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The Regularities of Coin Accumulation and Coin Circulation Based on Settlement Materials in Pannonia

Abstract: Hoards are snapshots of coin circulation at the time of their burial. The histogram, which shows the frequency of these coins according to the minting date, captures certain regularities of the accumulation. We turn to the experience gained from the examination of hoards when we want to characterize the coin circulation of a whole settlement through the centuries. Based on these results we have examined settlement materials in connection with the West-Pannonian municipium of Salla. When studying the coin circulation of this town we have taken into consideration the quantity of coins, the estimated life-time that the coin spends in circulation, and the date of minting which is usually a shorter or longer interval and rarely an exact year on the graph. Where each coin has the same weight, we get the yearly frequency of coins in circulation. The frequency graphs offer a possibility to characterize and compare different towns and areas historically.

The Coin Material in Salla (Municipium Aelium Sallense)

Six hundred and eighty-seven coins have so far been recovered during the excavations of the Roman settlement at Zalalövő (Redő 2003; about the other sites see the volumes of Šašel-Kos / Scherrer 2002–2004). The cemetery was also excavated but only 19 graves were unearthed, and they contained very few coins (Müller 1971). These coins are not included in the above number. The small find unit of 31 bronze coins from the beginning of the 4th century, which is the only find that can be interpreted as a coin hoard, was also ignored.

The nearly 700 coins recovered at the excavations cannot be compared with the richness of the Intercisa and Carnuntum materials, yet it is beyond the threshold of statistically valuable data. There are no accepted conventions regarding the limits from which such a material is regarded as valuable but the analysis of the material does afford some observations and the registering of certain aspects. Regarding the lower limit, the length of the chronological interval about which we want to learn something from the coins must be considered important. As this interval is four hundred years, seven hundred coins mean that 17–18 coins came from every Pannonian decade of the Romans at an even distribution. This is not a bad proportion regarding the exactitude of dating from coins. It is highly unlikely that any decade with real coin circulation could remain unmarked in the coin-frequency diagrams presented below.

At first glance, the upper limit of statistical validity does not seem necessary to be examined since the more coins are recovered from a site the more sensitive the curve of the diagram presenting coin circulation will be. However practice shows that the size of a statistical multitude is interdependent with the size of the territory we wish to characterize. It means that when we wish to know the coin circulation of an average Pannonian town (and we can analyse thousands of coins) even though all the coins came from the town, this sum will characterise not the site itself but its wider surroundings. In our case, for example, the curve will look more and more similar to that of the complex coin circulation of Pannonia. Although important it does not really characterize the given settlement. The number of the coins unearthed at Zalalövő is suitable for analyses from every respect.

In the present paper we are dealing with the dating of the site. This does not simply mean a chronological interval at the beginning of which the examined settlement was founded and at the end of which it was abandoned. It means the borders of various historical periods of the site, and the historical dynamics of the individual periods.

Coins play the greatest role in the dating of a site, although they are not among the sources that can easily be interpreted in this respect. The dating of archaeological finds is linked with the study of the circumstances of their production. What we can actually determine is not the period during which the finds were used but the time when they were produced. We suppose that the object arrived to the

place where it was used, not long after it had been produced, which is a logical supposition in the case of a commodity. This type of dating provides only a *terminus post quem* dating, which is, however, relatively exact. It is another question as to how long this open interval exists. The only help we can get is through similar examination of the next layer that covers the one we have already focused on.

The situation is different with coins. Coins are not commodities, and we have no reason to suppose that they got to the site soon after they had been minted since coins characteristically circulate in the economy, in which case it is the metal content that determines their value. This was the general practice in Antiquity, and their age did not limit their use value as long as they were valid. They do not offer even that little clue that we found in the above described archaeological finds. Thus the analysis of the individual coins will not give more reliable data with relevance to the dating of a layer than the fact that the overlying layer cannot be older.

The solution of this problem is an everlasting topic of archaeological practice. The most evident possibility is offered by the analysis of coin hoards.

A Short Analysis of Coin Hoards

The analysis of an amount of money that a person owned at a certain time could show the chronological interval of the coins that were present in coin circulation, in other words how long Romans used the coins in Salla or elsewhere. From the purpose of analysis, we call a closed coin find a coin hoard, the elements of which were valid coins at the time when they were hidden.

