

**SYLLOGE NUMMORUM GRAECORUM  
CZECH REPUBLIC**

**VOLUME I**

**THE NATIONAL MUSEUM  
PRAGUE**



**Part 7**

**Seleucid Empire and Imitations, Syria, Phoenicia, Judaea, Mesopotamia,  
Commagene, Armenia and Arabia**

Jiří Militký, Petr Veselý and Lenka Vacinová



**NATIONAL  
MUSEUM** : **205** years

Prague 2023

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(with contribution by Marek Fikrle)



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Scientific editor: Prof. PhDr. Eduard Droberjar, Ph.D.  
Reviewed by: Dr hab. Jaroslav Bodzek  
Mgr. Jan Kysela, Ph.D.

This work was financially supported by Ministry of Culture  
of the Czech Republic (DKRVO 2019–2023/11.IV.d., 00023272).

The author M. Fikrle was supported by AV21 Strategy Research Programme:  
‘City as a laboratory of change; construction, historical heritage and place for safe  
and quality life’.

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Photo: Abalon s.r.o.

Abstract:

*Sylloge Nummorum Graecorum, Czech republic, Volume I, Part 7, Seleucid Empire and Imitations, Syria, Phoenicia, Judaea, Mesopotamia, Commagene, Armenia and Arabia.* The National Museum, Prague 2023.  
This catalogue contains descriptions of 725 coins, illustrated on 91 plates + 52 colour plates.

Print run: 300

print ISBN 978-80-7036-783-4  
pdf ISBN 978-80-7036-784-1

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Publisher: Národní muzeum, Václavské náměstí 1700/68, 110 00, Praha 1 – Nové Město, [www.nm.cz](http://www.nm.cz)



Graphic design, typesetting, print and cover photo (cat. no. 333): Abalon s.r.o.

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## FOREWORD

The main goal of the long-term project *Sylloge Nummorum Graecorum, Czech Republic I: The National Museum, Prague*, is to gradually study and present the entire collection of Greek coins kept in this institution. The Antiquity section of the numismatic collections of the National Museum in Prague is currently being reorganised and documented for final publication. Volumes presenting coins from the region of Macedonia and Paionia (*SNG Prague I/3*) as well as coins from ancient Bactria, their contemporary imitations, and Indo-Scythian coinage (*SNG Prague I/10*) have been published recently. The following volume (*I/7*) presents coinage ranging from the Seleucid kingdom to Arabia, comprising a total of 725 coins. The present volume was written by three authors. Lenka Vacinová penned the description of Jewish coins.

### HISTORY OF THE COLLECTION OF SELEUCID TO ARABIAN COINS IN THE NATIONAL MUSEUM, PRAGUE

The absolute majority of the numismatic collections of the National Museum in Prague are kept in the Department of Numismatics (H5). Most of the coins presented in this publication come from this collection. Only a few coins are registered in the collections of the Department of Prehistory (H1) though physically they are kept and managed by the Department of Numismatics. This scarcity is also well reflected in the assemblage presented here which includes a mere two pieces (nos. 492 and 691). A collection on its own is that of the Náprstek Museum (N). Established only in the early 1960s, it focuses on non-European numismatics though it ultimately largely overlaps with the collection of the Department of Numismatics. This focus of the Náprstek Museum collection is also reflected in the structure of the material presented in this publication (nos. 25, 33, 65, 163, 163, 307, 382, 389, 474, 543, 545, 569, 571, 574, 576, 587, 598–600, 605, 617, 620, 623, 628, 632–633, 635, 638, 640, 645, 648–649, 652, 662, 665, 669, 671–675, 684, 686–689, 698, 711, 713–717, and 719–724). The most precious components of the Náprstek Museum collection are the ancient Jewish coins. The history of the ancient numismatic collection kept in the National Museum in Prague has been synthetically presented in the publication of Roman Republican coinage (*Militký – Vacinová 2018, 7–14*).

The most significant components of the collections of the ancient numismatics of the National Museum in Prague are the coins of the Seleucid kingdom and their imitations, and those of Syrian cities (540 pieces). A far less representative overview is provided by coins of Phoenicia (56 pieces). A small collection, but of very high value is the set of coins of ancient Judea (96 pieces). Only single pieces represent the Greek coin production in Mesopotamia (11 pieces), coins of Commagene (3 pieces) and of Armenia (3 pieces). The assemblage of ancient coins from Arabia is not very representative either (16 pieces). The disproportionate representation of the different regions of the ancient world directly reflects the ways and routes by which the coins entered the collection.

For a number of coins from the Department of Numismatics collection, the specifics of their acquisition are not clear – these specimens are therefore referred to as the Old collection (nos. 3, 5, 9, 12–13, 20, 31, 44, 46, 54, 57, 68, 71, 83, 87, 89, 92–94, 97, 108–109, 116, 118, 122, 130–132, 136–137, 139–142, 145, 159, 161, 182–184, 190, 200, 207, 210, 214, 217, 220, 226, 230, 235, 247, 249–250, 256–257, 280, 290, 299, 306, 309, 312–313, 321, 323, 336–337, 349, 351, 358, 361, 364, 368, 373, 378, 385–386, 388, 408, 424, 426, 428–429, 432, 440–441, 443, 446–447, 453, 455, 460, 466, 470–471, 473, 488, 490, 496, 515, 518, 522–523, 529–532, 535, 537–538, 541–542, 550, 552–553, 562, 564, 567, 575, 577, 579–581, 586, 589, 595–596, 602–603, 606–607, 611, 614, 619, 624–625, 639, 642–643, 654, 657–659, 661, 664, 667, 670, 681, 693–696, 701, 703–704, 707, 709, 712).

In the period before World War II, the Department of Numismatics purchased – one after another – several large assemblages of ancient coins through the dealer F. Zapletal; they included also some coins from the areas presented here (nos. 11, 17, 21, 30, 60–61, 63–64, 100–101, 151, 173, 356, 360, 409, 436, 438, 444–445, 448, 452, 457–459, 462, 465, 472, 489, 491, 493–494, 546–547, 549, 582–583, 601, and 708). Two large numismatic collections consisting of coins ranging from antiquity to modern times were acquired before 1924 and in 1924, however, coins from the regions under study were only marginally represented in them – the J. Zounek collection (nos. 95, 289, and 449) and the F. Hrdina collection (nos. 22, 125, 308, and 690).

A significant increase in acquisitions of coins subject to our study occurred after 1945. These include various random purchases of individual specimens (which has continued to the present day), sometimes even within larger collections, as well as various confiscations (nos. 4, 7, 15–16, 23, 36–40, 45, 49, 72–77, 79–80, 82, 84, 86, 96, 98–99, 105–107, 119, 121, 126–128, 133, 135, 143–144, 147, 149–150, 156–157, 172, 175, 193–195, 205, 209, 218, 228, 254, 258, 267, 270,



272, 276–277, 281, 287–288, 291, 298, 300, 315, 319, 322, 332, 334–335, 339, 355, 359, 417, 422, 430, 433–435, 439, 451, 456, 463, 467–468, 481, 484, 506, 513–514, 516, 519–521, 534, 539–540, 548, 551, 556–558, 561, 570, 585, 588, 590–592, 608, 610, 613, 615, 618, 626–627, 630–631, 637, 651, 653, 655, 666, 679–680, 682–683, 685, and 706). Of special note for the coins presented here are some of the confiscated collections – those of H. Zinke (nos. 18, 85, 164, 166, 174, 213, 414–415, 419, 469, 476–477, 479, 482, 495, 555, 568, 641, 647, 677, 705, and 725), of the Libochovice Chateau (nos. 124, 167, 259, 461, 486, 536, 573, 593, 597, 604, 609, 616, 621, 629, 636, 644, 650, 663, 668, 692, and 710), and of H. Palme (nos. 19, 255, 431, 464, and 594).

