's Kleudoros signature: "The main problem with the theory that Kleudoros was the single engraver lies in the number of the dies involved, about 23 obverses and 26 reverses; a number perhaps somewhat large for one engraver, so that there is the possibility that Kleudoros was the owner of the workshop which had the mint contract, perhaps also had an official position in the mint, and cut many dies himself, but accepted dies in his style from his pupils" [10]. As seen, both in the Ptolemaic coins and in those from the small city of Velia, to explain the monograms they suggest complicated bureaucratic intertwinements, commingling between public and private subjects.

Lorber adopts Zervos' hypothesis on the magistrates' annual term and clearly leads the monograms to the magistrates' names: these abbreviations reported on Ptolemy I coins are always magistrates' signature. At first these are simple signatures, composed by a single initial, like in the Χ monogram (it is the same monogram reported, for example, on the reverse of the coin no. 34, pl.

[4] Technically most of the monograms reported on the staters with the elephant quadriga are "compendia", that means symbols produced by putting a letter within or on top of another letter (McLEAN B. H., 2002, p. 55).
[5] ZERVOS O. H. (1967), p. 8.
[6] Ibid.
[7] ZERVOS O. H. (1967), p. 6.
[8] LORBER C. C. (2005), p. 56.
[9] LORBER C. C. (2018), p. 37.
[10] WILLIAMS R. T. (1992), p. 73.

V) that would indicate for the authoress the Macedonian year 303-302 or 302-301 BC[11]. From the presence of the Χ monogram on the first Ptolemaic issue of Sidon and on the second Ptolemaic issue of Tyre, Lorber derives very important consequences because she states that "the control links argue that the Ptolemy/eagle coinage was being minted on Cyprus and in Phoenicia contemporaneously with its introduction at Alexandria" [12] and according to Lorber's opinion that means in 294-293 BC, against Davesne's[13]opinion which puts the production of Cypriot mints' in 285-283/2 BC.

For Lorber, Ptolemy I in 305 BC abandons the Attic weight system reducing the issued coins weight: for the scholar on this occasion, even the criteria on which the monograms are reported, change. In fact, "the metrological reform was accompanied by administrative changes that tend to obscure the chronology. The old pattern, in which most coins bore only one monogrammatic or letter control, fit neatly with Zervos' hypothesis of annual magistracies for the Attic-weight coinage. The reduced-weight tetradrachms, in contrast, often bear two or even three such controls" [14]. In this new phase for Lorber the Ptolemy I tetradrachms "Alexander's head wearing the elephant skin/Athena Promachos" are "the output of workshops operating apart from the central mint, yet under its close supervision, and in reasonable propinquity to one another"[15] and the collaboration between more monetary workshops gives rise to the multiplicity of monograms found on the coins, a sign of the participation of more monetary magistrates who sign with their own monogram. In this context for Lorber the monogram ΔI "was arguably the same individual"[16] that signs with ΔI Ptolemy I Soter's tetradrachms "Heracles' head/ Zeus enthroned and the fulmen symbol" and the same person who signs with Δ behind the elephant's ear the tetradrachms "Alexander's head wearing the elephant skin/Athena Promachos" (respectively it is the same ΔI monogram interpreted by Zervos as the signature of the monetary magistrate in the year 321 BC and the Δ letter interpreted by Zervos as the signature of the artist C).

Lorber's thesis (and before also that of Zervos) is based on the assumption that every coin containing a given monogram or combination of monograms belongs to a distinct issue from the others, but this is an affirmation which has to be demonstrated. Then Lorber's explanation about the different monograms reported on the same coin (up to three different monograms) which belongs to monetary magistrates from different mints does not convince. In fact, when the scholar tries to identify the location of these different mints from Alexandria and not too far away from this city, she appears to be in an obvious dilemma and proposes as possible locations Naucratis, Memphis, Pelusium or the Fayum without having any historical confirmation about operating mints located in any of these cities simultaneously with Alexandria's mint[17].

Finally, if simple monograms like ΔI and Χ identify specific years because they are the initials of some magistrates in service only in those years, how can we explain the repeating of such monograms also on the coins issued by the successors of Ptolemy I (see coins no. 1-3, pl. I)? In particular, the monogram ΔI, is very often applied not only on Ptolemy V Epiphanes coins (coin no.3, pl. I), and therefore long after Ptolemy I's death, but also on his immediate successor's coins, Ptolemy II (coin no.1 and no. 2, pl. I); in some cases the monogram ΔI is accompanied on the same coin to those which are clearly numbers as for example the figure ΛΓ =36 (coin no.1, pl. I) or even

[11] LORBER C. C. (2005), p. 57.
[12] LORBER C. C. (2012a), p. 38.
[13] DAVESNE A., LE RIDER G. (1989), p. 273.
[14] LORBER C. C. (2005), p. 57.
[15] LORBER C. C. (2005), p. 59.
[16] Ibid.
[17] LORBER C. C. (2005), pp. 59-60.

the monogram  (coin no.2, pl. I). Are they all coincidences? Do all monetary magistrates have the same name? Impossible….

In her last work Catharine Lorber still considers valid the annual issues thesis, distinguished by exclusive monograms: "The patterns of die linkage indicate that Egyptian coinage of Attic weight, from the original Alexander tetradrachms (Type I) through the Athena Promachos series (Type IIIa), was minted as a series of successive emissions, each marked with its own controls. This pattern is consistent with an annual rhythm of coin production, though the notion of annual emissions remains unproven and was ultimately rejected by Zervos, who first proposed it. There are two main arguments in its favor: (1) Greek governmental functions, including accounting, were organized on an annual basis. (2) Throughout the history of the Lagid dynasty a large part of the silver coinage was issued on an annual basis, as attested by the regnal years on Syro-Phoenician tetradrachms from 261/0 to 242/1, on the silver of the Cypriote mints from the late 190s until the closure of these mints, and on the silver of Alexandria from 155/4 until the fall of the dynasty, and also by the numerals on the era coinage struck by Ptolemies IV-VI" [18]. However Lorber clarifies that "it must be conceded, however, that the practice of placing dates on annual issues of coinage was originally a special tradition of Phoenician mints and the practice came very late to Alexandria. Supposed annual dating system attributed to the Alexandrian coinage of Ptolemy II by Svoronos did not survive the scrutiny of later scholars" [19].

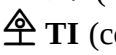
But for Lorber the annual issues thesis are applicable only in the first phase of Ptolemy I's coinage because "the Alexandrian control system changed when Ptolemy introduced his gold staters. The staters and their associated tetradrachms (…) bear diverse combinations of some twenty monograms and letters in patterns that no longer lend themselves to an annual interpretation. Intense die linkage among the staters reveals the simultaneous employment of perhaps as many as ten controls and the use of two anvils for part of the series, pointing to a heightened pace of production" [20].

As we can see, therefore, we are still far from having an overview about the monograms reported on Ptolemy I Soter's coins.

In this contribution I propose to limit the study of the monograms, just towards the gold staters with Ptolemy I Soter's portrait on the obverse and the elephant quadriga on the reverse, mentioned by Lorber in the last text. Dealing with an issue that carries very particular types, it is easier to examine the meaning of the monograms that certainly only and exclusively belong to this issue reported on the coins. In relation to this specific issue, then, the decisive difficulty that leads to definitively reject any attempts to interpret the monograms as monetary magistrates initials is caused by their certainly excessive number. In fact, 25 different monograms reported on coins belonging to this single issue are too many to be interpreted as the initials of people because they would indicate an enormous number of monetary magistrates involved in the minting of a single issue.

Besides, it must be considered which the presupposition of Lorber's thesis (borrowed by Zervos and bounded to the first phase of Ptolemy I's coinage) is that Ptolemy I's tetradrachms have been minted during different annual issues: the first identified by a single specific monogram and the last ones by a combination of multiple monograms (a different combination of monograms for each specific issue). A similar opinion is sure to be rejected with respect towards the gold staters with elephant quadriga on the reverse because the issue reconstruction proposed in plates II-V (see also the scheme of the obverse and reverse dies combinations in plate V) shows numerous die links. In

[18] LORBER C. C. (2018), p. 38.
[19] Ibid.
[20] LORBER C. C. (2018), p. 39.

some cases, in fact, a same obverse die is combined to more reverse dies bearing different monograms: the obverse die O8, for example, is first combined with a reverse die bearing monograms with  (coin no. 12, pl.III), then with a reverse die characterized by the monograms  (coins no.13 and no. 14, pl. III), again with a reverse die distinguished by the monograms  (coins no. 20, pl. III, and no. 21, pl. IV) and finally to a reverse die bearing the monogram  (coin no. 22, pl. IV). So much discontinuity excludes that the monograms can be interpreted as name initials because that meant there would have been continuous, unjustified changes of the personnel and, moreover, multiples considering that in two cases the obverse die O8 is combined with reverse dies bearing pairs of different monograms and in another case with a reverse die bearing even a triad of monograms different from each other and from the previous ones.

The numerous die links found in this golden stater issue were underlined both by Jenkins[21] and by Zervos[22]: for this last scholar the presence of many connections clearly indicates the simultaneous use of several different monograms. Taking note of Zervos' conclusions, Catharine Lorber affirms that "the control system too implies a definitive change in administrative arrangements: the tenure of annual moneyers can no longer be recognized among the two or even three controls that normally characterize the staters and their corresponding tetradrachms" [23]. Besides, with reference about Zervos' observation, according to which the consistency stylistic of the dies of Ptolemy I gold staters with elephant quadriga is significative for a limited production period, Lorber claims that "the evidence points to an episode of intense mint activity, necessary in order to provide an adequate supply of the new gold staters" [24]. But ultimately Lorber, while recognizing that Ptolemy I's gold stater issue was produced in a limited period using at the same time several different monograms, does not provide any interpretation about the possible meaning of these initials[25].

[21] JENKINS J. K. (1960), p. 35.
[22] ZERVOS O. H. (1974), pp. 229-231.
[23] LORBER C. C. (2018), pp. 270-271.
[24] LORBER C. C. (2018), p. 271.
[25] In fact, the complex explanation about the gold staters minting process does not lead to any practical proposal on the meaning of the monograms reported on the these staters: "The very different patterns of production for the gold staters and their associated tetradrachms become comprehensible if we assume that the reintroduction of gold coinage was planned in advance. The first step in the plan was the temporary suspension of the minting of gold staters, imposed at the time of the reduction of the tetradrachm c.306. This implies an alteration in the cycle of government revenues and payments: for several years, the part of the revenues in gold from taxes, port duties, and foreign exchange that would have been sent to the mint for coining was instead sequestered in the treasury. Probably a calculation was made of the volume of gold coinage that would ultimately be required to meet state payments and to support the needs of visiting merchants. The latter calculation could have been based on information collected at the points of entry into Egypt. When the government had accumulated the necessary bullion in the treasury, dies were prepared and the indented volume of gold coinage was minted with all due speed and released rapidly into the economy. The process can explain why the introduction of Ptolemy's gold staters, around 299, is not obviously correlated with any historic occasion or special fiscal need, despite the ideological significance of their types" (LORBER C. C. 2018, p.39). Lorber, in synthesis, hypothesizes a connection between the gold bars collected by the authorities and the dies made to mint the gold staters with the elephant quadriga but she does not clarify what the monograms reported on these staters indicate. If they then wanted to establish a connection between the "controls" probably reported on the gold bars and those reported on the gold staters, the memory would immediately go to a rather doubtful thesis according to which in some cases the symbol on the coins reproduces the same symbol engraved on the bars from which they are obtained. The thesis was stated by SELTMAN E. J. (1913) about Thourioi's coinage and later extended by C. Seltman (in MAY J. M. F., SELTMAN C., 1956), son of the first scholar, to Corinth's coinage. The element that inspires E. J. Seltman was the find in Tarentum of a silver bar on which it had been engraved the die of a Selinus' coin, but it is completely obvious that the find in Tarentum of a silver bar bearing the impress of a Selinus' die and not of a symbol, does not allow to constitute hypotheses about the symbols' meaning nor in the Thourioi's mint, nor either in those of Tarentum or Corinth, neither in any other mint.