The important data of a coin hoard are the following ones from the purpose of this analysis: a) the date of the earliest and the last coin, b) the length of the chronological interval determined by the above two dates, and c) the frequency distribution of the items of the hoard between the two limits. The necessity of the first two points does not require explanation. The third one can reduce the dating interval deduced from the first two data by the rate we determine using an acceptable error limit. The frequency distribution of coin hoards also characterises them since many diverse factors can influence the accumulation of finds. It is not certain, for example, that the process of accumulation was always the same. Experiences suggest that this process can be characterised with the frequency distributions: the general

tendencies of accumulation can be observed and the incidental factures can be separated.

The determination of the first and the last coin of a coin hoard (a) cannot mean a problem. The first coins are more difficult to determine since they often are strongly worn. We cannot err when we characterize this limit with the earliest possible date.

The length of the interval between the first and the last coins (b) is more complicated. Theoretically it is identical with the maximal length of time the coins spent in circulation in the given historical period. This time range also depends on the denomination of the coin. In the case of a gold find, this interval is too long to be useful. It is valuable in the case of silver finds, while bronze finds provide the most data. It can also be observed that coin finds of mixed denominations rarely occur. Bronze and silver coins can be found together but gold is seldom mixed with them. The reason is that gold coins were used to preserve wealth, for hoarding, and not as a change in the coin circulation.

The frequency distribution of the elements of a coin find (c) can initially help the determination of the average time range the coins spent in circulation. This distribution is not even but scattered around a peak. Thus it would be inappropriate to automatically use the entire interval since the quantity of the data is negligible at the two ends. The curve does not show a normal distribution either as it is not symmetrically distributed on both sides of the peak (like e.g. the weight of coins of the same age), but it is shifted toward the more recent ones. The curve that appears is called a lognormal curve in mathematics. From a practical empirical view, I would leave the minimal value toward the date of the hiding as it is, while I would ignore the last percent of the complete find at the oldest coins. This does not seem to be a high number regarding the total item number of the find and it can significantly shorten the dating interval and bring us closer to the real situation *(Fig. 1)*.

After this brief review about the experiences of dating coin hoards, let us see how we can use them for the analysis of coin material recovered from a settlement.

If we suppose that the inhabitants of the Roman province did not intentionally discard their coins but simply lost them, it means that the mass of coins lost in a year behaves the same way as a hoard. It could have been the content of the purse of an inhabitant in a given year. We cannot separate it from
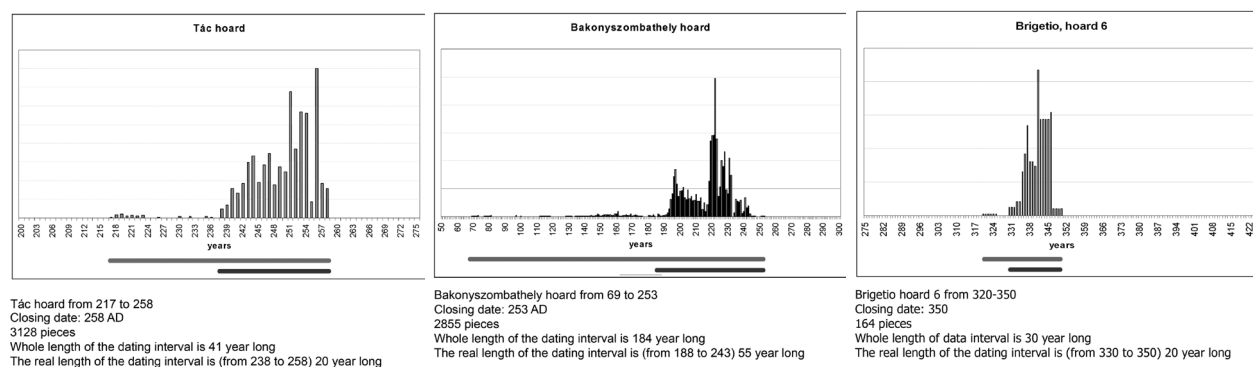
Fig. 1. Frequency graphs of Tác, Bakonyszombathely and Brigetio.

the mass of coins of 400 years as we know that the accumulation of these sums led to the complete coin circulation of the settlement.

A model where the individual small coin hoards are accumulated with yearly shifts according to the time they were lost (or hidden) would be the frequency distribution of the total coin circulation of the settlement. This is the same as the unified frequency curve of all the excavation finds on a chronological axis.