A large numismatic collection of J. Michera was purchased from his heirs in 1960. It contained among others many ancient coins, especially from the Black Sea region, but also some pieces presented in this publication (nos. 1, 70, 78, 203, 273, 437, 454, 483, 554, 559–560, 563, 565–566, 578, 584, 612, 622, 634, 646, 656, 660, 676, 699, 702, and 718).

In 1963, the Náprstek Museum managed to purchase an extraordinarily large coin collection of B. Augst. This collection was conceived as a general overview of coinage on the Asian continent from antiquity to the early modern period. Although its core consists primarily of Islamic and Chinese coinage, ancient coinage is also significantly represented, including the regions presented here (nos. 569, 571, 574, 576, 598–600, 605, 617, 620, 628, 632–633, 635, 638, 640, 648, 662, 669, 671–673, 675, 686, 689, 698, 711, 713–715, 717, 721–722, and 724).

As part of the acquisition programme aimed at the preparation of the new permanent exhibition of the National Museum, two exceptionally high-quality collections of ancient coins were purchased with the means provided by the Ministry of Culture of the Czech Republic to the Department of Numismatics. The first of them is MUDr. Michal Mašek's collection of Seleucid coins. Its purchase in 2018 followed up the acquisition of his collection of Bactrian coins that has already been published within the Prague issue of the *Sylloge Nummorum Graecorum* series (*SNG Prague I/10*). In total, the collection comprises 92 coins, providing a representative overview of Seleucid coinage with a small lot of the Antioch on the Orontes mint (nos. 26–29, 34, 42–43, 53, 59, 62, 66–67, 81, 90, 102, 104, 112–115, 117, 120, 123, 134, 138, 146, 148, 153–155, 160, 165, 169–171, 176–177, 180–181, 185, 204, 212, 223, 227, 229, 236, 237, 241–242, 245–246, 248, 252, 260–261, 263–265, 271, 275, 279, 283–286, 293, 297, 303, 305, 311, 316–317, 320, 325, 328, 333, 338, 340–341, 346, 348, 352–353, 357, 362–363, 369, 376, 380, 396, 410, 423, 425, and 427). This collection was assembled primarily through numismatic auctions around the world and also on the open foreign numismatic market. All coins in this collection are catalogued with their original inventory numbers.

The most important private collection of ancient coins acquired by purchase in recent years by the Department of Numismatics is the collection of Petr Veselý, who is also the co-author of this volume. It is a highly representative assemblage of issues of the Seleucid rulers and autonomous Syrian cities of the Seleucid period. Prior to its purchase by the National Museum the collection was presented in the form of a website (<http://www.seleukidtraces.info>) which is no longer active. The collection consists of a total of 141 coins (nos. 2, 10, 24, 32, 35, 41, 47–48, 50–52, 55–56, 58, 69, 88, 91, 103, 110–111, 129, 152, 158, 162, 168, 178–179, 186–189, 191–192, 196–199, 201–202, 206, 208, 211, 215–216, 219, 221–222, 224–225, 231, 232, 234, 238–239, 243–244, 251, 253, 262, 266, 268–269, 274, 282, 292, 294–296, 301–302, 304, 310, 314, 318, 324, 326–327, 329–331, 342–345, 347, 350, 354, 365, 370–372, 374–375, 377, 379, 381, 383–384, 387, 390–395, 397–405, 407, 411–413, 416, 418, 420–421, 497–505, 507–512, 517, 524–528, and 533). A number of very rare coins are represented in this collection, including unknown variants or previously published specimens. The collection of Petr Veselý was accumulated from auctions all over the world (very often at the CNG) and also from the open foreign numismatic market. Without exaggeration, it can be considered a collection of extraordinary documentary value. It is also significant that acquisition provenance is available for most of the coins. All the coins in this collection are also catalogued with their original registration numbers.

The acquisition of the Michal Mašek and Petr Veselý Collections represents a major achievement in the structure of the ancient coin collection of the National Museum in Prague. Unlike most earlier acquisitions, which are usually of a rather haphazard nature, both assemblages are the result of several years of systematic collecting, providing an exceptionally good overview of both Seleucid and autonomous city coinage.

## COMMENTARY ON THE CATALOGUE

The catalogue is arranged in the same manner as the previous Prague volumes of the *Sylloge Nummorum Graecorum* series and scrupulously follows a uniform structure. All available data are provided for each catalogue entry. Detailed bibliographic references reflect the latest state of research. Great emphasis is also placed on the provenance of the coins, both with regard to earlier collection provenance, including references to auction catalogues or previous publications of the particular specimens (referred to as “this coin”).

Coins of the Seleucid Empire are the most numerous component in the assemblage (404 pieces). By integrating coins from all the various sources, a fairly representative overview of Seleucid coinage was created covering the time span from Seleucus I to Antiochus XIII. Coins of virtually all the Seleucid rulers are represented in the collection (tab. 1) with only very few exceptions (Molon and Cleopatra Thea as sole ruler). Two gold staters of the Alexander type issued by Seleucus I (nos. 13 and 18) are very rare. A specific feature of the Seleucus coins is their production in many mints throughout the empire, though for many coins the mints remain unidentified as yet. In these cases, the system of their labelling and numbering consistently follows the basic catalogue (*SC 1*; *SC 2*). The same is true of the coin dating, the definition and numbering of the coin series, and the labelling of AE denominations. The coin descriptions are structured uniformly throughout the catalogue, only in the case of the coins from Phoenicia and Arabia the legends and inscriptions are not transcribed in Phoenician and Arab script.

A number of rare coins are represented in the collection including those of Antiochus Hierax (no. 119), Antiochus, son of Seleucus IV (no. 177), Timarchus (nos. 205–206), young Antiochus Epiphanes (no. 310), and Cleopatra Selene and Antiochus XIII (no. 396). Also rare is a bronze denomination B from the year 202 of the Seleucid Era issued by Antiochus VIII with the title ΦΙΛΟΜΗΤΟΡΟΣ (nos. 342–345). The representation of the coins of the late Seleucid rulers is particularly exemplary and of high quality.

The collection also includes several previously unpublished coins – a drachm of Seleucus I (no. 29), a bronze denomination C of Alexander I struck perhaps in the mint of Seleucia on the Tigris (no. 238), and a hemidrachm (a completely unknown denomination) of Antiochus VII struck hypothetically in the Tarsus Mint (no. 266). There are also numerous variants of previously unpublished (or untraced by us in more recent descriptions of the finds) variants represented here (nos. 49, 69, 74, 91, 94, 97, 101, 117, 130–131, 154, 165, 174, 178, 199, 229, 236, 242–243, 277, 282, 311, 315, 325, 353, 358, 361, 368, 387, 397, and 402–403). These coins demonstrate the extraordinary variety and intensity of Seleucid coin production. Although the Seleucid coinage as a whole has been exceptionally well published (*SC 1*; *SC 2*), there are clearly still many undocumented variants, as is excellently illustrated by the Prague collection. A total of 11 coins have been previously published as particular pieces (referred to as “this coin” in the catalogue) and are therefore important as comparative specimens (nos. 10, 103, 162, 179, 202, 224–225, 244, 295–296, and 392); all of these pieces come from the Veselý Collection. A group on its own is represented by the specimens previously published in the Prague *SNG Macedonia* volume (*SNG Prague I/3*). Based on the new interpretations of coinage bearing the name of Alexander III, they are now attributed to the Seleucid rulers (nos. 11, 14–16 and 18–23).