What function then could these monograms have? To understand something more let us pause to reflect on the effect produced by the incision of these mysterious initials on the reverse dies intended to coin the golden staters with Ptolemy I's portrait on the obverse and the elephant quadriga on the reverse.

Since a certain monogram was negatively engraved on one or more reverse dies it results that it was minted on all the coins obtained from those reverse dies which ended up to be characterized by that monogram. They were clearly distinguished from other coin groups bearing different monograms. The fact of having available subsets of coins, easily distinguishable from other subsets, allowed the mint officials to manage better the issue because the counting of the coins little by little minted became easier: instead of promoting a single counting (for example from 1 to 500,000, the coins that took part of an issue), many partial countings were made with the monograms that distinguished the various groups of coins from which sum obtained the total number of coins within the issue. It should not be forgotten that without the monograms' apposition, the coins in the issue would have all been completely identical and totally indistinguishable from one another. Every counting error would have required the need to re-count again all the coins until then minted.

The solution of dividing into groups identified by specific monograms, on the other hand, meant that if there was confusion counting the coins that were being minted and which had a certain monogram, it was sufficient to recount only the coins bearing that specific monogram and not all the groups of coins minted before and marked by different monograms. This method is the same that we unconsciously follow nowadays when we have to count money: for example, if we have to count 10,000 euro we make ten piles of 1,000 euro because, if we make a mistake counting, we do not have to recount all 10,000 but only the single pile thousand euro in whose count we have fallen into error; also after counting a pile we can stop and restart without forgetting the whole amount already counted. In the coin's case, then, it might be confusing not only the counting of different subgroups from the same issue but even different issues minted in close manner.

It is not foolish then to suppose that the different groups of coins characterized by different monograms were kept in distinct containers separated from each other (where a partial total was noted), once the reverse dies with which they had been minted were broken: the possibility of counting separately different subsets of well-defined coins through distinct monograms, rather than the whole issue (which without the monograms' apposition would have seemed only as a shapeless mass of hundreds of thousands of coins absolutely identical to one another) was also useful when the mint handed over the fully coined issue for the authorities' final control.

What is better than numbers to distinguish groups of objects of the same nature? This, in fact seems to be the nature of the monograms reported on the reverse of Ptolemy I Soter's gold staters: not monograms composed by letters, but figures composed by numbers, notoriously expressed in Greek with the same alphabetical letters. More precisely, the monograms on Ptolemy I's golden staters seem to belong to two different categories of numbers. A portion of them are figures that are part of a numerical progression, which means increasing figures indicating the number of staters in the minting progress at the time of the reverse die realization which bears that given monogram. The remaining part of monograms indicate in different plurality ways the final cut, which means the total amount of coins being minted, expressed in drachms. The thesis, therefore, is that the monograms on Ptolemy's staters are in part numbers that indicate the quantity of staters in the minting progress and in part figures expressed in drachms that indicate the number of coins to be minted (in this case we refer to drachms because the drachm was still the basic monetary unit, even if it is an issue of staters, that is to say coins worth two drachms gold each). These figures were always arranged in a different way, even if they sometimes indicated the same amount of money as other monograms and were variously arranged with other figures on the same coin, just to characterize a certain group of coins, in order to make it distinguishable from the others. If the

nature of the numbers of these monograms was confirmed, it could clarify the principle in which they follow each other what is, at least for a part of them, the numerical progression and not the mere case as it currently appears.

In fact, quickly reviewing the monograms reported on Ptolemy Soter's gold staters two of them immediately catch the attention. First is the fact that the first monogram on the left on the reverse of the coin no.7, pl. II (see even the monogram's detail of the coin no. 7, pl. VI), means the monogram , is formed by an interlacement between a P and a *sampi* (), the sign used to indicate the number 900. The number is so well defined and clear that it cannot be confused with a Greek letter. It cannot be a T because this letter was without two dashes placed on the sides of the upper horizontal line. It certainty appears to be rejected, then, the interpretation made by Svoronos[26] of the monogram as , which corresponds to a Π in which inside is reported a P. Such interpretation has to be rejected because in the monogram the loop of the P is placed not at the end of the vertical central rod but in the middle and this indicates that this rod belongs to a different sign from the P. Another difficulty in Svoronos' interpretation is the fact that the central rod ends well below the two vertical lines of the supposed Π and there is no logical explanation for this. If indeed the long central rod had belonged only to P it could had well finished at the Π lateral rod's height and not gone much further down as it happens. In this case there would have been no need of the space above the loop of the P (just to give you an idea the monogram should have been and not). The unreliability of Svoronos' interpretation about this monogram (in place of in which main element is a *sampi*) is finally demonstrated by the fact that the monogram immediately following on the reverse of the same coin no.7 in pl. II (see also the detail of the monogram of coin n. 7 in pl. VI) is from the scholar[27] interpreted as , intending the central element of the monogram constituted by a Δ when it is quite obvious that it is an A, as evidenced by the absence of the lower horizontal line typical of the Δ.

Since the most conspicuous element of the monogram appears to be reasonably a *sampi*, that means a number and not a letter, it is necessary to think that even the other element of the monogram (P) is also a number (it is known that in Greek the numbers were expressed with the same letters of the alphabet).

Another revealing element is constituted by the apex placed on the second monogram's right, reported on the reverse of the coin no.31, pl. IV (see the detail of the monogram of the coin no. 31 in pl. VII). Notoriously the apex reported on the letter's right was a diacritical mark[28] that helped the text reader to understand that letter was not used as a letter, but as a number for which it is legitimate to suppose that the monogram in question followed by an apex was actually composed by numbers and not by letters. The apex is well defined and clear, and does not at all seem to be a defect or a successive breakage of the reverse die, but it appears deliberately engraved at the time of the reverse die preparation.

If, then, the two monograms just mentioned are composed by numbers, it is legitimate to assume that all the other monograms reported on Ptolemy I's golden staters were composed by numbers, exactly how the dates reported on Ptolemy I's successors coins[29] are composed by numbers. If these dates were not preceded by the L symbol that is in place of ἔτους no one would have ever noticed that these were numbers and not letters.

[26] SVORONOS J. (1904-1908), p. 24, no. 147

[27] SVORONOS J. (1904-1908), p. 24, n. 147. Catharine Lorber, instead, interprets the monogram as in which A correctly appears in the Δ place but also a P appears that in reality is not represented (LORBER C. C. 2005, p. 50).

[28] On the diacritical marks see TOD M. N. (1979), pp.136-137.

[29] Ptolemy I's successors followed an era that began with the Queen Arsinoe's death, which took place in 271-270 BC.

But before moving on to dissolve in numbers the various monograms reported on Ptolemy I Soter's gold staters in order to verify if it holds their "numerical" interpretation, let us refresh our memory on the numerical systems used by the Greek to express the numbers[30].

The oldest Greek numeral system was called "Attic" or even "Acrophonic" (from *akron*, "the end", "the beginning", and from *phōnē*, "entry") because they used as numerical symbols the initial letters of the words that indicated the main numbers: thereby the number 10 was indicated with Δ, the initial letter from the word *deka*, ten; the number 1.000 with X, the initial letter from the word *chilia*, thousand, and so on. The basic signs were I= 1, Π = 5, Δ= 10, H = 100, X= 1,000, M = 10,000. Other signs were obtained with the addition or multiplication by merging two basic signs. For example, the number 50 was indicated with ⏋ (5 times 10 = 5 x 10), etc.

The most recent numeral system was called "Ionic" or even "Alphabetic" (see the following layout) which used 27 alphabet letters: nine for the numbers lower than 10, nine for the multiples of 10 lower than 100 and nine for the multiplies of 100 lower than 1,000. Because the classic Greek alphabet was only composed by 24 letters, three archaic letters were also used, falling into disuse: *digamma* (in the form Ϝ or in the most common form ⊏) which indicated number 6, *koppa* (Ϙ) used to represent number 90 and *sampi* (ϡ) for the number 900. This circumstance suggests that the origins of the Ionic numeral system dates back at least to the fifth century BC, when these letters were still in use.

Usually (but not always) the letters that indicated the numbers were followed by an apex and this often happened when small letters were used (ex. α′=1).When instead the letters-numbers were preceded by a subscript they became multiplies of a thousand (ex. ,α = 1,000).The complete set of signs that showed the various numbers within the Ionic or Alphabetical numbering system was the following:

A, α′,	1.	I, ι′,	10.	P, ρ′,	100.
B, β′,	2.	K, κ′,	20.	Σ, σ′,	200.
Γ, γ′,	3.	Λ, λ′,	30.	T, τ′,	300.
Δ, δ′,	4.	M, μ′,	40.	Y, υ′,	400.
E, ε′,	5.	N, ν′,	50.	Φ, φ′,	500.
ϛ′,	6.	Ξ, ξ′,	60.	X, χ′,	600.
Z, ζ′,	7.	O, ο′,	70.	Ψ, ψ′,	700.
H, η′,	8.	Π, π′,	80.	Ω, ω′,	800.
Θ, ϑ′,	9.	Ϟ, ϟ′,	90.	Ͳ, ϡ′,	900.

The sources witness in some limited cases the contextual use of numbers expressed according to different numeral systems. For example, in two epigraphs from the second-first century BC numbers taken from the Ionic numbering system were found used within the same figure next to numbers taken from an Archaic numbering system[31]and figures taken from the Acrophonic numbering system used next to figures taken from the Alphabetical numbering system[32]. Other evidence of the contemporary use of figures taken from the Attic and the Ionic numerical system were evidenced by the papyrus-rolls written in Greek found at Herculaneum: very often on the papyrus-rolls that reproduce literary works or Philosophy treatise, on the title page, after the author's name, the number of books is expressed according to the Ionic numeral system, and the

[30] On the Greek numeral system see HEATH T. (1981), pp. 30-35; GUARDUCCI M. (2005), pp. 85-87.
[31] ROESCH P. (1966), pp.77-82.
[32] CALVET M., ROESCH P. (1966), pp. 297-332.

number of lines according to the Attic numeral system, just as we commonly use Roman figures to denote *Books* and Arabic figures for *sections* or *lines*[33].

Besides the numerical symbols of the Attic system and the number-letters of the Ionic system there were also some symbols that indicated certain quantities of money which, although derived from minor numerical systems, these symbols in the Greek world had a great diffusion as for example the ⊙ notation, often simplified in O, which in Argos' numerical system designated the quantity of 10 drachms. The symbol O = 10 drachms original from Argos is found, for example, on an inscription from 170-150 BC, a statement by a Theban cavalry commander named Pompidas[34]: within an amount expressed with numbers taken from the Acrophonic or Attic numeral system, the number 50 is expressed with the symbol 𐅅, composed by a Π that frames O, the Argos' simplified symbol of the10 drachms. The fact that the two numbers are overlapped indicate that they must be multiplied by each other giving a 50 result. But the text publishers preferred to "eliminate these particularisms" about the cavalry commander Pompidas' inscription and replaced the 𐅅 symbol with the corresponding and more known symbol 𐅁 from the Attic numeral system (that is also present in Pompidas' inscription but denotes the number 500) in order "to facilitate the text reading"[35].