Returning to the point where we first turned to the coin hoards for help, we found that this type of finds is suitable to estimate the time an exactly dated coin spent in coin circulation. If we were to collect coin hoards from the coin circulation of the examined territory (e.g. Pannonia province or the Roman Empire) in which the closing dates continuously cover the examined coin circulation period (first four to five centuries AD), we could give a fairly good estimate to the intervals characteristic of the individual historical periods. In other words, when and how long an average coin was used in the coin circulation.

The following figure contains the data of 49 hoards *(Fig. 2)* (Redő 2003, 231 note 104; Royal Numismatic Society 1978–1980). Most of them came from Pannonia but not all of them, as there are many periods from which I could not find hoards originating from Pannonia. Column "A" of the table gives the provenance of the hoard. Column "B" contains the dating of the opening and the closing coins, while column "C" refers only to the closing coins. In column "D" we can find the starting and closing dates of the interval that the hoards realistically cover, and column "E" shows the length of the interval in years. The two diagrams are the graphic illustrations of the data listed in columns "C" and "E". The order of the data of the hoards is the same in the diagrams as in

the tables, so the points of the first diagram match the columns of the second diagram.

Hoards closed with a suitable dating are still missing at many places in the first diagram. In an ideal case, the points of the diagram would be distributed along a diagonal straight line.

We can observe in the second diagram that 45 finds, disregarding the columns of the first two and the last two hoards, are distributed in three groups. The first contains the hoards that closed between 98 and 211, the second one contains those closed between 232 and 253, while the hoards closed between 256 and 378 compose the third group.

The intervals show a rising trend in the first two groups, which is logical. The starting coins of these groups indicate boundaries of numismatic periods (the start of coin mintage of the principate; Caracalla's reform; the time when *Antoninianus* practically became the only bronze coin) that almost completely closed the coin circulation of the previous periods. They opened a new period, in which lengthening chronological intervals can be observed in coin circulation until the next boundary, when the same rising trend restarted. Nothing like that can be found in the third group: the columns indicating the intervals are evenly low apart from a few by chance higher values. The first two omitted columns contain the data of hoards that did not yet contain coins of the Republican Period, and have too broad a dating. The last two columns, at the same time, indicate the start of a new phase, for which we do not have sufficient data.