Ancient imitations of Seleucid coins present a specific category. These are coins of a good quality metal but produced outside the Seleucid Empire. The first group is represented by imitations of the Antiochus VII's tetradrachms struck in Cappadocia, mainly during the reign of the local Cappadocian rulers Ariarathes V and Ariarathes VII (nos. 405–408). However, these coins also continued to be produced later, probably as late as 80 B.C. They are imitations of a very good artistic style that have only recently received more attention (e.g. *Lorber – Houghton 2006*; *Krengel – Lorber 2009*). The second group is represented by coins of variously barbarized artistic styles and corrupt inscriptions (nos. 409–413). These include a tetradrachm (no. 409), drachms (nos. 410 and 412–413), and one bronze denomination (no. 411). The earliest model that was imitated is a coin of Seleucus II while the latest is that of Alexander I, i.e. from the period around the middle of the 2nd century B.C. However, it is not clear how much time after their models these imitative coins were struck. Most importantly, it is not at all clear, where they were made. They are only vaguely referred to as ‘Celtic’ in this catalogue. Their European origin can be ruled out with certainty, as Seleucid coinage was not imitated anywhere in the vast territories from Gaul to the East Celtic area. Their origin in Asia Minor could be hypothetically considered, but this is not yet certain either. At the same time, their origin in the ‘non-Celtic Eastern’ area cannot be ruled out. In summary, we still know very little about the barbarised imitations of Seleucid coinage.

**Tab. 1.** Overview of Seleucid coins and their imitations represented in the collections of the National Museum.

	AV	AR	AE	Σ
<b>Seleucus I</b>	2	22	14	<b>38</b>
<b>Antiochus I</b>		10	19	<b>29</b>
<b>Antiochus II</b>		8	28	<b>36</b>
<b>Seleucus II</b>		7	8	<b>15</b>
<b>Antiochus Hierax</b>		1		<b>1</b>
<b>Seleucus III</b>		2	4	<b>6</b>
<b>Achaeus</b>			5	<b>5</b>
<b>Antiochus III</b>		7	32	<b>39</b>
<b>Seleucus IV</b>		4	3	<b>7</b>

<b>Antiochus, Son of Seleucus IV</b>	1		<b>1</b>
<b>Antiochus IV</b>	4	22	<b>26</b>
<b>Antiochus V</b>	1		<b>1</b>
<b>Timarchus</b>		2	<b>2</b>
<b>Demetrius I</b>	10	9	<b>19</b>
<b>Alexander I</b>	5	8	<b>13</b>
<b>Demetrius II, First reign</b>	4	3	<b>7</b>
<b>Antiochus VI</b>	7	8	<b>15</b>
<b>Tryphon</b>	1	3	<b>4</b>
<b>Antiochus VII</b>	14	17	<b>31</b>
<b>Demetrius II, Second reign</b>	10	4	<b>14</b>
<b>A Young Antiochus Epiphanes</b>	1		<b>1</b>
<b>Alexander II</b>	6	13	<b>19</b>
<b>Cleopatra Thea and Antiochus VIII</b>	3	1	<b>4</b>
<b>Antiochus VIII</b>	8	11	<b>19</b>
<b>Antiochus IX</b>	8	8	<b>16</b>
<b>Seleucus VI</b>	5	1	<b>6</b>
<b>Antiochus X</b>	2		<b>1</b>
<b>Antiochus XI</b>		1	<b>1</b>
<b>Demetrius III</b>	2	2	<b>4</b>
<b>Philip I</b>	8		<b>8</b>
<b>Antiochus XII</b>		6	<b>6</b>
<b>Cleopatra Selene and Antiochus XIII</b>		1	<b>1</b>
<b>Antiochus XIII</b>	1		<b>1</b>
<b>Philip I, posthumous issue</b>	6		<b>6</b>
<b>Uncertain ruler</b>		1	<b>1</b>
<b>Cappadocia – imitations of the tetradrachms</b>	4		<b>4</b>
<b>Unattributed “Celtic” imitations</b>	4	1	<b>5</b>

A relatively good overview of coin production is provided by the issues of Syrian cities (tab. 2). This category is completely dominated by Antioch on the Orontes (nos. 414–496) with the most intensive minting. The coinage of Antioch on the Orontes can be divided into four main groups. The first is represented by two types of bronzes of the autonomous coinage of the Seleucid period bearing the dates of the Seleucid Era (nos. 414–421). The next chronological phase is that of the civic coinage of the Pre-Roman Imperial period (64 B.C.–7 B.C.). This phase includes the production of tetradrachms imitating the coinage of Philip I (nos. 422–425) and the bronze civic issues (nos. 426–433). These coins are usually dated to the Caesarean or Pompeian Era. A particular case is that of the portrait tetradrachm of Marc Anthony and Cleopatra VII (no. 434) struck at Antioch on the Orontes but in a secondary mint. The third group of Antioch coins is represented by the civic coinage of the Roman Imperial period (nos. 435–443). These are bronze denominations mainly from the 1st century A.D. without portraits or names of Roman emperors, dating from the Caesarean and Actian Eras to the latest issue from 158/9 A.D. (no. 443). The most numerous group of issues of Antioch on the Orontes is represented by Roman Provincial coinage (nos. 444–496). This numerical representation reflects a massive production of silver, and later billon tetradrachms as well as bronze denominations. The Roman Provincial coinage of Antioch has been studied in detail (*Prieur – Prieur 2000; McAlee 2007; RPC 1; RPC 2; RPC 3; RPC 7/2 online; RPC 8 online; RPC 9*), the latest issues being minted under Valerian I (253–260 A.D.). The basic classification criterion of this group is the location of the portrait and the name on the obverse. Tetradrachms always bear legends exclusively in Greek whereas on bronze coins both Latin and Greek were used. Although the Antioch on the Orontes coinage assemblage is relatively representative, it emerged in a completely haphazard way – apart from a few pieces from the Veselý (nos. 416, 418, and 420–421) and Mašek (nos. 423, 425, and 427) Collections, it prevalently consists of coins from the National Museum’s earlier acquisitions.

Another fairly representative assemblage among the Syrian cities comes from Seleucia in Pieria (nos. 498–517; tab. 2), a significant number of these coins come from the Veselý collection (nos. 498–506, and 508–513). These coins can also be divided into several groups. The first is represented by the autonomous civic coinage of the Seleucid period (nos. 498–506). These are civic issues from the period under the Seleucid rulers, but without their portraits and names. If these coins bear a date (such as no. 501) it is of the Seleucid Era. They are chronologically followed by Seleucid period civic coinage from the first half of the 1st century B.C. (nos. 507–511). The dates on these coins are those of the local civic era. A case apart is that of two coins of the ‘Brother Peoples’ – Seleucid period from 148/7 B.C. (nos. 512–513). The fourth group is represented by two coins of the civic coinage of the Roman Imperial period, i.e. city coins without a portrait and the name of the Roman emperor from 80/81 A.D. (nos. 514–514). The last group is represented by two coins of the Roman Provincial coinage (nos. 516–517) with an imperial portrait.

Other Syrian cities are represented in the collection by incomparably fewer coins (tab. 2). Laodicea by the Sea, called Ioulieia in Roman times, is represented by seven pieces (nos. 518–524). These coins can also be divided into several groups. The set of the city of Apamea on the Axios (nos. 525–533) is interesting, of which five specimens come from the Veselý Collection (nos. 525–529). The first group is represented by autonomous civic coinage of the Seleucid period (nos. 525–526), i.e., civic coins from the period under Seleucid rule, dated to the Seleucid Era. The second group is represented by civic coinage of the Seleucid period from the first half of the 1st century B.C. (nos. 527–529), again dated by the Seleucid Era. The third group is represented by three coins of the civic coinage of the Pre-Roman imperial period, i.e. civic coins from 40/39 to 30/29 B.C. dated by the Seleucid and Antonian Eras (nos. 530–532). The last group is represented by one piece of Roman Imperial period civic coinage from the reign of Augustus with the date by the Seleucid Era and without the portrait of the ruler (no. 533). The city of Seleucia on the Bay of Issus is represented by a single specimen from the Veselý Collection (no. 534). It is a published specimen of a very rare coin (*Franke 1993*, 183, Pl. XIV:5). The rest of Syrian cities (Damascus, Heliopolis, Cyrrhus, and Emesa) are represented by a total of seven Roman Provincial coins (nos. 535–541).