Another Greek particularity consists of the fact that the figures were expressed in tens (*dekades*), hundreds (*hekatontades*), thousands (*chiliades*), tens of thousands (*myriades*) and hundreds of thousands (*dekakismyriades*). For example, Lucian (*Scytha* 10) to nominate "the ten Attic orators" says "*ē Attikēdekas,* which means "the Attic ten"; Plato (*Phaedrus*257) to indicate the 9,000 year figure uses the expression "*ennea chiliades etōn*", that means "nine thousand years"; Herodotus (*Histories* 3,91) speaks about "*myrias medìmnōn*, "a myriad of medimnoi of wheat" to indicate "ten thousands medimnoi of wheat"; in the Book of Danielthe Prophet has a vision of God in which "thousands upon thousands (*chiliai chiliades*) were attending Him, and myriads upon myriads (*myriai myriades*) were standing before Him" (Dn. 7,10); Plutarch (*Marius* 34) uses the expression "*myriadōn epta ēmisous priasthai*", "buy for seven and a half myriads (of drachms)".

In addition to the formation of the figures of the Attic or Acrophonic numeral system, the multiplication criterion was sometimes used even in written texts and in the current language to indicate some quantities using cardinal numerical adjectives, collective numerical adjectives or multiplicative adverbs (not using numerical symbols). The figure that it was intended to indicate, was not directly indicated but it was obtained by a multiplication between the indicated quantities of two or more cardinal numerical adjectives, between a cardinal numeral adjective and a collective numerical adjective (ex. "tens", " thirties", etc.) or between a cardinal and a multiplicative adverb. Demosthenes (*On the crown*, 237), for example, expressed the number of 15,000 foreigners with the expression "*myrioi men kai pentakischilioi xenoi*", "ten thousand and five times a thousand foreigners". Aeschylus **(***Persians*, 323) denotes the quantity of 250 ships through the expression "*pentēkonta pentakis neōn*", "five times fifty ships", while the quantity of 300 ships is indicated with "*triakades deka neōn*", "ten thirties of ships" (*Persians*, 339). As you can see, to know what the amount in which the first case refers to, you have to multiply 5 x 50 to have a total of 250 and in the second case you need to multiply 10 x 30 to get the amount of 300.

The last two figures assembled by Aeschylus seem to be expressed with numerical symbols rather than with cardinal numerical adjectives and they particularly lend themselves well to be expressed with monograms (obviously composed by numbers and not by letters): in fact, the

[33] See HEATH T. (1981), p. 35.
[34] GRANDJEAN C. (1995), pp. 1-26.
[35] "Les éditeurs du texte, de W. Dittenberger à J.R. Melville Jones, ont pris le parti de gommer ces particularismes afin de faciliter la lecture du texte" (GRANDJEAN C. 1995, p. 3). About the Argos' sign ⊙, see TOD M. N. (1979), p. 5.

quantity "*pentēkonta pentakis*", "five times fifty", can be expressed with the monogram Π Γ if the Attic numeral system is used or with the monogram EN if the Ionic numeral system is used; while the quantity "*triakades deka*", "ten thirties", can be indicated with the monogram ΙΛ, using figures taken from the Ionic numeral system. All three hypothetical monograms just proposed by the writer are based on the multiplicative principle: inside them we find the numbers that have to be multiplied by each other to obtain the final number designated.

The multiplicative principle, as well as in written texts, was often used right in the numerical notations reported on the Greek coins, in which two or more numbers were put together with the intention of referring to their product, that would have been a figure too long to be written on the coin's small space: in this way, therefore, multiplying two or more numbers by each other gave a much higher and "longer" number.

But let us go on analyzing the monograms reported on the gold stater issue with elephant quardiga[36] entirety reconstructed in plates II-V (see also the details of all of the monograms in plates VI-VII).

On the reverse of the coin no.1, pl. II, inside the first numerical notation  we can clearly distinguish an A and a X. The figure A does not indicate the number A′=1 but the number ,A=1,000 while the number X is not the number 600 from the Ionic system but the number 1,000 from the Attic system for which the monogram  is nothing more than 1,000 from the Ionic system (,A simply written as A to simplify the engraver's work) for the 1,000 number from the Attic system (X) with a full result of 1,000,000. To lead us towards the interpretation about symbol X as 1,000 from the Attic system and not as 600 from the Ionic system is the circumstance, that not only on the second monogram reported on the reverse of the same coin no.1, pl. II, but also on further monograms reported on other coins belonging to the same issue, as we see later on, give place to the figure 1,000,000. Evidently the use within the same figure  of a number taken from the Ionic numbering system and a number taken from the Attic numbering system and, therefore, the irregular use of numerical systems, is the price to pay for obtaining a short and concise numerical notation that with only two figures intertwined between each other, expressed a high number such as a million. In this stater issue, such a high number can only indicate the size, expressed in drachms. If, therefore, the issue as a whole has an one million drachms size, being a gold staters issue (coins with a two gold drachms value) the staters minted in it will be 500,000.

As already anticipated, even the second monogram reported on the reverse of the coin no.1, pl. II, indicates a one million drachms figure. In this monogram, in fact, the number 100 from the Attic system (H) is found rotated 90 degrees to the left, it multiplies with Argos' original 10 drachms symbol (O), positioned at the top of the inverted figure H: the 1,000 result is expressed in thousands (*chiliades*) and therefore stands for 1,000(,000) drachms. Even on the monogram reported on the reverse of the coin no. 30, pl. IV, a figure is found rotated 90 degrees to the left (I=10 Attic)[37], as in the present case, and also on the two monograms reported on the reverse of the coin no.31, pl. IV, an Argive symbol of the 10 drachms (O) is observed, situated at the top of the monograms and

[36] LORBER C. C. (2005), p. 60, believes that between 298/7 and 295/4 BC all of the gold staters with an Attic weight circulating in Egypt were converted into staters with elephant quadriga and, together with all the other circulating coins, they were in turn withdrawn starting from 294 and then replaced by the new golden and silver Ptolemaic coinage in reduced weight compared to the Attic's standard (for Lorber the process would have took at least two years). Therefore, the staters listed in plates II-V, seem to have been saved from their withdrawal and their consequent fusion.

[37] Also on the coins I-II, pl. I, there is a monogram in which inside it there is a figure rotated 90 degrees to the left, sign that turning over the numbers within the monograms was quite common among the Greek. A number "in balance" (exactly a 100 Attic = H) is observed also in the monogram on the reverse of the coin I, pl. VIII.

reported in a simple semicircle form, exactly as we see in the monogram . This last monogram is often used on the coins minted by the Macedonian kings Philip V and Perseus to indicate the 1,000,000 drachms figure, as shown in the coins I-II, pl. I, minted by Perseus in which on the reverse is reported, as well as the notation, some alternative numerical notations which express in a different way always the same quantity of 1,000,000 drachms: more numerical notations are then reported, differently assembled but always indicating the same number, in order to eliminate any doubts about the issue's size and in order to form coin groups that are easily distinguishable from others thanks to the different monogram combinations reported on them. For other scholars was composed by = Z and Ω and was the mint director's monogram, ΖΩΙΛΟΣ, in service before Philip V and his son Perseus[38], but if things were really like this, how can we interpret the other monograms reported on the same coins? Are they always mint officials? How can we explain the monogram's recurrence not only on Perseus' and his father Philip V's coins, but also on those from their ancestor Demetrios Poliorketes (coin I, pl. II),who lived over a century before them? Zoilos had remained in service for more than a century or was he a progenitor of a mint officials dynasty that handed down the same name and the same working place from father to son? Finally, to definitively refute the thesis that it was an official's monogram is the recurrence of the same monogram on a coin from a mint far from the Macedonian mint and under another sovereign authority, this a clear proof that it is not a monogram from a person but something different.

While on the reverse of the coin no.2, pl. II, we find the same numerical notations just examined ( ) with the only difference that they are inverted[39], on the coin no. 3, pl. II, we find new and elaborated numerical notations. The first notation is given by the intertwining of three figures: within a simplified Argive 10 drachms (O) symbol, the number 10 from the Attic system (Δ) is inserted and both lean on the number 300 from the Ionic system (T). The consecutive multiplication between these three numbers give place to the 30,000 result. The second initials show on the reverse side of the coin no.3, pl. II, the monogram that appears composed by A, by Γ and by N: as already anticipated, the reading made by Svoronos[40], about this monogram as must be rejected because in the lower horizontal line from the presumed Δ and the loop of the P on the monogram's right is completely missing. The monogram corresponds to 3 (Γ) from the Ionic numeral system x 50 (N) x 1,000 from the Ionic system (A=,A=1,000)= 150,000. The two monograms reported on the reverse of the coin no. 3, pl. II, then, indicate that the coins belong to the tranche issue between 30,000 and 150,000 staters (equal, respectively, to 60,000 and 300,000 drachms).

On the successive coins from no.4 to no.7, pl. II, the numerical notations change again. As we have previously seen, the first monogram on the left is the figure composed by a *sampi* ( ) it denotes the number 900, reported in ligature with a P that corresponds to the number 100 from the Ionic numbering system. The fact that the two numbers are overlapped indicate that they must be multiplied together giving the 90,000 result, exactly how it was necessary to do with the two numbers that are in the compounded figures from the Attic numbering system (for example, the number is composed by the figure Δ = 10 surmounted by the figure Π = 5 they multiply by each other giving the result of 50). Indeed the multiplication between (900) and P (100) appears to be the only possible operation between two numbers belonging to the same decimal order of the

[38] So consider MAMROTH A. (1930), pp. 277-290, and BOEHRINGER C. (1972), pp.102-104.
[39] JENKINS G. K. (1960), p. 35, Group g, lists one stater obtained by our obverse die O2 from which the stater no.2, tab. II and a further reverse die bearing in exergue the monograms and : if the second monogram is dissolved as just indicated in the text (X=1.000 Attic that multiplies with A=1,000 Ionic), the monogram must be intended as A = ,A = 1,000(,000) drachms(about this variation there are not any imagines of the present study).
[40] SVORONOS J. (1904-1908), p. 24, n.147.

hundreds (if, for example, after the first number 900, expressed in hundreds, there would have been, instead of the number 100, the number 10, expressed in tens, we could think of two numbers to be read in sequence with a 910 result). It cannot be a sum (900+100=1,000) because in this case it would have been more logical and cheaper to report directly the number 1,000.

It is then reasonable to assume that the monogram  is composed by the number = 900 and by the number P=100 that multiply by each other and give a 90,000 result, a figure that could have been made by Aeschylus in one of his texts as “hundred times nine hundred” or as “nine hundred hundreds”. Shooting forward from the 30.000 number with the  numerical notation to the 90.000 number with the  notation is then a confirmation that we are in a numerical progression presence.

The second initial shown on the reverse of the coins from no.4 to no.7, is the  monogram that we know is equal to 150,000, while the third  monogram is the same one we find on the first two reversedies of the issue and it is represented by a product of 1,000 of the Ionic system (,A=A), for 1,000 of the Attic system (X) which gives the result of 1,000,000 drachms and it indicates the size of the issue in drachms.