Regarding the three apparent phases, we can deduce that a coin could spend 92 years in average in coin circulation in the fist phase, 56 years in the second one and 24 in the third one. The black line intersecting the columns marks these data.
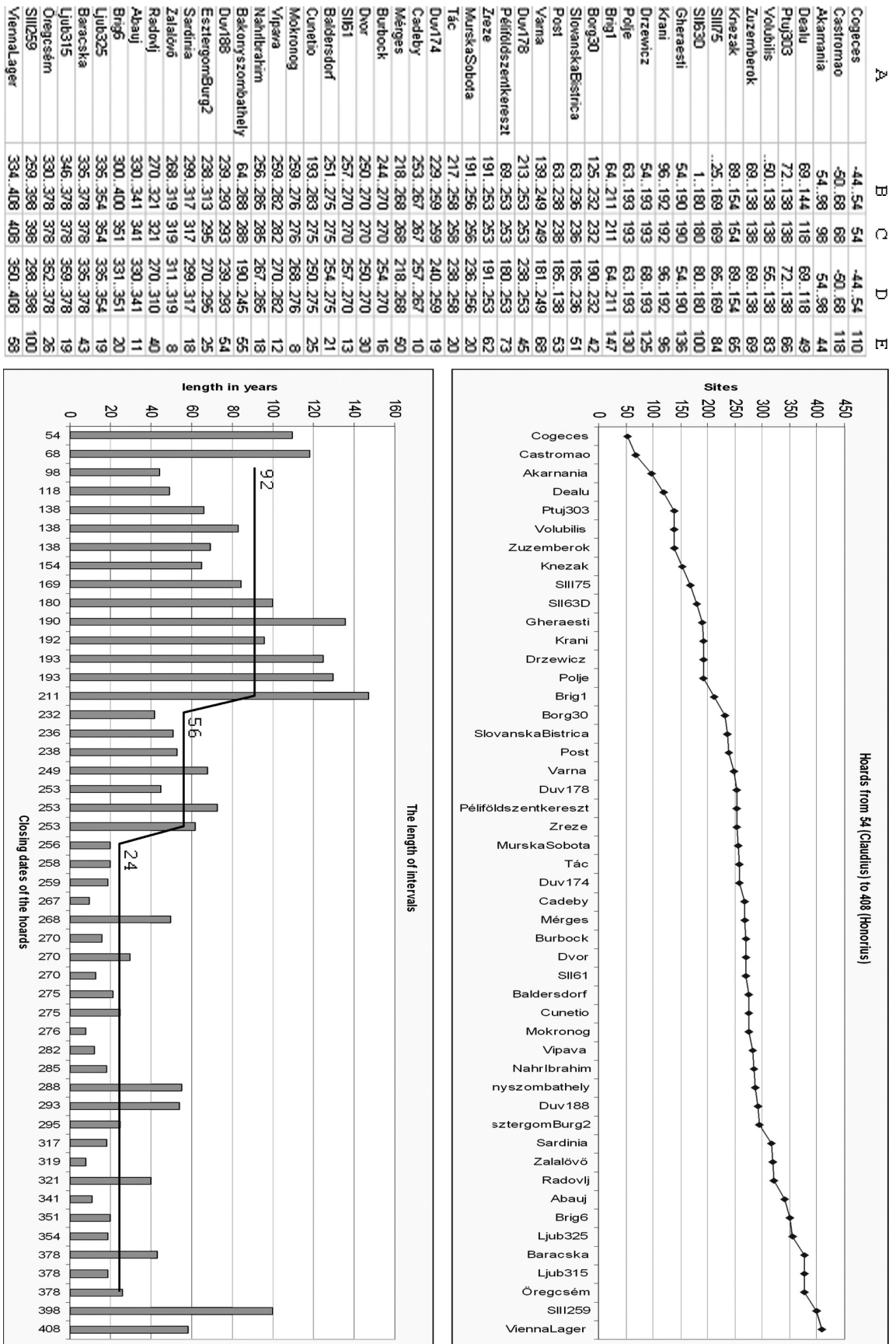
A	B	C	D	E
Cogeces	-44..54	54	-44..54	110
Castromao	-50..68	68	-50..68	118
Akarnania	54..98	98	54..98	44
Dealu	69..144	118	69..118	49
Ptuj303	72..138	138	69..118	66
Volubilis	-50..138	138	72..138	83
Zuzemberok	69..138	138	89..138	69
Knezak	89..154	154	89..154	65
SIII75	-25..169	169	85..169	84
SII63D	1..180	180	80..180	100
Gheraesti	54..190	190	54..190	136
Krani	96..192	192	96..192	96
Drzewicz	54..193	193	68..193	125
Polje	63..193	193	63..193	130
Brig1	64..211	211	64..211	147
Borg30	125..232	232	190..232	42
SlovanskaBistrica	63..236	236	185..236	51
Post	63..238	238	89..238	53
Varna	139..249	249	181..249	68
Duv178	213..253	253	238..253	45
Péliföldszentkereszt	69..253	253	180..253	73
Zreze	191..253	253	191..253	62
MurskaSobota	217..258	256	238..256	20
Tác	229..259	259	240..259	19
Duv174	253..267	267	257..267	10
Cadeby	218..268	268	218..268	50
Mérges	244..270	270	254..270	16
Burbock	250..270	270	250..270	30
Dvor	257..270	270	257..270	13
SII61	251..275	275	254..275	21
Baldersdorf	251..275	275	250..275	25
Cunetio	193..283	275	268..276	8
Mokronog	259..276	276	268..276	12
Vipava	259..282	282	270..282	18
NahrIbrahim	256..285	285	267..285	55
Bakonyszombathely	64..288	288	190..245	54
Duv188	239..293	293	239..293	25
EsztergomBurg2	238..313	295	270..296	18
Sardinia	299..317	317	299..317	8
Zalalövö	268..319	319	311..319	40
Radovlj	270..321	321	270..310	11
Abauj	330..341	341	330..341	20
Brig6	300..400	351	331..351	19
Ljub325	335..354	354	335..354	43
Baracska	335..378	378	335..378	19
Ljub315	346..378	378	369..378	26
Öregcsém	330..378	378	335..378	100
SIII259	259..398	398	288..398	26
ViennaLager	334..408	408	360..408	68

Sites

Hoards from 54 (Claudius) to 408 (Honorius)