**Tab. 2.** Overview of Syrian cities coins represented in the collections of the National Museum.

	AR	Bill.	AE	Σ
<b>Antioch on the Orontes</b> – Seleucid period			8	<b>8</b>
<b>Antioch on the Orontes</b> – Pre-roman imperial period	5		8	<b>13</b>
<b>Antioch on the Orontes</b> – Roman imperial period			9	<b>9</b>
<b>Antioch on the Orontes</b> – Roman Provincial coinage	17	16	20	<b>53</b>
<b>Seleucia in Pieria</b> – Seleucid period	1		13	<b>14</b>
<b>Seleucia in Pieria</b> – Brother Peoples			2	<b>2</b>
<b>Seleucia in Pieria</b> – Roman imperial period			2	<b>2</b>
<b>Seleucia in Pieria</b> – Roman Provincial coinage			2	<b>2</b>
<b>Laodicea by the Sea</b> – Seleucid period	1		1	<b>2</b>
<b>Laodicea by the Sea</b> – Roman Imperial period			1	<b>1</b>
<b>Laodicea by the Sea</b> – Roman Provincial coinage			4	<b>4</b>
<b>Apamea on the Axios</b> – Seleucid period			5	<b>5</b>
<b>Apamea on the Axios</b> – Pre-roman Imperial period			3	<b>3</b>
<b>Apamea on the Axios</b> – Roman Imperial period			1	<b>1</b>
<b>Seleucia on the Bay of Issus</b> – Seleucid period			1	<b>1</b>
<b>Damascus</b> – Roman Provincial coinage			1	<b>1</b>
<b>Heliopolis</b> – Roman Provincial coinage			2	<b>2</b>
<b>Cyrrhus</b> – Roman Provincial coinage			2	<b>2</b>
<b>Emesa</b> – Roman Provincial coinage			2	<b>2</b>

A total of 56 pieces represent Phoenician coinage (nos. 541–596; tab. 3). Like the previous group, these coins have never been the subject of a systematic collecting effort by the National Museum and the current collection has therefore been formed mostly randomly. Some rare pieces were purchased from F. Zapletal (nos. 544, 546–547, 549, and 582–583). Some Phoenician cities are represented here only by single pieces – Ake-Ptolemaïs (nos. 541–542), Berythus (nos. 560–563), Byblus (no. 564), or Marathus (nos. 565–566). The city of Tripolis is represented by a single tetradrachm (no. 582) dated

to 104/3 B.C. with the date by the Seleucid Era. It is a coin of an exquisitely rendered depiction of Dioscuri on the obverse, clearly reflecting Seleucid coinage in style. A bronze denomination of the city of Simyra dating from the Hellenistic period is also relatively rare (no. 581).

The collection includes a relatively large number of coins of the city of Aradus (nos. 543–559), which reflects the historical development of this site. The earliest horizon is represented by the Persian period coins from the 4th century B.C. (nos. 543–546) with the head of Ba'al-Arwad on the obverse, and a galley on the reverse. The Hellenistic period is represented by drachms from the 2nd century B.C. dated by the local civic era (nos. 547–549), with the motif of a bee and a deer, imitating the coinage of the city of Ephesus. Another group is represented by tetradrachms with a bust of Tyche on the obverse and a standing Nike on the reverse (nos. 550–552) struck during the first half of the 1st century B.C. and dated by the local civic era. The hemidrachm dated to 117/6 B.C. (no. 553) by the Aradian Era is of a hitherto unpublished issue year. Bronze denominations from the 2nd and 1st centuries B.C. bear on the obverses the bust of Tyche (nos. 554–556) or the head of Zeus (nos. 557–559). The reverses bear a ship's prow with a Phoenician dating by the Aradian Era.

The town of Sidon (nos. 567–580) is represented by a total of 14 coins in the collection. The first group is represented by royal coins of the Persian period (nos. 567–569). The next group consists of civic coinage of the Hellenistic period (nos. 570–572), with the reverse side of the tetradrachm no. 570 alluding to the tetradrachms of Tyre. Issues of the Roman Imperial period can be divided into an earlier group without the name of the ruler (nos. 573–573), and later issues with his portrait (nos. 578–580).

The city of Tyre is represented by a total of 14 coins (nos. 582–596). Only one shekel specimen comes from the Persian period (no. 583). Civic coinage of the Hellenistic period is represented mainly by tetradrachms dating to the years of the local civic era (nos. 584–589), as well as by two bronze denominations (nos. 590–591). Civic coinage of the Roman Imperial period is represented by two bronze denominations (nos. 592–593). A contemporary counterfeit of a tetradrachm (no. 594) may also belong to the same period. Two tetradrachms with portraits of Roman rulers belong to Roman provincial coinage (nos. 595–596).

**Tab. 3.** Overview of Phoenician coins in the collections of the National Museum.

	AR	AE	Σ
<b>Ake-Ptolemais</b> , City – Seleucid period		1	1
<b>Ake-Ptolemais</b> , City – Roman provincial coinage	1		1
<b>Aradus</b> , City – Persian period	4		4
<b>Aradus</b> , City – Hellenistic period	7	5	12
<b>Berythus</b> , City – Hellenistic period		1	1
<b>Berythus</b> , City – Roman provincial coinage		3	3
<b>Byblus</b> , City – Roman provincial coinage		1	1
<b>Marathus</b> , City – Hellenistic period		2	2
<b>Sidon</b> , Kings – Persian period	2	1	3
<b>Sidon</b> , City – Hellenistic period	1	2	3
<b>Sidon</b> , City – Roman imperial period		4	4
<b>Sidon</b> , City – Roman provincial coinage		4	4
<b>Simyra</b> , City – Hellenistic period		1	1
<b>Tripolis</b> , City – Seleucid period	1		1
<b>Tyre</b> , City – Hellenistic period	7	2	9
<b>Tyre</b> , City – Roman imperial period		3	3
<b>Tyre</b> , City – Roman provincial coinage	2		2

The coins related to ancient Judaea in the collections of the National Museum present a modest assemblage of 95 pieces and a brief overview on the topic. All the main periods in the short and turbulent history of ancient Jewish coinage as well as the issues of Roman governors are represented almost equally, though far from being comprehensive.

The Hasmonean coinage (nos. 597–616) is represented by *prutot* of John Hyrcanus I, Judas Aristoboulos and Alexander Jannaeus, and one large denomination of Mattathias Antigonus. The Herodian issues in our collection are those of Herod the Great, Herod Archelaus and Herod Agrippa I. (nos. 617–627). Among the coins struck by Roman governors of ancient Judaea (nos. 628–652) only the issues of Coponius are missing. The coinage of the First Jewish Revolt (nos. 653–670) is represented with one silver shekel, the rest being the bronze denominations. The greatest variability within our collection displays the assemblage from the time of the Bar Kokhba Revolt (671–690) comprising silver as well as bronze denominations.

Only two pieces struck in Aelia Capitolina (no. 691) and Tiberias (no. 692) during the reign of Hadrian rank among the Roman Provincial coinage.