The meaning for the tern of monograms, seems to be this: the coin belongs to the tranche issue between the 90,000 () and the 150,000 staters () within an issue from a million drachms edition () corresponding to 500,000 staters (since the value of one staters is 2 drachms, 1,000,000 drachms : 2 = 500,000 staters).

As seen, the information about the minted coins has passed from 30,000 staters (equal to 60,000 drachms) marked on the coin no.3, pl. II, to 90,000 staters (equal to 180,000 golden drachms) indicated on the coins no.4 to no.7, pl. II. Another clear proof that the monograms reported on Ptolemy’s staters are actually numbers of a numerical progression is confirmed by the fact that on the coin no. 8, pl. II, the figure  = 90,000 is not reported anymore, but only the number = 150,000: this evidently indicates that at the time of the reverse die realization from which this coin was obtained, the 90,000 staters threshold was already reached and they aimed to the following step which was = 150,000 staters.

On the coin no.8, pl. II, the second monogram  , instead, is composed by P (which can only be the number 100 of the Ionic system) inscribed within a Π that can be the number 80 of the Ionic system or the number 5 of the Attic system. While the option for the number 80 of the Ionic system does not give place to any relevant figure (Π +P = 180 or Π x P = 8,000), the interpretation of Π as number 5 of the Attic system gives place to the multiplication of 5 (Π) x 100 (P) which result is 500 that reminds the final cut of the issue that as seen is 500,000 staters, equal to one million drachms. In the specific case the thousands are not reported but they are implied so that the resulting number should be read as 500(,000) staters. Even in this case we are in the presence of a forcing, an irregular use of the numerical systems imposed by the limited space available on the coin: just to obtain a synthetic and concise numerical notation, suitable to be inserted in the limited space available in the exergue, the numbers were sometimes expressed in a slightly different way from the classical one, that means implying to the figure different decimal orders. The forced interpretation found until now (the use within the same figure of numbers taken from different numeral systems and the implying different decimal orders to a certain figure) did not cause perplexity because we must remember that it was not necessary that the numerical notations were immediately understood by everyone because they were not destined for a consumer’s use but only to facilitate the mint officials work. As already mentioned, in fact, the monograms’ function was mainly to make recognizable different groups of coins (which otherwise would fall into one indistinguishable mass) allowing them to easily separate for counting them. The mint officials, knowing what was the issue’s size in process of coining, were able to dissolve the monograms and understand what was

the decimal order possibly implied to a certain figure, and based on which numeral system interprets the numbers that composed a given monogram.

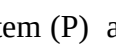
With the R8 and R9 reverses from which the coins no. 9 and 10, pl. III were obtained, coins are continuously minted to reach the 𐅵 = 150,000 staters threshold; the 𐅄 notation keeps on reminding us that the issue's limit is 1 million drachms and therefore 500,000 staters. The issue's limit is instead indicated in an alternative way on the R10 reverse (coin no. 11 and 12, pl. III): the 𐅃 monogram, in fact, is dissolved in 100 from the Attic system (H) x 10 from the same system (Δ) with a result of 1,000, a number that implies the thousands (*chiliades*) and that we can write reporting the implied large quantities using brackets and therefore like this: 1,000(,000) drachms, equal to 500,000 staters. On the R10 reverse the specific quantity of staters in process the of being minted at the moment of its realization, continues to be always expressed with the same numerical notation 𐅵= 150,000 staters.

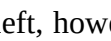
On the R11 reverse (coin no.13 and 14, pl.III) we find again the notation 𐅵=150,000 staters, a quantitative threshold that is confirmed by the new 𐅆 notation in which the number 500 of the Ionic system (Φ) multiplies with the number 30 from the same system (Λ) the result is 150,00(0) staters. The central figure TI, instead, is dissolved by the 300 of the Ionic system (T) x 10 from the same system (I) the result is 300,0(00) staters: while on the R4, R5 and R6 reverses the range was 90,000-150,000 staters, now the numerical notations reported on the R11 reverse, inform us that at the moment of the realization of this last reverse die was being minted the range, that went from 150,000 to 300,000 staters.

The issue's coining goes on, in fact, on the R12 reverse (coin no.15, pl.III) the 𐅵 = 150,000 numerical notation does not appear anymore, it is an evident sign of achievement and exceeding of this quantitative limit, but then other three new figures just appear, all three of them indicate the 200,000 staters quantity, the new target of the mint. In fact, the most noticeable numerical notation on the reverse of the coin no.15 is the monogram 𐅇, reported on the right in exergue, it is dissolved by the number 400 of the Ionic system (Y) x number 5 of the Attic system (Π) the result is, expressed in hundreds, of 200,0(00) staters. The interpretation of Π as 5 from the Attic system rather than 80 from the Ionic system is preferable because the alternatives 400(Y) + 80 (Π Ionic)= 480 or 400 (Y) x 80 (Π) = 32,000 give place to figures that do not harmoniously fit in the context we are analyzing.

The central notation 𐅁 in exergue on the reverse of the coin no. 15, pl. III, is instead a retrograde number 20 from the Ionic system which evidently stands for 20(0,000) staters, numerical threshold further reaffirmed also by the last figure Σ (the first on the left) that is made up by number 200 of the Ionic system and which in turn is to be understood as indicating the quantity of 200(,000) staters.

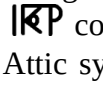
The "odometer" goes on again and on the coins no.16 and 17, pl. III, the monogram 𐅈 informs us that at the moment of the realization of the R13 reverse which reports it was in progress of minting the 250,000 staters quantity because this numerical notation is made up of two number 5 of the Attic system (Π) which multiply between each other and the resulting number 25 is multiplied again by Argos' 10 drachms (O) simplified symbol, located on the right, and by the number 10 of the Ionic system (I) immediately positioned on the left, before the interweaving of numbers: the 2,500 result is expressed in an understood way in hundreds and stands for 250,0(00) staters (see monogram's detail on plate VI). The other numerical notation on the left is 𐅀 that corresponds to the number 20 from the Ionic system (K) it multiplies with number 100 from the

same system (P) and gives the 200,0(00) staters result[41]. Both the  and  notation, indicate the new range of 200,000-250,000 staters in the minting progress at the moment of the realization of the R13 reverse die (shared between the O10 and O11 obverse dies).

On the reverse of the coin no. 18, pl. III, the notation on the right is KE that corresponds to the number 25 of the Ionic system and should be read as 25(0.000) staters: this is the concrete number of staters that the mint wanted to coin when this reverse die was created. The numerical notation  on the left, however, is much more complex: it consists of the number 10 of the Ionic system (I) that multiplies with the monogram  in which within the number 5 of the Attic system (Π) we find the number 20 of the Ionic system (K) in ligature with the simplified symbol for Argos' 10 drachms (O), reported inside the corner formed by the K two lateral lines; on the right of Π we find instead the number 100 of the Ionic system (P): consecutively multiplying the five numbers just listed we get the 1,000,000 drachms figure which is the issue's quantitative limit, indicated in an alternative way compared to the most synthetic monogram  of the coin no.1 and 2, pl. II, and of the coins from no. 4 to n. 7, pl. II.

The reverse dies R15 and R16 are made to help reach the 280,000-300,000 staters threshold from which are obtained the coins no.19 and 20, pl.III. In fact, the notation  that looks like one of our traffic signs corresponds to the number 4 of the Ionic system (Δ) by the simplified Argive symbol of 10 drachms (O) that multiplies again by the number 7 of the Ionic system () giving the final result of 280(.000) staters. In the TI notation immediately on the right, the number 300 of the Ionic system (T) multiplies with the number 10 from the same system (I) giving the 3,000 hundreds of staters result, equal to 300,0(00) staters.

The reverse dies R18 and R19 also help reach the 300,000 staters threshold, from which are obtained the coins from no. 22 to no. 24, pl. IV, here we find the notation  formed by the Ionic system (Γ) that multiplies the number 1,000 (A=,A) from the same system, the result is 3,000 hundreds (*hekatontades*) of staters, that means 300,0(00) staters, that is the mint's work updated target. The coin no.23, pl. IV, was minted using the obverse die O7 that appears more worn out (see the relief in front of Ptolemy's mouth) compared to his penultimate use, when it was combined to the reverse die R10 bearing the  monogram (coinno.11, pl. III). The progressive consumption to which the obverse dies are liable combined to different reverse dies bearing different monograms, it is one of the guiding criterion to dissolve the concealed numerical sequence in the monograms: if, for example, the obverse die O7 appears more worn out when it combines to the reverse die R18 bearing the monogram  (coin no. 23, pl. IV), it will then mean that this last one will be a biggest number of the monogram  which is found on the reverse die R10 (coin no.11, pl. III) combined with a newer obverse die O7.

The one million drachms quantity is indicated again in a different way on the coins from no.25 to no.29, pl. IV, that means with the monogram  composed by the number 10 of the Ionic system (I) that multiplies with the number 5 of the Attic system (Π) inside which the number 20 of the Ionic system (K) is inscribed and, inside the corner formed by the K two lateral lines, the simplified symbol for Argos' original 10 drachms (O). The number 100 of the Ionic system (P) written in ligature on the P's right side completes everything: consecutively multiplying between each other all these numbers, the 1,000,000 drachms figure is obtained (see the detail of the monogram in plate VII).

[41] LORBER C. C. (2018), p. 309, n. 272, refers, without attaching imagine, to another reverse die that in place of carries the monogram in which, besides K= 20 Ionic and P =100 Ionic, we find an Argive symbol for 10 drachms (O) inside the K's corner formed by two lateral lines; these three numbers, consecutively multiplied between them, give place to the 200,00(0) staters figure.

On the coin no.30, pl. IV, we find the compendium constituted by the number 10 of the Ionic system (I) that multiplies with a composed number. Inside the 5 of the Attic system (Π) we find the number 20 of the Ionic system (K) that multiplies with the Argive's 10 drachms symbol and the number 10 of the Ionic system (I) rotated 90 degrees to the left, both reported inside the K's corner formed by the its two lateral lines: consecutively multiplied between each other these five numbers give place to the 100,000 tens of drachms, equal to 1,000,00(0) drachms. It is once again referred to the issue's quantitative limit in drachms (see the detail of the monogram in plate VII).

These staters obtained by the reverse dies bearing the and numerical notation that exceeds the 300,000 pieces threshold are placed in the issue's tranche (towards which the coins obtained from the reverse dies from R18 to R19 were tending) and they aim the 400,000 minted staters finishing line, as it appears witnessed by the numerical notation reported to the left in exergue on the reverse of the coin no.31, pl. IV. This notation, in fact, is dissolved by the number 40 of the Ionic system (M) x 10 from the same numeral system (the number I reported below the number M) x Argos' 10 drachms symbol (symbol reported above the M): the result was 4,000 that evidently stands for 4,000 hundreds of staters, equal to 400,0(00) staters.

On the other hand, the numerical notation, in exergue to the right on the reverse of the coin no.31, pl. IV, indicates in another different way the size of the issue (see the detail of the monogram on plate VII): in this figure genially synthesized, in fact, we recognize the number 40 of the Ionic system (M) and the number 50 from the same system (N) embedded inside the number 5 of the Attic system (Π), while above the Π we find Argos' 10 drachms symbol ( ). The result of consecutive multiplications between all of these numbers is 100,000 tens of drachms, equal to 1,000,00(0) drachms. As already seen above, the apex found on the right of this complex figure clarifies that it is a compendium of numbers and not letters.