Category axis (top to bottom): Cogeces, Castromao, Akarnania, Dealu, Ptuj303, Volubilis, Zuzemberok, Knezak, SIII75, SII63D, Gheraesti, Krani, Drzewicz, Polje, Brig1, Borg30, SlovanskaBistrica, Post, Varna, Duv178, Pélifölszentkereszt, Zreze, MurskaSobota, Tác, Duv174, Cadeby, Mérges, Burbock, Dvor, SII61, Baldersdorf, Cunetio, Mokronog, Vipava, NahrIbrahim, nyszombathely, Duv188, sztergomBurg2, Sardinia, Zalalövö, Radovlj, Abauj, Brig6, Ljub325, Baracska, Ljub315, Öregcsém, SIII259, ViennaLager

length in years

The length of intervals

Closing dates of the hoards (axis values): 54, 68, 98, 118, 138, 138, 138, 154, 169, 180, 190, 192, 193, 193, 211, 232, 236, 238, 249, 253, 253, 253, 256, 258, 259, 267, 268, 270, 270, 270, 275, 275, 276, 282, 285, 288, 293, 295, 317, 319, 321, 341, 351, 354, 378, 378, 378, 398, 408

Trend line values: 92, 56, 24

Fig. 2. A small collection of hoards from the Roman imperial period, the graphs illustrating their main tendencies.

How Can We Use These Data for the Dating of the Settlement?

As already discussed, the coin material from a settlement can be regarded as a cumulated histogram built from supposed hoards. These supposed coin hoards contain coins hidden in the earth in the subsequent years (decades). Examining this cumulated histogram, we will immediately notice how difficult the curve is to describe when all the coins are only put to the place of their dates alone *(Fig. 3a)*.

In practice and in a number of publications, I have used graphs in which an average number valid for the entire Imperial Period compensates this shortcoming. This number was in general 30 years. This is an estimated interval the coins spent in coin circulation in the Imperial Period.

Although we say that a coin was not used according to the time of minting since it was present in coin circulation for 30 years, this process cannot be executed as if we had found 30 times more coins in Salla than we actually did, because it would not be true. We could not change the number of the uncovered coins so we had to choose another method. Keeping the numbers in our example, we modified the curve so that every point, that is the frequency of the coins produced in the year marked by the point, was taken into account at the formation of an average through the following 30 years. So the frequency of year 117 is the average of the frequencies measured between the years 117 and 147, that of year 118 is the average between 118 and 148, etc. This method makes the curve smoother and easier to evaluate. The theoretical base of the method is the statement that the coin minted in 117 was certainly in circulation in 147 *(Fig. 3b)*.

I have been using these curves as they are simple and familiar, even though this method is arbitrary and does not stand the test of consequent criticism. Yet we cannot completely refute it. As long as coin hoards do not completely cover the investigated period, that is we do not know coin hoards from every 4–5 years where the last coin can be dated from the given year (4–5 years), a theoretically more exact process may cause larger distortions than the uniform average number. The way to advancement is the applications of the results gained from coin hoards.

Thus using the data of the above tables with caution based on empirical (and not monetary historical!) evidences, we divided the coin circulation of the Imperial Period into three phases. The first one lasted from Augustus to approximately Caracalla's monetary reform (211 AD). We can characterize this phase from the aspect of our actual analyses as the lifetime of the coin system of the principate from the *Quadrans* to the *Denarius*. The second phase ended when Valerianus' ascended the throne (253). This was the lifetime of the *Antoninianus* introduced by Caracalla. The original silver content of the coin was more-or-less successfully preserved during these forty years. The third long phase closed with the end of Valens' reign (378). This chronological interval witnessed a number of monetary reforms yet the disuse of silver coins generally characterized the entire phase. The *Antoninianus* of the 3rd century were practically bronze coins from Gallienus' sole reign, and the weight of the silver denominations emitted afterwards could not be felt in the real coin circulation. The values of the bronze coins that were the most commonly used in this phase lasted a whole century (*Centenionales*, *Maiorinae*) and can best be compared with the *Antoninianus* reformed by Aurelianus.