Neither the collection of the coins related to ancient Judaea was built systematically. It comprises earlier and unidentified acquisitions, later individual accessions of the Náprstek Museum and the Department of Numismatics, and even confiscated specimens. Only tiny number of discussed pieces belong to the former B. Augst Collection; in terms of this acquisition, however, all the main periods of the Jewish coinage are illustrated by two or more examples. Rather surprisingly, only one piece (no. 601) was purchased from the well-known collector and dealer in antiquities F. Zapletal.

**Tab. 4.** Overview of Judean coins in the collections of the National Museum.

	AR	AE	Σ
<b>John Hyrcanus I</b> (134–104 B.C.)		2	2
<b>Judas Aristoboulos I</b> (104–103 B.C.)		1	1
<b>Alexander Jannaeus</b> (103–76 B.C.)		16	16
<b>Mattathias Antigonus</b> (40–37 B.C.)		1	1
<b>Herod the Great</b> (40–4 B.C.)		2	2
<b>Herod Archelaus</b> (4 B.C.–6 A.D.)		1	1
<b>Herod Agrippa I</b> (37–44 A.D.)		9	9
<b>M. Ambibulus</b> (9–12 A.D.)		3	3
<b>Valerius Gratus</b> (15–26 A.D.)		2	2
<b>Pontius Pilatus</b> (26–36 A.D.)		3	3
<b>Antonius Felix</b> (52–59 A.D.)		17	17
<b>First Jewish Revolt</b> (66–70 A.D.)	1	17	17
<b>Bar Kokhba Revolt</b> (132–136 A.D.)	10	10	20
<b>Aelia Capitolina</b>		1	1
<b>Tiberias</b>		1	1

Mesopotamian coinage is represented only in single digits in the Prague collection (tab. 5). Two coins of Caracalla come from the city of Carrhae, including one tetradrachm (nos. 693–694). The city of Edessa is represented here by bronze denominations – examples of Royal and Roman provincial coinage – of Septimus Severus with Abgar VIII (nos. 695–696) and Gordian III with Abgar X (nos. 697–699). The city of Nisibis is represented by two coins from the Roman provincial coinage category (nos. 700–701), as is the city of Singara (nos. 702–703). Three Roman Provincial coins come from Commagene, specifically from the city of Samosata (nos. 704–706; tab. 5).

**Tab. 5.** Overview of Mesopotamian and Commagene coins in the collections of the National Museum.

	AR	AE	Σ
<b>MESOPOTAMIA</b>			
<b>Carrhae</b> , city – Roman Provincial coinage	1	1	2
<b>Edessa</b> , city – Royal and Roman Provincial coinage		5	5
<b>Nisibis</b> , city – Roman Provincial coinage		2	2
<b>Singara</b> , city – Roman Provincial coinage		2	2
<b>COMMAGENE</b>			
<b>Commagene</b> , city – Roman Provincial coinage		3	3

Armenian coins represent a completely marginal segment of the presented collection (tab. 6). The coinage of the Kingdom of Armenia has recently been comprehensively treated, including new mint attributions (*Kovacs 2016*). Only two coins of Tigranes II – a tetradrachm and a drachm (nos. 707–708) – are represented in the Prague collection. A very rare piece is a bronze denomination of Artavasdes I, the ruler of Media Atropatene (no. 709) which was an Armenian sub-kingdom.

**Tab. 6.** Overview of Armenian coins in the collections of the National Museum.

	AR	AE	Σ
<b>Tigranes II</b> (96–56 B.C.)	2		<b>2</b>
<b>Media Atropatene, Artavasdes</b> (c. 56–30 B.C.)		1	<b>1</b>

The Prague collection includes 15 Arabian coins (tab. 7). The coins of the Nabatean Kingdom are represented by three bronze denominations from the Petra mint (nos. 710–712). The Kingdom of Saba' is represented by silver imitations of the Athenian 'Old Style' (nos. 713–717) and 'New Style' (no. 718) coinage. The silver denominations of the 'Bucranium' Series, also of the Kingdom of Saba', were minted in the 2nd to 3rd centuries A.D. (nos. 719–721). Three silver specimens in the collection come from Himyar issued by Amdan Bayan Yuhaqbid (nos. 722–724). Still within Arabia, one piece of the Roman Provincial coinage comes from the city of Bostra (no. 725).

**Tab. 7.** Overview of Arabian coins in the collections of the National Museum.

	AR	AE	Σ
<b>Nabatea, Aretas IV</b> (9 B.C.–40 A.D.)		1	<b>1</b>
<b>Nabatea, Malichus II</b> (40–70 A.D.)		1	<b>1</b>
<b>Nabatea, Rabbel II</b> (70–106 A.D.)		1	<b>1</b>
<b>Saba', kingdom</b>	9		<b>9</b>
<b>Himyar, Amdan Bayan Yuhaqbid</b> (c. 100–120 A.D.)	3		<b>3</b>
<b>Bostra, city – Roman provincial coinage</b>		1	<b>1</b>

## COMMENTARY ON THE XRF ANALYSES

Marek Fikrle – Petr Veselý

### INTRODUCTION

As in previous catalogues of the coin collection in the National Museum, a basic archaeometallurgical survey was carried out. X-ray fluorescence analysis (XRF) was again chosen as the analytical tool. The principle of the method has been described in previous catalogues (*SNG Prague I/3*, 10–11; *SNG Prague I/10*, 14–21), so only a very brief overview will be published here. XRF is an analytical method that uses characteristic X-rays to determine the elemental composition of a sample. Characteristic X-rays are photons emanating from the inner shells of an atom due to the release of electrons by an external source and the filling of gaps with electrons from the upper shells. For the analysis of metals, it is referred to as the surface method. There are two interrelated reasons – (1) the external source has limited energy, i.e., limited penetration into the material, and (2) the emitted X-rays, which also have different energies, have a limited ability to escape from the sample. Here is the main problem of XRF analyses of historical material.

Let us explain this with a simple (and simplified) example. Historical silver coins typically contain 80–95% silver and 5–20% copper (as mentioned, this is a simplified example, so Au, Pb, Bi and other elements are neglected). Characteristic X-rays from copper (in the material defined above) can escape from a depth of approximately 20 to 30 μm, but characteristic photons from silver are able to escape from a depth of approximately 270 to 350 μm (for the K line).<sup>1</sup> Thus, the analytical volume for silver (in the same sample) is approximately one order of magnitude larger than for copper. For a homogeneous sample, this is not a major problem, and the solution is proper calibration. In the case of a historical artefact, however, we have very superficial information about homogeneity, especially depth homogeneity. For this reason alone, the measured data are burdened with uncertainties that are, at the very least, very difficult to determine. The most common consequence of this phenomenon is a higher concentration of silver and a lower concentration of copper than would correspond to reality. The solution is not so easy. The so-called hydrostatic method developed by Richtera (*Richtera – Zmrzly 2016*) is helpful, but even this has its limitations. This phenomenon must be kept in mind when analysing these historical artefacts.

<sup>1</sup> A brief explanatory note should be made – for the L line of silver, the depth is only 7.5 to 8.2 μm (interesting for comparison with other measurements such as SEM-EDS).

## EXPERIMENTAL

Analyses were performed on a commercial Spectro Midex (3rd generation) instrument. A Mo X-ray tube (voltage 45 kV; current 0.5 mA) was used as the radiation source. Each coin (except for a few exceptions mentioned below) was measured at three different locations on the surface using a 0.1 mm square collimator (i.e. an area of approximately 0.01 mm<sup>2</sup>).