The following R25 reverse die always matches the O17 obverse die (coin no.32, pl. IV) and bears, as well as the notation = 400,00(0) staters, even the new notation that is nothing more than the number 5 of the Ionic system (E) for the number 100 from the same numeral system (P) with a 500 thousand of staters result, equal to 500(,000) staters (see the detail of the monogram in plate VII). It informs that the mint is about to exceed the 400,000 minted staters and is now heading towards the 500,000.

The O17 obverse die continues to carry out its honored service even after it has been reached and exceeded the 400,000 staters threshold. In fact, on the coin no. 33, pl.V, we do not find the notation = 400,00(0) staters anymore, but only the figure = 500(,000) staters; the notation on the left, instead, is another masterpiece of clearness and concision because using only two simple numbers to multiply between themselves (A=,A Ionic = 1.000 and P Ionic = 100) they obtain the 100,000 tens of drachms figure, equal to 1,000,00(0) drachms that is always the final size of the issue.

To mint the following staters the R27 and R28 reverse dies are produced (coins from no.34 to no.36, pl. V) that carry only the notation= 1,000,000 drachms, already found on the issue's first coins.

Concluding the coin series, the two reverse dies R29 and R30 (coins no. 37 and no. 38, pl. V) which did not carry monograms in exergue but a symbol that was described by Svoronos like a silphium plant, a circumstance that causes some scholars to consider the staters bearing this symbol in exergue belonging to an issue minted in Cyrene, different from the issue of similar staters bearing

monograms in exergue, minted at Alexandria[42]. For other scholars the depicted symbol was not a silphium plant but an apple branch and they believe it was an Euesperides mint sign, where these staters would have been minted within a different issue from the previous one, minted in Alexandria (among the scholars who adhere to this opinion is Catharine Lorber[43]). It is preferable instead to believe that both types of staters were coined in Alexandria and that they took part of a single issue because the stylistic characteristics are practically identical for all of the golden staters with elephant quadriga. In particular, you can notice, the strong similarity between the O21 obverse die, combined with the two reverse dies bearing the plant element (silphium or apple branch), and the O16 obverse die that leads us to think that both were made by the same engraver. It does not seem plausible that in Cyrene or in Euesperides an issue was minted from such a small consistency, obtained from only one obverse die and from two reverse dies.

The element that finally makes definitive propensity for the unique issue is the fact that also in other mints on the last reverse dies of some issues bearing monograms we find symbols (or even symbols). This is done in order to point out that the numerical progression marked on various monograms had reached its end and that therefore the issue had reached its end.

So, for example, on some drachms minted in Akragas in 212-211 BC during the Carthaginian occupation, the imminent completion of the issue, which meant that the minting of all the coins falling within the monetary series, was marked on the reverse die with which the last coins were minted (coin no.4, pl. VIII) with the wheat ear symbol incision that was added to the monograms (that in reality were numerical notations) systematically reported on all the previous reverse dies (coins no.1-3, pl. VIII) [44].

Furthermore, in a stater issue coined in Aspendos (Pamphylia) in 330-250 BC and distinguished by the horse protome symbol, the reverse dies from which the coins from the first part of the issue were obtained, are distinguished by monograms (coin I and II, pl. VIII), while the reverse dies with which the coins from the second part of the issue were minted, are no longer distinguished by monograms but by additional symbols that are added to the main horse protome symbol which identifies the whole issue (coin III and IV, pl. VIII); in total the additional symbols are seven and all seven identify sub-groups.

Even in the case of Ptolemy I's gold staters, therefore, the plant element (silphium or apple branch) could have been inserted in exergue on the reverse of the last coins of the issue just to mark the numerical progression conclusion that dissolves on different monograms. If it really is a silphium plant and not an apple branch, then, the choice to represent this plant could have been proposed, as well as to point out the issue's imminent completion, just for the purpose of celebrating Cyrene's return under Ptolemy I's dominion at the end of the revolt in 305-300 BC (rather than to point out the fact that the coins were minted in that city) or simply because the silphium was something typical in the Egypt's Kingdom like the wheat was for Akragas.

But there are also other coins that are attributed to Cyrene's mint. For some scholars, in fact, the staters no.16 and no.17, pl. III (bearing the monogram ), the stater no.18, pl. III (bearing the monogram ) and the staters from no.25 to no.29, pl.IV (all characterized by the monogram )[45],were not minted in Alexandria but in Cyrene, because a monogram similar to those reported by the mentioned staters, was also found on Alexandrine tetradrachms (coin n.3, pl. IX) that are attributed to Cyrene's mint and on some Magas didrachms (the group of didrachms bearing the

[42] So he believes, for example, MØRKHOLM O. (1980), p. 154.
[43] LORBER C. C. (2018), pp. 309-310.
[44] This drachm issue of Akragas is reconstructed in DE LUCA F. (2018).
[45] The staters from no.25 to no. 28, pl. IV, of our reconstruction, bearing the same monogram of the stater no. 29, pl. IV, are not cataloged by LORBER C. C. (2018).

snake symbol: see the coins no.1 and 2, pl. IX). Among the scholars who believe that the staters just mentioned have been minted in Cyrene, we also find Mørkholm whose position about succession and paternity of these different issues was summarized by Fischer-Bossert in this way: "Mørkholm suggested that the Alexander tetradrachms were issued by Cyrenian rebels while the 'Magas' didrachms were produced by Ptolemaic authorities after the revolt was crushed, and the same flexible magistrate was responsible for both of them" [46]. So, there would have been one single, "flexible magistrate" (that for Robinson 1927, p.72, 1-2, was called Hippocrates[47]) that would have affixed his own monogram first on the Alexandrine tetradrachms minted by the rebels against Ptolemy, then on the didrachms "of Magas" minted by Ptolemy I's stepson and then on Ptolemaic golden staters with elephant quadriga: if things really went this way, this magistrate was a real survival champion and a political transformism!

Even Catharine Lorber[48] believes that the gold staters with elephant quardiga bearing the monograms  , and were minted in Cyrene in 299-294 BC. To support such opinion she adduces the fact that identical monograms are reported on some bronze coins with Ptolemy I's portrait minted in Cyrene, among which there is the coin no.4, pl. IX, it is an hemiobol: for Lorber the monograms reported on this bronze coin are KE and and they would be the same Cyrene minters' signatures found on some gold staters with elephant quadriga. But with a closer inspection the second monogram reported on this bronze coin is similar but not the same as the monogram reported on some golden staters with elephant quadriga because actually it is (see the monogram's detail in pl. IX) that can be dissolved with the following 10 Ionic (I) x 5 Attic (Π) x 8 Ionic (H inserted inside of the Π) x 100 Ionic (P brought in ligature on the right of the Π) = 40,000 that obviously will be the edition in drachms of this issue of hemiobols. To reach the 40,000 drachms edition it would have been necessary to mint 480,000 hemiobols. In fact, the 40,000 programmed drachms number must be multiplied by 6 (the number of obols present in each drachms) and then by 2 (the number of hemiobols present in each obol): the result will be, exactly, 480,000 hemiobols, that means a number certainly congruous for a territory densely populated like Cyrenaica.

If, we want to be precise, even the monogram reported on the Alexandrine tetradrachms minted in Cyrene and on the didrachms "of Magas" is similar but not the same as the three *different* monograms reported on Ptolemy's golden staters. On Ptolemy's staters we have the monograms , and , on the Alexandrine tetradrachms and on the didrachms "of Magas" instead we have the monogram (that on the coin no. 2, pl. IX, it is also retrograde). Even if all the monograms just mentioned would have been absolutely identical there would remain the problem of explaining the sense of the other monograms that in some cases are placed besides them: the monogram on the gold stater no. 17, pl. III,is accompanied to the monogram and the monogram KE that on the gold stater no. 18, pl. III, is accompanied to the monogram .

It seems more likely that the monograms and (reported on Ptolemy I's gold staters) and the monogram (reported on Alexandrine tetradrachms minted in Cyrene and on didrachms "of Magas"), more than a signature from one or two people, were instead numerical notations that indicated the issue's quantitative limit set by pure coincidence for all three issues (the Alexandrine tetradrachms minted in Cyrene, Magas' didrachms and the golden staters with elephant quadriga) in 500,000: more precisely in 500,000 drachms for Alexandrine tetradrachms and Magas didrachms and in 500,000 staters for the gold staters with elephant quadriga[49].

[46] FISCHER-BOSSERT W. (2016), p. 58.
[47] In the analysis of the monograms reported on the coins, the numismatics scholars have always been misguided by the habitual conviction that these initials indicated the monetary magistrates' name and they were always tempted by the desire to identify some.
[48] LORBER C. C. (2018), p. 309.
[49] Instead, the monogram , as seen previously, indicates 250,000 staters and not 500,000 staters.

To make us suspect that even the monogram reported on the Alexandrine tetradrachms and on the "Magas" didrachms was a numerical notation, is its strong resemblance with the monogram ΠΟ, which was often used on the Aspendos coins, in Pamphylia (coin A, pl. IX). Oğuz Tekin, observing how the notation ΠΟ is used on many staters' issues minted in Aspendos over a century (throughout the fourth century BC until the beginning of the third) states that "if the letters ΠΟ indicate the name(s) of magistrate(s), it is difficult to conceive how such a person would have remained in office for so long"[50]. Tekin adds: "even if we regard this change on the reverse as a reform carried out in a short period of time, it would be indeed quite difficult to explain the ΠΟ on the bronze emissions which were clearly in circulation at a much later date than this series [of staters]"[51]. But even in this case every interpretative difficulty vanishes if the monogram ΠΟ is correctly considered for what it really is (that means a number indicating an issue quantitative which was a limit quite common among the Greek mints) and not a person's name, like it is clearly indicated in coin II, pl. IX, in which the numerical notation ΠΟ, formed in the compendium , follows on some bronze coins within a numerical sequence (coins I and II, pl. IX) where it is present a figure which is certainly a number and not a letter, that means number 6 of the Ionic numbering system (Ϝ) [52].

Furthermore, we must consider that the presence of signs that can only be numbers and nothing else (like Ϟ) within the monograms reported on the gold staters with elephant quadriga and the fact that such monograms, as we have seen, lend themselves to be dissolved as numbers in sequence or as numbers that always remain the same amount of 500,000 drachms, it reassures us about the nature of compendiums of numbers and not of letters of all these monograms, including those which are usually brought back to the Cyrene's mint.