The previously described methods will provide curves that can characterise the coin circulation of a settlement *(Fig. 3c)*. I compared the curve composed of the coins of Salla with the curves of 14 other Pannonian towns (Emona, Celeia, Poetovio, Savaria, Scarbantia, Carnuntum, Vindobona, Arrabona,
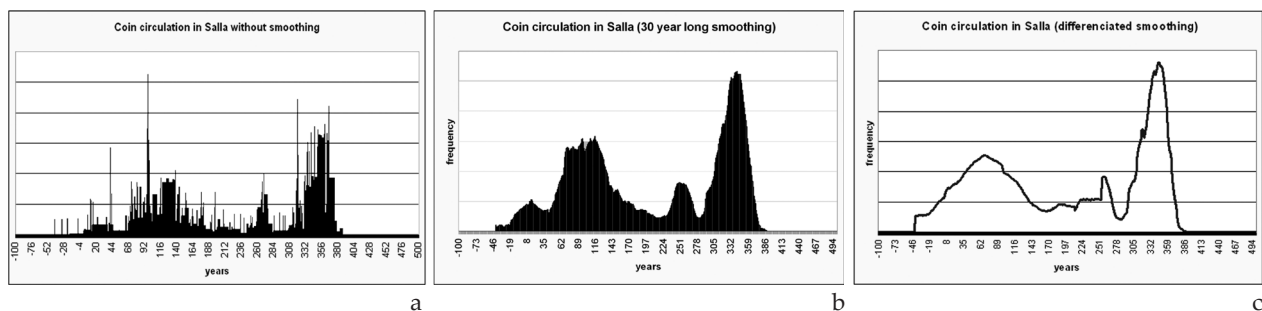

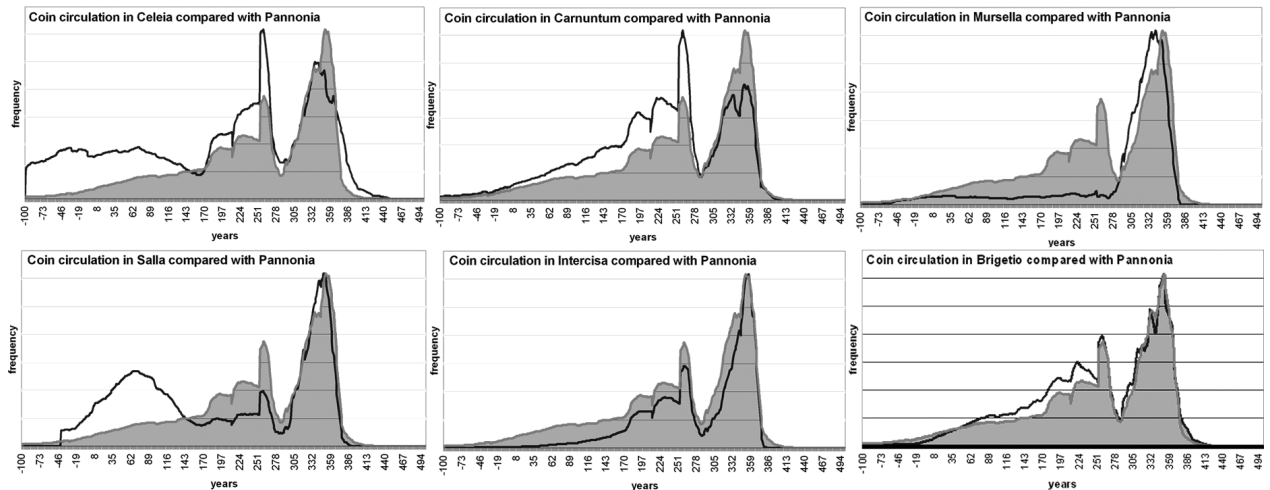Fig. 3. (a)–(c). Coin circulation of Salla: three different methods.

Fig. 4. Coin circulation of Celeia, Salla, Carnuntum, Intercisa, Mursella, Brigetio compared with Pannonia.

Mursella, Brigetio, Aquincum, Gorsium, Intercisa, Sopianae) and I realised that well-defined groups can be found among the coin circulations of the settlements. There are towns that are strikingly similar (for instance Salla and Scarbantia), and other ones that definitely show different pictures. The major historical periods can evidently be separated in the coin circulation of Salla: the time of the occupation, the lifetime of the auxiliary fort, the subsequent civil development, which stopped after the division of the province, the Marcomann devastation, the end during the Severus period and the reconstruction of the settlement in the 4th century.

These curves are interesting not only in themselves but also in comparison with each other and a standard, which is valid to a certain degree. The standard to which all the coin circulations were compared was the coin circulation of Pannonia composed of the pooled data of all the towns (the grey surface in the graphs). A group along the Limes and another one along the Amber Route can definitely be differentiated (Fig. 4).