The use of three measurement points was a compromise between a large finite data set and some effort to at least partially affect the homogeneity of the analysed material. One of the features of the equipment used is that it takes a snapshot of each measurement point. It is therefore possible to subsequently link the analytical results to simple images. This can be particularly advantageous if the data are different. If the sample is homogeneous, the differences are more or less statistical (because the measurement process is). A large inhomogeneity means chaotic data and three measurements are not enough. The last possibility is that one measurement differs. If there is a simple explanation, such as a visually different site or the knowledge that the surface of the coin has been altered (either in historical time or in the present), then interpretation of the data is also simple. The problem is when the artefact looks homogeneous and numismatic research assumes no possibility of manipulation. In these cases, the only correct way is to present the entire data set.

## SELEUCID AND RELATED COINS

A total of 161 coins were analysed by XRF, including 2 gold staters of Seleucus I, 143 Seleucid silver coins and 16 non-Seleucid silver coins including 3 non-official imitations of Seleucid coins.<sup>2</sup> Due to the limited measurement capacity, only coins made of gold and silver were analysed. The composition of the examined corpus in terms of coin denominations is shown in the tabular overview (tab. 8). Analyses of the metal composition of Seleucid coins have generally received less attention so far. (for example: *Alinezhad – Dehpahlavan – Rashti – Oliayi 2019*).

**Tab. 8.** Analysed coins according to denomination.

	AV staters	AR tetradrachms and staters	AR didrachms and drachms	Lower denominations	Total
Seleucid gold coins	2				2
Seleucid silver coins		102	32	9	143
Other silver coins		12	3		16

In total, the following 10 elements were measured: silver (Ag), arsenic (As), gold (Au), bismuth (Bi), copper (Cu), iron (Fe), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn). In addition to these elements, trace presence of bromine (Br) was detected in 15 coins, of iodine (I) in one coin and of selenium (Se) in one coin. These trace elements are not subject to further analyses. The reason is twofold. First, bromine and iodine are not a part of the alloy, but only of the corrosion layer; second, selenium – usually below the detection limit – needs to be reported only because it reflects the association with the ore used. Several independent XRF measurements were made for each coin to determine the content of the ten elements listed above. Three independent XRF measurements were performed for 157 coins, two measurements were made for one coin and four independent measurements were made for three coins.<sup>3</sup> For one coin, one of the three independent measurements was not taken into account due to unrealistic results.<sup>4</sup> For the other coins, the results of all independent measurements were considered.

The measured values of each element were adjusted as follows: if the result of any measurement was below the tolerance detection limit, the value of that measurement was taken to be half of that limit (concerns As, Bi, Fe, Pb, Ni and Zn). The average of the adjusted values was then calculated for each coin and each element. However, if the presence of an element was not confirmed across all independent measurements, then this average was set equal to zero.

2 The non-official imitations of Seleucid coins are represented by one imitation of drachms of Antiochus III (no. 410) and by two imitations of drachms of Alexander I (nos. 412 and 413).

3 Two measurements were performed for one coin of a Young Antiochus Epiphanes (drachm, no. 310). Four measurements were performed for three coins of Antiochus VIII (tetradrachm, no. 352), Antiochus IX (drachm, no. 353) and Philip I Philadelphus (tetradrachm, no. 386).

4 A tetradrachm of Seleucus I (no. 32). The excluded measurement showed a silver content of 89.9%, while the total content of all measured elements was only 91%. This indicates that this measurement was significantly distorted by some impurity on the surface of the coin. This problem may be caused by light elements that are not detectable by the method in the settings used, but the system knows that “something” is there. Or it may be caused by the surface of the coin not being flat at the point of measurement and some of the radiation that should be detected not reaching the detector. Of course (and most likely) it could be some combination of both.



Elements Ag, Au, Bi, Cu and Pb were detected in all examined coins. The only exception is Antiochus VI, for whom bismuth was not detected on any of his coins. The presence of iron was reliably confirmed in 23 coins. Arsenic was detected in 8 coins (two coins of Seleucus III and six coins of Antiochus VI). In all measurements of these eight coins, however, its measured value was below the tolerance limit. For this reason, it was not considered in further analyses. The remaining three elements, that is Hg, Ni and Zn, were not confirmed on any coin by all independent measurements. Therefore, they are also not included in the following tables and analyses.

The average values of all measurements of Ag, Au, Cu, Pb, Bi and Fe calculated in the above manner are shown in the tabular overview (tab. 9). Aggregated values for individual Seleucid rulers are shown in the tabular overview (tab. 10). The order of the rulers in the table corresponds to their order in the catalogue and thus roughly to their chronological sequence (the reigns of some rulers overlapped in time). Analogous aggregation of non-Seleucid coins is shown in the tabular overview (tab. 11). The values in these two tables (tabs. 10–11) were calculated by averaging the values of the corresponding rows in the tabular overview (tab. 9). Note that the row sums in the tabular overviews (tabs. 9–11) do not equal to 100%. This is partly due to the possible presence of other elements, partly due to the above approximation for sublimit measurements and measurement errors. If we compare the data in the tabular overview (tab. 10) with those reported in the literature (*Nadooshan – Azizipoor – Safari 2009*), they agree very well.

**Tab. 9.** Elemental concentrations of the gold and silver coins.

Ruler	Cat. no.	Denomination	Mint	Ag	Au	Cu	Pb	Bi	Fe
<b>SELEUCID COINS</b>									
<b>Seleucus I Nicator</b>	11	Tetradrachm	Antigonea on the Orontes or Seleucia in Pieria	98.77%	0.47%	0.30%	0.41%	0.03%	
	13	AV Stater	Carrhae	0.85%	98.90%	0.20%	0.03%	0.03%	
	14	Tetradrachm	Carrhae	98.90%	0.56%	0.27%	0.23%	0.03%	
	15	Tetradrachm	Carrhae	98.80%	0.54%	0.40%	0.13%	0.03%	
	16	Tetradrachm	Carrhae	98.97%	0.62%	0.27%	0.05%	0.03%	
	17	Tetradrachm	Carrhae	97.47%	0.53%	1.54%	0.30%	0.03%	
	18	AV Stater	Babylon I	0.20%	98.63%	0.57%			
	19	Tetradrachm	Babylon I	98.73%	0.61%	0.30%	0.32%	0.03%	
	22	Tetradrachm	Babylon I	99.13%	0.38%	0.19%	0.21%	0.03%	
	24	1/30 Stater	Babylon I	98.83%	0.70%	0.25%	0.15%	0.03%	
	26	Stater	Babylon II	95.87%	0.55%	2.99%	0.28%	0.03%	
	27	Obol	Babylon II	92.70%	2.28%	1.22%	2.07%	0.03%	0.33%
	28	Tetradrachm	Seleucia on the Tigris I	99.10%	0.56%	0.16%	0.13%	0.03%	0.10%
	29	Drachm	Seleucia on the Tigris I	98.83%	0.72%	0.27%	0.09%	0.03%	
	30	Tetradrachm	Seleucia on the Tigris I	98.10%	0.67%	0.96%	0.20%	0.03%	
	32	Tetradrachm	Seleucia on the Tigris II	99.05%	0.61%	0.19%	0.05%	0.03%	
	33	Tetradrachm	Seleucia on the Tigris II	99.03%	0.62%	0.27%	0.06%	0.03%	
37	Tetradrachm	Ecbatana	98.87%	0.74%	0.18%	0.16%	0.03%		
38	Obol	Ai Khanoum	93.27%	0.52%	5.68%	0.17%	0.03%	0.10%	
<b>Antiochus I Soter</b>	39	Tetradrachm	Pergamum	98.73%	0.40%	0.14%	0.51%	0.18%	
	47	Tetradrachm	Antioch on the Orontes	98.60%	0.81%	0.33%	0.11%	0.03%	
	58	Tetradrachm	Seleucia on the Tigris	99.07%	0.65%	0.17%	0.05%	0.03%	
	59	Tetradrachm	Seleucia on the Tigris	98.87%	0.82%	0.19%	0.03%	0.03%	
	60	Tetradrachm	Seleucia on the Tigris	99.03%	0.63%	0.20%	0.05%	0.03%	
	62	Drachm	Seleucia on the Tigris	99.03%	0.56%	0.26%	0.07%	0.03%	
	63	Tetradrachm	Susa	98.63%	0.89%	0.25%	0.15%	0.03%	
	64	Tetradrachm	Ecbatana	98.23%	0.97%	0.26%	0.48%	0.03%	
	66	Drachm	Ai Khanoum	97.97%	1.22%	0.70%	0.05%	0.03%	