Beyond the inconsistency of the main argument in support of the thesis that the monograms , and carried on Ptolemy's golden staters indicate the name of one or more monetary magistrates in service in Cyrene's mint, deposes in the sense of belonging to a single issue fully minted in Alexandria even the substantial stylistic coherence of all the staters with elephant quadriga, including those bearing monograms traced back to the Cyrene minters' names. It is true, in fact, that the obverse dies O10, combined to a reverse die bearing the numerical notation (coin no.16, pl.III), and the obverse die O11, combined to a reverse die bearing the notations and (coin no.17, pl. III, and no. 25-28, pl. IV), they deviate from the other obverse dies' style: Ptolemy's robust jaw seems to be created from one single engraver's distinctive feature and from it all of the coins were made. It is also true that the obverse die O15 (coin no. 29, pl. IV), even if it combines to the reverse die with the notation , it looks a lot like other obverse assigned to the Alexandria's mint, like the O17 or even more the O8. Finally, even in this case it seems unlikely that an issue with very similar standards to another was made elsewhere, but only with the use of 4

[50] TEKIN O. (2000), p. 166.
[51] Ibid.
[52] The reconstruction of the full staters' issue minted in Aspendos puts in evidence that the numerical notation ΠΟ very often indicates the issue's 5 million drachms limit, equal to 2,500,000 staters. The notation ΠΟ reported on Aspendos' staters, in fact, is dissolved by the number 5 of the Attic system (Π) x Argos' original 10 drachms symbol (O): the result of 50 drachms is expressed in hundreds of thousands and stands for 5,0(00,000) drachms. Also the bronze coins' issue edition became preventively established and noted on the coins: evidently not in ΠΟ = 5,0(00,000) drachms like in the staters' case because it would have been translated in an excessive number of coins, but in = ΠΟ = 50(,000) drachms. In the obol's issue case an edition from ΠΟ = 50(,000) drachms indicate a 50,000 issue (the issue's limit expressed in drachms) x 6 (number of obols present in each drachms) = 300,000 obols. This size type seems to belong to the two coins I and II, pl. IX of the issue: on the reverse of the coin I, pl. IX, the half issue notation is reported by the multiplication between the number 6 of the Ionic system (Ϝ) with number 4 from the same numeral system (Δ): the result is 24 thousands (*myriades*) of drachms, equal to 24(,000) drachms in bronze coins; on the reverse of the coin II, pl. IX, belonging to the same issue as the previous coin, the issue's final limit is indicated by the multiplication between the number 1,000 of the Ionic system (A=,A) x the number 50 ( ) with a full result of 50,000 drachms in bronze coins.

obverse dies and 5 reverse dies (more possibly the obverse die O21 and the two reverse dies R29 and R30 with the silphium plant or apple branch).

If, in this case, all of Ptolemy I's golden staters reported on the plates II-V belonging to a single issue and the interpretation of the monogram's number reported on them just proposed is correct, it is possible to grasp a harmonious numerical sequence composed by deliberately different figures in order to distinguish better the coins groups which carried them. The coins groups so clearly characterized by different monograms could have been easily counted by the mint officials during the coining phase, because a separated count of the minted pieces was made within each group of coins distinguished by a certain monogram and not a single count of the pieces coined within the whole issue, a very difficult counting if you think that the monetary production was carried on not only by one but by many anvils.

Thanks to the numerical notations reported on the coins, then, the monetary magistrates could comfortably check that the whole raw precious metal quantity received at the beginning of their commission was always transformed into money: the more the raw gold quantity which had to be minted diminished the more the "counter" of the numerical notations arose. Besides, to distinguish the coins of the issue in separated batches, accurately counted and verified, certainly facilitated the monetary magistrates in reporting their work to Ptolemy I's senior officials. The monetary magistrates, in fact, would have handed over at the end of their commission the entire issue divided into homogeneous groups of coins characterized by the same numerical notation, perhaps collected in separated containers identified according to the different notations. Indeed, at the end of their mandate, the monetary magistrates will have handed over to the king's top officials the entire issue divided by homogeneous groups of coins characterized by the same numerical notation, perhaps collected in separate containers identified on the basis of different notations as hypothesized in the following fantasy figure.

In this way it was sufficient to add up the number of pieces that were in each batch bearing a distinct numerical notation (number probably noted on a mint register) to obtain the programmed total of coins belonging to the issue. Showing the completed issue so neatly divided in batches, perhaps it was not even necessary to recount again all the 500,000 golden staters in front of Ptolemy I's official, who were in charge of the final inspection. It was enough to check the amount's accuracy on the mint's register, by counting the coins held in a single container and therefore only the coins marked by a specific notation.

In turn, then, to the same Ptolemy I it was enough to verify the correspondence between the numerical notations reported on the coins and the reports presented by the high officials to verify the reliability and truthfulness of such reports, knowing that the figures indicated on the coins corresponded to quantity of coins actually minted because they were listed in sequence on the various reverse dies with which the issues were made. By controlling the numerical notations reported on all monetary issues coined in a year, the sovereign was thus able to quickly realize the

amount of money produced in his kingdom in that year so as to be able to compare this figure (together with the revenues deriving from taxes and duties) with the annual sums necessary to cover the expenses of the army and the bureaucratic apparatus and, ultimately, in order to have control of the State budget.

The numerical notations reported on the coins, therefore, were numerical codes that indicated certain subgroups of coins within the overall group constituted by the issue, completely comparable to the numerical codes that are found on the current banknotes. Today as then these numerical codes identify certain amounts of money and make it possible to carry out a series of checks between different organs of the State, indispensable for its proper functioning[53].

The affixing of the various numerical notations on Ptolemy I's gold staters must have happened in this way. First they started to mint coins using the first reverse dies bearing the two numerical notations  and  (coins no.1-2, pl. II). When these reverse dies were broken and had to be replaced, all the minted coins with the numerical notations were counted and set aside in appropriated containers and probably the number was written down on a special register. Subsequently, they passed on minting coins using reverse dies on which was engraved the issue's second numerical notation combination, constituted by  (coin no.3, pl. II). When even these dies were damaged, the coins obtained from them were counted and were stored in other distinct containers which contained the coins bearing the issue's first numerical notations combination ( ) after having noted the total on the mint register. Consequently, they went on using reverse dies bearing the numerical notations   (coin no.4-7, pl.II) and afterwards reverse dies bearing the numerical notations   (coin no.8, pl. II) and so on. Adding up the number of staters in each batch, they knew exactly how many coins had been minted up to that moment and how many more had to be coined to reach the programmed total of pieces of the issue. Let us take an example of how the recordings on the mint register related to the minting of the gold staters of Ptolemy I could appear in the initial part of the issue:

Reverse dies with the notations : 33,090 staters +
Reverse dies with the notations : 22,280 staters +
Reverse dies with the notations : 66,402staters +
Reverse dies with the notations : 24,010staters =
TOTAL 145,782 staters

The reconstruction proposed in plates II-V of Ptolemy I Soter's gold staters issue has therefore identified 21 obverse dies and 30 reverse dies. In both cases these numbers are absolutely compatible with the advanced hypothesis that the issue had the size of 500,000 pieces. In fact, if we divide the 500,000 staters quantity by the number of the identified dies, we realize that all of the 21 obverse dies produced an average of 23,809 pieces (500,000 : 21 =23,809) while all of the 32 reverse dies[54] produced in average 15,625 coins (500,000 : 32 = 15.625).

The reconstruction of Ptolemy I's gold staters issue in plates II-V witnesses a certain intense exploitation of the obverse dies that makes acceptable the hypothesis that each obverse die had produced on average 23,809 coins. The obverse die O4, for example, appears to have microfractures which disfigures Ptolemy I's eye yield and especially his mouth (coin no.5, pl. II). The obverse die O21, then, shows a conspicuous fracture on the sovereign's full face, on his cheek, and again on his temple (coin no.37 and no.38, pl. V).

[53] Or more simply, the numerical notations on Greek coins can be compared to the figures that nowadays are directly pinned on the first banknote of a bundle of banknotes, at the end of its counting, in order not to forget how much the sum of money contained therein.
[54] In fact, to the 30 reverse dies proposed in the reconstruction of plates II-V we need to add the reverse die mentioned in note no.40 and the one mentioned in note no. 42 of which images in the present study are not provided.

The plausibility of the average yield just indicated above appears confirmed also by the studies conducted on Delphi's Amphictyonic coinage in 330 BC of which we received a statistically satisfactory sample of coins that allows us to calculate the original number of pieces minted, especially since Delphi's inscription (among the very few non-numismatic documentary sources to us available) informs us about the weight of the metal used for the issue (between 100 and 157,5 talents): for Raven[55] every obverse die used by Delphi's Amphictyonic league produced between 10,000 and 30,000 silver staters, while thirty years later Kinns[56] estimated that to mint Amphictyonic staters required 7/9 obverse dies with an average yield between 23,333 and 47,250 staters for each of them.

The conclusions reached by Kinns and the data we have available for the Middle Ages then led de Callataÿ to conclude that the average yield was 20,000 coins for each obverse die[57] and this is now the figure used by the majority of Greek coin specialists[58].

Precisely in order to understand what could have been the average dies yield, in 2007-2008 Faucher, Téreygeol, Brousseau and Arles[59] rebuilt a real Greek mint and they coined 12,281 coins very similar to the Athenian tetradrachms with Attic weight (17.20 g) reaching the conclusion that the obverse dies could have had an average yield between 10,000 and 15,000 pieces minted, numbers which have to be taken very carefully into consideration since they were about experimental dates. It is the result of a single simulation within which an important number of coins but certainly not unlimited were minted and that, in any case, were bigger than Ptolemy I's golden staters. In this case, the same authors warn saying "un coin de droit, la seule référence disponible pour tenter de quantifier l'ampleur d'une émission monétaire antique, pouvait connaître une productivité différente selon la taille des flans, l'expérience de l'équipe et le métal utilisé" [60]: a yield of 23,809 small golden coins for every obverse die used by Ptolemy I's minting officials appears then certainly assumable.

The monogram's interpretation as numbers on Ptolemy I Soter's staters certainly will have generated the readers' perplexity, the largest concerns the same number nature of the monograms. Everyone, in fact, might be asking: "Who assures us that they are really numbers and not letters?".

Another doubt concerns the contemporary use within the same numerical notation of figures from the Attic numeral system next to figures from the Ionic numeral system or even next to numerical symbols deriving from minor numeral systems. How is such a wide appeal to these contaminations between different numeral systems possible which, apart from some examples, does

[55] RAVEN E. J. P. (1950), pp. 1-22.
[56] KINNS P. (1983), pp. 1-22.
[57] For example, de Callataÿ speaks about a 20,000 coins average yield for the obverse dies used to mint the Hellenistic *stephanophoroi* tetradrachms of Magnesia on the Meander (DE CALLATAŸ F., 2012, p. 46). Instead, regarding the reverse dies de Callataÿ estimates an average yield of 1,500 pieces for the reverse dies used to mint the Athenian New Style tetradrachms (DE CALLATAŸ F., 2012, p. 45). The much higher yield of reverse dies of Ptolemy I's gold staters with elephant quadriga compared to the yield supposed by de Callataÿ for the reverse dies used to mint the Athenian New Style tetradrachms (15,625 against 1,500) is explained thinking about the different sizes of the coins in question. In fact, Ptolemy I's gold staters are small coins with just a 17-18 mm diameter, while those from Athens are large tetradrachms with almost a double diameter (30-31 mm): it is evident that the larger dimensions of the reverse dies of the tetradrachms (housed inside a punch on which the hammer hit the beat to strike the coin) exposed it to much more intense stresses than those suffered by a reverse dies of a stater, mostly in gold (the most malleable metal that exists) that inevitably caused its more rapid wear and consequent breakage.
[58] The numismatics, then, to calculate the probable number of dies used in the mint to coin a given issue are increasingly used the simplified method of G. F. Carter that indicates three equations with a lower and higher oscillation band, starting from the number of specimens examined and the number of known dies. The three equations correspond to the numerical ratio of the two values. An additional equation serves to define the oscillation band.
[59] FAUCHER T., TÉREYGEOL F., BROUSSEAU L., ARLES A. (2009), pp. 43-90.
[60] FAUCHER T., TÉREYGEOL F., BROUSSEAU L., ARLES A. (2009), pp. 77-78.

not find confirmation in the other sources? Is it possible that they made such an irregular use of the numeral systems?