However it is impossible to build groups that are valid for all the four and a half centuries of the Imperial Period since different military political, administrative and economic interests controlled the individual territories of the province during this long period. The dynamics of these varying clusters became tangible in the last figure (Fig. 5). In the first two centuries of the principate (Fig. 5.1) advance from the direction of Italy, the eminent role of the Amber Route is one of the important phenomena. The development of the Limes can also be observed. The northern borderline of the province seems to

have been more uniform than the eastern one, and an inner Pannonian group is also separated. The uniformity of the towns along the Amber Route disintegrated by the first half of the 3rd century (Fig. 5.2) and the settlements became separated from each other and the whole of Pannonia. At the same time, the uniform coin circulation of the northern Limes was preserved and even intensified. The towns situated on the northern part of the province show a slightly stronger cohesion but the separation of the inner Pannonian group is still perceptible. Map 3 of the second half of the 3rd century and the 4th century shows a province where the eastern part appears to be the most uniform (Fig. 5.3). The cohesion that had bound the province to Italy and Noricum dissolved contrary to the fact that the greatest pressure affected it from the east after Aurelianus had emptied Dacia.

With this work, I intended to create a tool that was suitable to characterize a Roman period town from the coin material. Now, I have to accept that only groups of towns (maybe even disregarding the provincial borders) can really be characterized in their historical dynamics, in their evolution.

Acknowledgements

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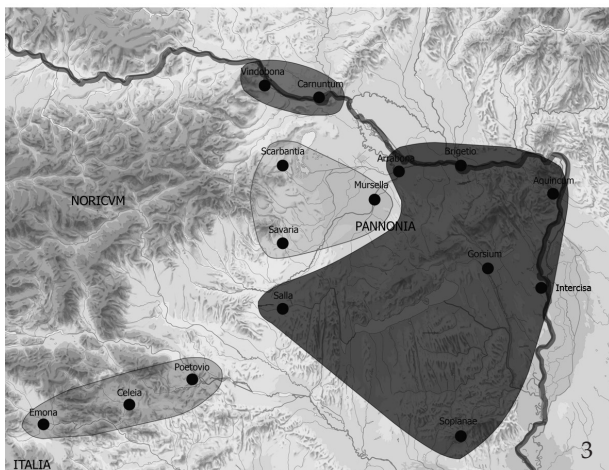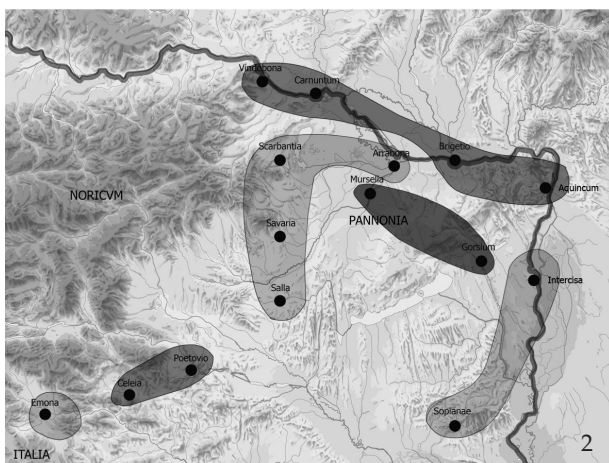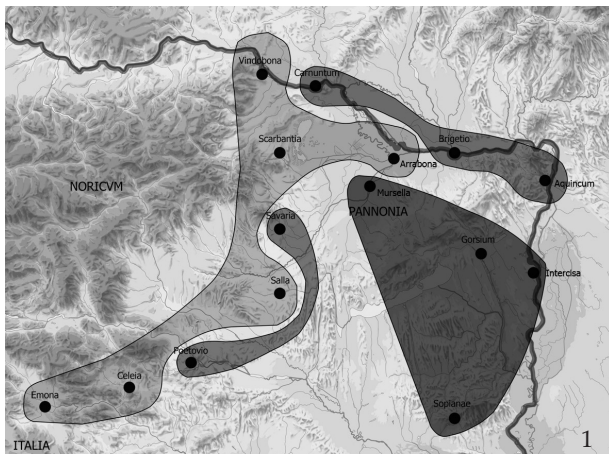
Fig. 5. Maps of the examined towns: 1. The 1–2 centuries. 2. The 1st half of the 3rd century. 3. The age of the military anarchy and the 4th century.