Ruler	Cat. no.	Denomination	Mint	Ag	Au	Cu	Pb	Bi	Fe
<b>Antiochus II Theos</b>	68	Tetradrachm	Sardes	99.07%	0.65%	0.22%	0.03%	0.03%	
	87	Drachm	Alinda or Mylasa	98.70%	0.80%	0.30%	0.12%	0.03%	
	90	Tetradrachm	Antioch on the Orontes	98.23%	1.07%	0.22%	0.14%	0.04%	0.20%
	91	Tetradrachm	Antioch on the Orontes	98.58%	0.78%	0.39%	0.18%	0.03%	
	95	Tetradrachm	Antioch on the Orontes	98.47%	0.73%	0.47%	0.13%	0.03%	0.17%
	100	Tetradrachm	Seleucia on the Tigris	99.00%	0.72%	0.18%	0.03%	0.03%	0.10%
	101	Tetradrachm	Ecbatana	98.00%	1.35%	0.31%	0.28%	0.03%	
	103	Tetradrachm	Alexandria in Aria (Artacoana)	99.07%	0.43%	0.34%	0.11%	0.03%	
<b>Seleuos II Callinicus</b>	109	Drachm	Magnesia on the Meander	98.33%	0.84%	0.34%	0.21%	0.03%	
	110	Tetradrachm	Antioch on the Orontes	98.17%	0.21%	1.32%	0.03%	0.03%	
	112	Tetradrachm	Nisibis	98.60%	0.63%	0.39%	0.08%	0.03%	
	113	Tetradrachm	Nisibis	98.03%	0.91%	0.58%	0.26%	0.03%	
	114	Obol	Nisibis	66.83%	0.32%	29.93%	0.14%	0.03%	0.49%
	115	Drachm	Commagene or Western Mesopotamia	91.00%	0.64%	7.49%	0.13%	0.03%	
	116	Tetradrachm	Seleucia on the Tigris	98.47%	0.73%	0.18%	0.41%	0.03%	
<b>Antiochos Hierax</b>	119	Tetradrachm	Lampsakos	98.23%	0.76%	0.21%	0.54%	0.03%	
<b>Seleucus III Soter (Keraunos)</b>	120	Tetradrachm	Antioch on the Orontes	98.20%	0.72%	0.67%	0.25%	0.03%	
	125	Tetradrachm	Susa	97.93%	1.19%	0.38%	0.29%	0.03%	
<b>Antiochus III</b>	149	Tetradrachm	Antioch on the Orontes	98.33%	0.79%	0.17%	0.49%	0.03%	
	150	Tetradrachm	Antioch on the Orontes	98.17%	0.87%	0.21%	0.44%	0.03%	
	161	Tetradrachm	ΔI mint. in Southern or Eastern Syria	96.77%	0.69%	0.98%	1.11%	0.03%	
	162	Tetradrachm	“Rose” mint. perhaps Edessa	98.53%	0.75%	0.22%	0.23%	0.04%	
	163	Tetradrachm	Seleucia on the Tigris	98.67%	0.81%	0.21%	0.07%	0.03%	0.10%
	165	Drachm	Nothern Media or Hyrkania	97.77%	0.55%	0.69%	0.64%	0.03%	0.10%
	<b>Seleucus IV Philopator</b>	170	Drachm	Soli	98.03%	1.36%	0.39%	0.08%	0.03%
171		Tetradrachm	Antioch on the Orontes	97.93%	0.73%	0.65%	0.39%	0.03%	
173		Tetradrachm	Antioch on the Orontes	97.27%	0.70%	1.10%	0.51%	0.03%	
<b>Antiochus IV Epiphanes</b>	179	Tetradrachm	Antioch on the Orontes	98.20%	0.71%	0.41%	0.32%	0.03%	0.10%
	180	Tetradrachm	Antioch on the Orontes	98.37%	1.01%	0.23%	0.13%	0.03%	
	181	Drachm	Antioch on the Orontes	97.57%	0.64%	0.84%	0.58%	0.03%	
	202	Tetradrachm	Seleucia on the Tigris	98.67%	0.67%	0.37%	0.10%	0.03%	
<b>Antiochus V Eupator</b>	204	Tetradrachm	Antioch on the Orontes	98.20%	1.09%	0.31%	0.18%	0.03%	
<b>Demetrius I Soter</b>	207	Tetradrachm	Tarsos	96.00%	0.72%	1.55%	1.07%	0.15%	0.10%
	208	Tetradrachm	Antioch on the Orontes	98.13%	0.76%	0.56%	0.32%	0.03%	
	209	Tetradrachm	Antioch on the Orontes	97.27%	0.62%	0.96%	0.67%	0.14%	0.10%
	210	Tetradrachm	Antioch on the Orontes	97.07%	1.08%	1.13%	0.38%	0.07%	
	211	Tetradrachm	Antioch on the Orontes	98.03%	0.90%	0.55%	0.26%	0.03%	
	212	Drachm	Antioch on the Orontes	97.43%	0.88%	0.57%	0.74%	0.03%	
	214	Drachm	Antioch on the Orontes	98.27%	1.14%	0.24%	0.17%	0.03%	
	224	Tetradrachm	Antioch on the Persian Gulf	96.17%	0.68%	2.18%	0.38%	0.04%	
	225	Tetradrachm	unattributed Southeastern issue	98.03%	0.66%	0.82%	0.27%	0.04%	