Unexpectedly all these doubts are dispelled by the Roman Republican coinage. It is known that in some Roman Republican issues, the reverse dies have as "control-marks" [61] numbers in a strictly consecutive increasing order. Such as, for example, the reverse dies with which were minted the denarius issue of 79 BC edited by the minter C. Naevius Balbus reported, in the upper center field, the numerals from I to CCXXX[62]. Because of wide clearness of the Roman numbering system no one puts in discussion that they were actually numbers (a part of the numerical sequence reported on the reverse of this coin issue that is proposed in pl. X, coins A-E). Every numeral is reported on only one reverse die and this circumstance suggests that the reverse dies were consecutively numbered as they were made probably in order to report on a special register the number of coins obtained by each of them[63].

Even the reverse dies in the issue edited in 75 BC by the monetary magistrate L. Farsuleius Mensor (coins no.1-5, pl. X)[64] are numbered in a strictly consecutive manner (the numerals are reported below the biga horses' hooves): the progressive numbering continues without particular problems until it reaches the number LXXIX after that, instead of passing on to LXXX, as usual, it passes to XXC that is an irregular number. In fact, in the Latin numeral system the number on the left of a higher number is subtracted from it. The norm, therefore, is that only one number is subtracted and not two (IX = 9 and not IIX = 8, XC = 90 and not XXC = 80, CM = 900 and not CCM = 800). In rare cases in the inscriptions of the Republican age there are figures in which to the left of a number are placed two lower numbers to be subtracted from the first (as, for example, XXC[65]). In these cases, therefore, there is a greater recourse to the principle of subtraction but, as Georges Ifrah points out, "use of this principle (which undoubtedly reflects the influence of the popular system on the monumental system) *was nevertheless unusual on well-styled inscriptions*"[66]. Most probably the reason why on the money of Farsuleius, in the context of a "well-styled" numbering on the official coin issued by the State, XXC and not LXXX are used, thus making an irregular use of the Roman numeral system[67], is to "save" a figure. The total number, in fact, is composed by three figures (XXC) and not four (LXXX), as it should have correctly been, and this allows the engraver to easily arrange the number into the coin's narrow space as intended. On the coin no. 2, pl. X, therefore, we see that the number 81 is reported on the reverse in a concise manner with XXCI instead of LXXXI. On the coin no. 3, pl. X, number 89 is interpreted with the figure composed by five numbers XXCIX, instead of the correct figure composed by six numbers LXXXIX: it is true that forcing does not justify a great saving but one less number is always one less number…

[61] CRAWFORD M. H. (1974), p. 374, for example, defines "control marks" the numerals reported on denarii representing Venus' bust on the obverse and Venus driving galloping biga on the reverse issued by the monetary triumvirate composed by L. Censorinus, C. Limetanus and P. Crepusius in 82 BC.
[62] CRAWFORD M. H. (1974), p. 397.
[63] Another part of the issue edited by the monetary magistrate C. Naevius Balbus in 79 BC reports as control-marks some letters in sequence on the obverse and no numerals or symbols on the reverse; the same letter occurs on several obverse dies, unlike the numerals which instead occur on a single reverse die in the issue portion mentioned in the text: see CRAWFORD M. H. (1974), pp.397-398.
[64] CRAWFORD M. H. (1974), pp. 406-407.
[65] For example, we find the number XXCIIII = 84 on a milestone (*CIL*, I, 638) found in the ancient Forum Popilii (Lucania) and commissioned by Popilius Laenas, consul in 172 BC. and in 158 BC, currently preserved in the Museum of Roman Civilization in Rome.
[66] IFRAH G. (1998), p.198.
[67] The Roman numeration system is essentially an additive numbering system, that is a system in which each symbol is associated with a value and the number represented is given by the sum of the symbol values: in this context an excessive recourse to the subtraction principle configures a case of irregular use of the numbering system comparable to the simultaneous use of two different numeral systems that is found on Greek coins.

This occurrence also clarifies our ideas on the commingling between figures of different numeral systems, observed in the monograms reported on Ptolemy I's gold staters: figures from different numeral systems are used (and therefore an irregular use of the Greek numbering systems is made) for the precise purpose of obtaining compact and concise numbers, that even occupying small spaces indicate huge quantities, exactly how it happens on the Farsuleius denarii on which, a figure is expressed in an irregular way just to not carry a number. There were no problems if this operation was a clearness disadvantage, because the figures carried on the coins were destined to the mint officials that knew very well both the quantities of coins in the coining course and therefore the figures reported on the coins, and also the simplification introduced to indicate those figures. Besides, it must be kept in mind that the numerical symbols from the Acrophonic system were nothing else than the initial letters of the words indicating the numbers used by the mint officials during a mental calculation created to put together the notations themselves, so their use within figures expressed according to the Alphabetical numbering system probably was not at all a reason for confusion to those who read those numerical notations.

The same goes for the wide use of the multiplicative principle: on Ptolemy's staters, numbers which multiply with each other are constantly reported in order to obtain concentrated and functional compendiums able to indicate large numbers with few signs.

Even the Roman Republican coins provide us a further proof *ad abundantiam* on the fact that the monograms on some Greek coins are actually numbers. On the denarius issue edited in 78 BC by the monetary magistrate M.Volteius[68] (coins from I to XII, pl. XI), in fact, the reverse dies are numbered in a strictly consecutive order[69] however not with Latin numbers but with Greek numbers! The numbering proceeds from A to ΠΕ and to each reverse bearing a different number, an obverse bearing a different symbol is combined to it[70]: even in this case so much precision has an aim to identify and to register in an unequivocal manner the quantities of coins obtained from each combination of a given obverse die (distinguished by a specific symbol) and a determined different reverse die (characterized by a different progressive number). The Greek numbers reported on M. Volteius denarii, although do not indicate the quantities of coins minted but the different reverse dies used in sequence to mint coins (however relevant to the accounting of coins gradually minted), represent an important confirmation that the monograms on the Greek coins were numbers and as such they were understood, not only from the same Greek but also from the Romans. In this issue, the Romans seem to pay homage to the techniques introduced by the Greeks for the differentiation and the counting of the different quantities of coins minted within the same issue.

I conclude, remembering that the difficulty of distinguishing figures composed by numbers and monograms composed by Greek letters, do not only characterize we modern people but also concerned the same ancient Greeks *if they were not aware of the standard by which to interpret the monograms*, like this nice epigram from Alcaeus of Mitylene (*Anthologia Palatina*, VII, 429) reminds us:

> I ask myself why this road-side stone has only two Φ chiselled on it.
> Was the name of the woman who is buried here Chilias?
> The number *chilia* [=1,000] which is the sum of two letters [Φ =500; Φ x 2= 1,000]
> points to this.
> Or am I astray in this guess
> and was the name of her who dwells in this mournful tomb Phidis [= Φ δίς = twice Φ]?

[68] On this issue see CRAWFORD M. H. (1974), pp. 399-402.
[69] The numbers are reported on the reverse in the upper center field.
[70] For the complete Greek symbols and numbers list reported on the denarius minted by M. Volteius see CRAWFORD M. H. (1974), pp. 401-402. In our plate XI only some denarii are shown (with their Greek numbers and symbols) included in the issue.

Now am I the Oedipus who has solved the sphinx's riddle.
He deserves praise, the man who made this puzzle out of two letters,
a light to the intelligent and darkness to the unintelligent.

PLATE I

1

2

3

I

On the right and above the eagle:  =  =  = **HO** = Attic 100 (**H**) x Argive 10 (**O**) = 1,000(,000) drachms;
between the legs of the eagle:  =  =  = Attic 10,000 (**M**) x Attic 100 (**H**) = 1,000,000 drachms.

II

On the right of the eagle:  =  =  = Attic 10,000 (**M**) x Attic 100 (**H**) = 1,000,000 drachms;
on the right of the eagle: =  =  = Attic 100 (**H**) x Attic 100 (**H**) x Argive 10 (**O**) = 1,000,00(0) drachms.

PLATE II

I

1) O1-R1

2) O2-R2

3) O3-R3

4) O4-R4

5) O4-R5

6) O2-R5

7) O5-R6

8) O5-R7

PLATE III


9) O6-R8


10) O7-R9


11) O7-R10


12) O8- R10


13) O8-R11


14) O8-R11


15) O9-R12


16) O10-R13


17) O11-R13


18) O12-R14


19) O13-R15


20) O8-R16

PLATE IV


21) O8-R17


22) O8-R18


23) O7-R18


24) O14-R19


25) O11-R20


26) O11-R20


27) O11-R21


28) O11-R22


29) O15-R22


30) O16-R23

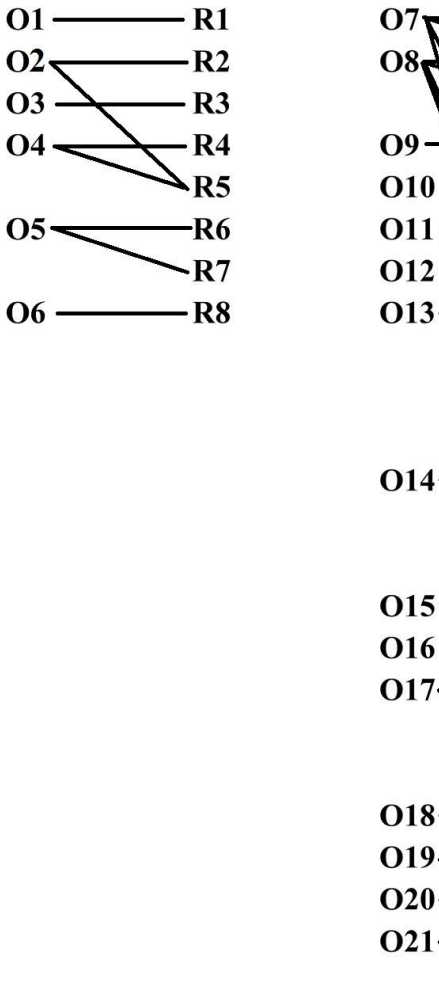

31) O17-R24


32) O17-R25


33) O17-R26

PLATE V

34) O18-R27 35) O19 -R27 36) O20-R28 37) O21-R29 38) O21-R30



Scheme of the pairings between obverse and reverse dies of the gold stater issue of Ptolemy I Soter with elephant quadriga on reverse.

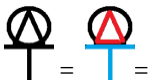
PLATE VI - INTERPRETATION OF THE MONOGRAMS CARRIED ON THE GOLD STATERS OF PTOLEMY I SOTER WITH ELEPHANT QUADRIGA ON REVERSE (PLATES II-V)

-Coin no.1:

 = 1)  = Ionic 1,000 (**,A=A**) x Attic 1,000 (**X**) = 1,000,000 drachms;

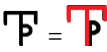
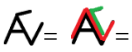
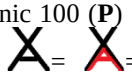
2)  = **H O** = Attic 100 (H) x Argive 10 (O) = 1,000(,000) drachms.

-Coin no.3:

 = 1)  = Ionic 300 (**T**) x Attic 10 (**Δ**) x Argive 10 (**O**) = 30,000 staters;

2)  = Ionic 1,000 (**,A=A**) x Ionic 50 (**N**) x Ionic 3 (**Γ**) = 150,000 staters.

-Coin no.7:

 = 1)  = Ionic 900 (**Ϟ**) x Ionic 100 (**P**) = 90,000 staters; 2)  = Ionic 1,000 (**,A=A**) x Ionic 50 (**N**) x Ionic 3 (**Γ**) = 150,000 staters; 3)  = Ionic 1,000 (**,A=A**) x Attic 1,000 (**X**) = 1,000,000 drachms.

-Coin no.8:

 = 1)  = Ionic 1,000 (**,A=A**) x Ionic 50 (**N**) x Ionic 3 (**Γ**) = 150,000 staters;

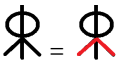
2)  = Attic 5 (**Π**) x Ionic 100 (**P**) = 500(,000) staters.

-Coin no.12:

 = 1)  = Attic 100 (**H**) x Attic 10 (**Δ**) = 1,000(,000) drachms;

2)  = Ionic 1,000 ((**,A=A**) x Ionic 50 (**N**) x Ionic 3 (**Γ**) = 150,000 staters.

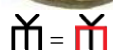
-Coin no.14:

 = 1)  = Ionic 500 (**Φ**) x Ionic 30 (**Λ**) = 150,00(0) staters; 2) **TI** = Ionic 300 (**T**) x Ionic 10 (**I**) = 300,0(00) staters;

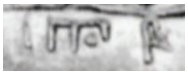
3)  = Ionic 1,000 (**,A=A**) x Ionic 50 (**N**) x Ionic 3 (**Γ**) = 150,000 staters.

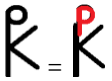
-Coin no.15:

 = 1) **Σ** = Ionic 200 = 200(,000) staters; 2)  = **K**= Ionic 20 =20(0,000) staters;

3)  = Attic 5 (**Π**) x Ionic 400 (**Y**) = 200,0(00) staters.

-Coin no.17:

 =1)  =  = Ionic 10 (**I**) x Attic 5 (**Π**) x Attic 5 (**Π**) x Argive 10 (**O**) = 250,0(00) staters;

2)  = Ionic 20 (**K**) x Ionic 100 (**P**) = 200,0(00) staters.

-Coin no. 18:

 = 1)  =  = Ionic 10 (**I**) x Attic 5 (**Π**) x Ionic 20 (**K**) x Argive 10 (**O**) x Ionic 100 (**P**) = 1,000,000 drachms; 2) **KE** = Ionic 25 = 25(0,000) staters.

PLATE VII - INTERPRETATION OF THE MONOGRAMS CARRIED ON THE GOLD STATERS OF PTOLEMY I SOTER WITH ELEPHANT QUADRIGA ON REVERSE (PLATES II-V)

-Coin no.19:

 = 1)  = Ionic 4 (**Δ**) x Argive 10 (**O**) x Ionic 7 ( ) = 280(,000) staters;
2) **TI**= Ionic 300 (**T**) x Ionic 10 (**I**) = 300,0(00) staters.

-Coin no.22:

 =  = Ionic 3 (**Γ**) x Ionic 1.000 (**,A=A**) = 300,0(00) staters.

-Coin no.24:

 =  = Ionic 3(**Γ**) x Ionic 1,000 (**,A=A**) = 300,0(00) staters.

-Coin no.25:

 =  = Attic 10 (**I**) x Attic 5 (**Π**) x Ionic 20 (**K**) x Argive 10 (**O**) x Ionic 100 (P) = 1,000,000 drachms.

-Coin no.28:

 =  = Ionic 10 (**I**) x Attic 5 (**Π**) x Ionic 20 (**K**) x Argive 10 (**O**) x Ionic 100 (P) = 1,000,000 drachms.

-Coin no.30:

 =  = Attic 10 (**I**) x Attic 5 (**Π**) x Ionic 20 (**K**) x Argive 10 (**O**) x Attic 10 (**I**) = 1,000,00(0) drachms.

-Coin no.31:

 = 1)  = Ionic 40 (**M**) x Ionic 10 (**I**) x Argive 10 ( )= 400,0(00) staters;
2)  = Attic 5 (**Π**) x Ionic 40 (**M**) x Ionic 50 (**N**) x Argive 10 ( ) = 1,000,00(0) drachms.

-Coin no.32:

 = 1)  = Ionic 40 (**M**) x Ionic 10 (**I**) x Argive 10 ( )= 400,0(00) staters;
2)  = Ionic 5 (**E**) x Ionic 100 (**P**) = 500(,000) staters.

-Coin no.33:

 = 1)  = Ionic 1,000 (**,A= A**) x Ionic 100 (**P**) = 1,000,00(0) drachms;
2)  = Ionic 5 (**E**) x Ionic 100 (**P**) = 500(,000) staters.

-Coin no.34:

 =  = Ionic 1,000 (**,A= A**) x Attic 1,000 (**X**) = 1,000,000 drachms.

PLATE VIII

PLATE IX

1

2

3

4

A

I

II

PLATE X


A (CCX)
B (CCXI)
C (CCXII)
D (CCXIII)
E (CCXIIII)
1 (LXXII)
2 (XXCI)
3 (XXCIX)
4 (XCII)
5 (CIX)

PLATE XI

LIST OF COINS

Plate I -
No. 1: iNumis, Mail Bid Sale 8, lot 93, 20/03/2009, 14.26 g, 25.00 mm;
no. 2: Gorny & Mosch Giessener Münzhandlung, Auction 220, lot 1457, 11/03/2014, 14.03 g, 24.00 mm;
no. 3: CNG, Triton IX, lot 1081, 10/01/2006, 13.81 g, 23.90 mm.
Coin I: Coin Cabinet Bibliothèque royale de Belgique, Bruxelles, Naster 1127, 17.27 g, 30.00 mm;
Coin II: Harlan J. Berk Ltd, Buy or Bid Sale 178, lot 58, 15/03/2012, 17.51 g, 31.20 mm.

Plates II-V -
Coin I: NAC AG, Auction 39, lot 28, 16/05/2007, 17.26 g, 29.00 mm.
No. 1: Lorber 2018, Alexandria, no. 102, weight and diameter n.a.;
no. 2: Lorber 2018, Alexandria, no. 101, weight and diameter n.a.;
no. 3: Lorber 2018, Alexandria, no. 97, weight and diameter n.a.;
no. 4: Gemini 6, lot 370, 10/01/2010, 7.10 g, 18.00 mm;
no. 5: CNG, Mail Bid Sale 84, lot 751, 5/05/2010, 7.08 g, 17.00 mm;
no. 6: Hess Divo AG, Auction 320, lot 266, 26/10/2011, 7.11 g, 17.80 mm;
no. 7: NAC, Auction 88, lot 451, 8/10/2015, 7.04 g, 17.00 mm;
no. 8: Svoronos 122a, pl.IV,19, 7.12 g, 17.10 mm;
no. 9: Kunker 97, lot 1011, 7/03/2005, 7.04 g, 17.00 mm;
no. 10: British Museum, London, no. 1870,0101.1, 7.08 g, 17.20 mm;
no. 11: Münzkabinett, Staatliche Museen Berlin, no. 18246006, 19 mm, 7.11 g, 17.90 mm;
no. 12: Svoronos 121a, Pl. IV,18, 7.12 g, 17,85 mm;
no. 13: British Museum, London, no. 1897,0104.508, 7.09 g, 18.00 mm;
no. 14: https://en.wikipedia.org/wiki/Heracleion, weight and diameter n.a.;
no. 15: Maison Palombo, Auction 12, lot 42, 6/12/2013, 7.20 g;
no. 16: Svoronos 152a, 7.16 g, 17,40 mm;
no. 17: Lorber 2018, Cyrenaica, no. 272, weight and diameter n.a.;
no. 18: Bibliothèque nationale de France, Paris, Fonds général 33, 7.03 g, 18.00 mm;
no. 19: Museum of Fine Arts Boston, no. 11.1754, 17 mm, 7.06 g, 17,80 mm;
no. 20: Lorber 2018, Alexandria, no.99;
no. 21: iNumis, Mail Bid Sale 25, lot 52, 3/06/2014, 6.77 g, 16.20 mm;
no. 22: Münzkabinett, Staatliche Museen Berlin, no. 18200178, 7.13 g, 18.00 mm;
no. 23: Svoronos 103a, Pl. IV, 7, 7.15 g, 18.00 mm;
no. 24: Bibliothèque nationale de France, Paris, Fonds général 33, 7.03 g, 17,70 mm;
no. 25: CNG, Triton XIX, lot 2079, 5/01/2016, 7.15 g, 17.5 mm;
no. 26: Adolph E. Cahn, Katalog 84, lot 455, 29/11/1933 7.10 g, 17.80 mm;
no. 27: Harvard Art Museums, object no. 1.1965.2735, 7.14 g;
no. 28: Gemini LLC, Auction II, lot 171, 11/01/2006, 7.11 g, 17.90 mm;
no. 29: CNGroup, Triton VII, lot 374, 12/01/2004, 7.12 g, 19.00 mm;
no. 30: Metropolitan Museum of Art, New York, n.1993.290, 7.15 g, 18.00 mm;
no. 31: Museum of Fine Arts, Boston, no. 14.421, 17 mm, 7.10 g, 17.80 mm;
no. 32: Lorber 2018, Alexandria, no.104, weight and diameter n.a.;
no. 33: ANS, n.1967.152.621, 7.10 g, 18.00 mm,;
no. 34: The New York Sale, Auction XXVII, lot 627, 4/01/2012, 7.11 g, 17.70 mm;
no. 35: Svoronos 111b, Pl. IV, 6, 7.11 g, 18.10 mm;
no. 36: Numismatica Genevensis SA, Auction 8, lot 62, 24/11/2014, 7.11 g, 18.00 mm;
no. 37: CNG, Triton 19, lot 2080, 5/01/2016, 7.09 g, 19.00 mm,;
no. 38: Svoronos 101a, Pl. IV, 1, 7.05 g, 10.20 mm.

Plate VIII -
No. 1: Burnett 1983, Enna 2, weight and diameter n.a.;
no. 2: Bertolami Fine Arts - ACR Auctions, Auction 8, 3/02/2014, lot 73, 3.38 g, 20.00 mm;

no. 3: NAC AG, Auction 39, 16/05/2007, lot 9, 3.29 g, 19.00 mm;
no. 4: NAC AG, Auction 72, 16 May 2013, lot 844, 3.56 g, 20.20 mm.
Coin I: Dr. Busso Peus Nachfolger, Auctions 407/408, 7 Nov. 2012, lot 838, 10.41 g, 25.00 mm;
coin II: Dr. Busso Peus Nachfolger, Auctions 407/408, 7/11/2012, lot 839, 10.34 g, 24.00 mm;
coin III: Heidelberger Münzhandlung Herbert Grün e. K., Auction 64, 20/11/2014, lot 1197, 10.42 g, 24,20 mm;
coin IV: Auktionshaus H. D. Rauch GmbH, Auction 86, 12/05/2010, lot 379, 10.35 g, 24 mm.

Plate IX -
No. 1: Fritz Rudolf Künker GmbH & Co. KG, Auction 182, lot 392, 14/03/2011, 7.66 g, 18.50 mm;
no. 2: Ira & Larry Goldberg Coins & Collectibles, Auction 91, lot 1762, 7/06/2016, 7.65 g, 19.00 mm;
no. 3: Auktionshaus H. D. Rauch GmbH, Summer Auction 2010, lot 149, 13/09/2010, 16.96 g, 27 mm;
no. 4: Lorber 2018, Vol. II, Cyrene, B145, 4.00 g, 18 mm.
Coin A: Gorny & Mosch Giessener Münzhandlung, Auction 190, 10/11/2010, lot 308, 10.88 g, 24 mm.
Coin I: Vcoins, Tom Vossen, Item #21135, 1/11/2007, 3.17 g, 16 mm;
coin II: eBay, Item # 8387146190, 21/02/2006, 3.58 g, 17 mm.

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