Ruler	Cat. no.	Denomination	Mint	Ag	Au	Cu	Pb	Bi	Fe
<b>Alexander I Balas</b>	226	Drachm	Antioch on the Orontes	98.17%	1.14%	0.43%	0.18%	0.03%	
	228	Drachm	Antioch on the Orontes	97.13%	0.72%	1.24%	0.81%	0.05%	
	229	Hemidrachm	Antioch on the Orontes	98.17%	0.59%	0.52%	0.59%	0.03%	
	235	Tetradrachm	uncertain mint 87 in Northern Syria	97.50%	0.76%	1.06%	0.57%	0.06%	
	237	Tetradrachm	Seleucia a on the Tigris	96.10%	0.88%	2.64%	0.23%	0.03%	
<b>Demetrius II Nicator, 1st reign</b>	239	Drachm	Antioch on the Orontes	97.60%	0.82%	1.03%	0.47%	0.03%	
	241	Tetradrachm	Tyre	98.40%	0.54%	0.62%	0.35%	0.06%	
	242	Didrachm	Tyre	98.80%	0.72%	0.20%	0.20%	0.03%	
	245	Tetradrachm	Seleucia on the Tigris	96.20%	0.78%	2.18%	0.74%	0.03%	
<b>Antiochus VI Dionysos</b>	246	Tetradrachm	Antioch on the Orontes	99.30%	0.21%	0.39%	0.03%		
	247	Tetradrachm	Antioch on the Orontes	98.23%	0.29%	0.89%	0.57%		
	248	Drachm	Antioch on the Orontes	96.53%	0.74%	1.55%	1.04%		
	249	Drachm	Antioch on the Orontes	95.93%	0.75%	1.58%	1.65%		
	251	Drachm	Antioch on the Orontes	95.43%	0.73%	2.34%	1.34%		
	252	Drachm	Antioch on the Orontes	97.20%	0.66%	0.53%	1.38%		
<b>Tryphon</b>	261	Drachm	Antioch on the Orontes	98.10%	0.91%	0.43%	0.51%	0.03%	0.10%
<b>Antiochus VII Euergetes (Sidetes)</b>	265	Drachm	Tarsos	97.30%	0.58%	1.26%	0.76%	0.03%	
	266	Hemidrachm	Tarsos	98.73%	0.54%	0.55%	0.15%	0.03%	
	267	Tetradrachm	Antioch on the Orontes	96.50%	0.59%	2.19%	0.56%	0.03%	
	268	Tetradrachm	Antioch on the Orontes	97.57%	0.53%	0.64%	1.06%	0.15%	
	269	Tetradrachm	Antioch on the Orontes	95.43%	0.56%	2.31%	1.33%	0.11%	
	284	Drachm	uncertain mint 101 in Syria, Northern Mezopotamia or Cilicia	96.40%	0.67%	1.22%	1.64%	0.03%	
	285	Drachm	uncertain mint 101, in Syria, Northern Mezopotamia or Cilicia	95.37%	0.82%	2.50%	1.12%	0.03%	
	286	Tetradrachm	Sidon	98.63%	0.70%	0.47%	0.13%	0.03%	
	288	Tetradrachm	Tyre	97.13%	0.53%	1.75%	0.49%	0.03%	
	290	Didrachm	Tyre	97.00%	0.54%	1.20%	0.65%	0.09%	
294	Tetradrachm	Seleucia on the Tigris	98.60%	0.85%	0.43%	0.10%	0.03%		
<b>Demetrius II Nicator, 2nd reign</b>	296	Tetradrachm	Antioch on the Orontes	98.00%	0.32%	0.58%	1.02%	0.06%	
	297	Tetradrachm	Antioch on the Orontes	96.20%	0.62%	0.94%	2.19%	0.05%	
	303	Drachm	uncertain mint 111 in Northern Syria	96.93%	0.66%	1.77%	0.38%	0.20%	0.10%
	304	Drachm	unattributed drachm issues of Northern Syria	99.10%	0.42%	0.33%	0.05%	0.07%	
	305	Tetradrachm	Damascus	95.00%	0.42%	3.35%	0.87%	0.27%	
	306	Tetradrachm	Tyre	99.07%	0.42%	0.22%	0.14%	0.03%	
	309	Tetradrachm	Tyre	97.40%	0.51%	1.03%	0.83%	0.08%	
<b>A Young Antiochus Epiphanes</b>	310	Drachm	Antioch on the Orontes	96.65%	0.95%	1.34%	0.92%	0.04%	
<b>Alexander II Zabinas</b>	311	Tetradrachm	Antioch on the Orontes	96.00%	0.37%	1.40%	1.40%	0.40%	
	312	Tetradrachm	Antioch on the Orontes	98.20%	0.69%	0.55%	0.34%	0.03%	0.10%
	313	Tetradrachm	Antioch on the Orontes	94.07%	0.50%	3.50%	1.57%	0.12%	
	314	Tetradrachm	Antioch on the Orontes	98.27%	0.54%	0.65%	0.37%	0.09%	
	315	Tetradrachm	Antioch on the Orontes	96.83%	0.55%	2.08%	0.29%	0.08%	
	316	Drachm	Antioch on the Orontes	97.77%	0.49%	0.97%	0.62%	0.12%	0.10%

Ruler	Cat. no.	Denomination	Mint	Ag	Au	Cu	Pb	Bi	Fe
<b>Cleopatra Thea and Antiochus VIII Epiphanes</b>	330	Tetradrachm	Antioch on the Orontes	97.73%	0.56%	1.13%	0.40%	0.05%	
	332	Tetradrachm	Damascus	97.50%	0.51%	1.28%	0.46%	0.08%	0.10%
	333	Tetradrachm	Damascus	96.10%	0.45%	2.83%	0.27%	0.25%	
<b>Antiochus VIII Epiphanes</b>	334	Tetradrachm	Tarsos	96.93%	0.52%	1.79%	0.50%	0.03%	
	335	Tetradrachm	Antioch on the Orontes	95.40%	0.28%	2.93%	1.03%	0.03%	
	339	Tetradrachm	Antioch on the Orontes	98.40%	0.60%	0.67%	0.21%	0.05%	0.10%
	340	Drachm	Antioch on the Orontes	97.17%	0.64%	1.81%	0.15%	0.03%	
	347	Tetradrachm	Antioch on the Orontes	96.97%	0.54%	1.87%	0.34%	0.06%	
	350	Tetradrachm	Damascus	97.13%	0.59%	1.72%	0.26%	0.16%	
	351	Tetradrachm	Ake-Ptolemais	94.97%	0.64%	3.47%	0.56%	0.12%	
	352	Tetradrachm	Ake-Ptolemais	98.12%	0.65%	0.76%	0.37%	0.05%	0.10%
<b>Antiochus IX Eusebes Philopator</b>	353	Drachm	Tarsos	94.88%	0.63%	2.66%	1.25%	0.03%	
	355	Tetradrachm	Antioch on the Orontes	98.33%	0.70%	0.53%	0.22%	0.03%	
	356	Tetradrachm	Antioch on the Orontes	94.73%	0.59%	3.49%	0.78%	0.06%	
	358	Drachm	Antioch on the Orontes	97.65%	0.94%	0.48%	0.80%	0.03%	
	362	Tetradrachm	Antioch on the Orontes	91.11%	0.34%	7.57%	0.47%	0.03%	
	363	Hemidrachm	Antioch on the Orontes	96.43%	0.54%	2.10%	0.50%	0.03%	
	367	Tetradrachm	Ake-Ptolemais	96.93%	0.47%	1.75%	0.65%	0.08%	
	368	Tetradrachm	Ake-Ptolemais	96.67%	0.45%	1.82%	0.52%	0.08%	
<b>Seleucus VI Epiphanes Nicator</b>	369	Tetradrachm	Antioch on the Orontes	89.93%	0.48%	8.59%	0.22%	0.03%	
	370	Tetradrachm	Antioch on the Orontes	96.47%	0.50%	2.46%	0.14%	0.05%	
	371	Drachm	Antioch on the Orontes	89.97%	0.59%	8.60%	0.14%	0.03%	
	372	Hemidrachm	Antioch on the Orontes	97.83%	0.51%	1.14%	0.15%	0.03%	
	373	Hemidrachm	Antioch on the Orontes	97.67%	0.46%	1.32%	0.28%	0.03%	
<b>Antiochus X Eusebes Philopator</b>	375	Tetradrachm	Antioch on the Orontes	97.23%	0.46%	1.73%	0.23%	0.03%	
	376	Tetradrachm	Antioch on the Orontes	96.00%	0.56%	2.87%	0.14%	0.03%	
<b>Demetrius III Eucareus</b>	378	Tetradrachm	Damascus	97.60%	0.69%	1.05%	0.22%	0.03%	
	379	Tetradrachm	Damascus	96.23%	0.62%	2.53%	0.17%	0.03%	
<b>Philip I Philadelphus</b>	382	Tetradrachm	Tarsos	88.93%	0.53%	8.95%	0.50%	0.07%	
	384	Tetradrachm	Tarsos	88.87%	0.42%	8.99%	0.69%	0.05%	
	385	Tetradrachm	Tarsos	95.73%	0.59%	2.53%	0.49%	0.03%	
	386	Tetradrachm	Tarsos	89.28%	0.46%	8.46%	0.66%	0.03%	
	388	Tetradrachm	Antioch on the Orontes	85.17%	0.46%	12.47%	0.76%	0.03%	
	389	Tetradrachm	Antioch on the Orontes	90.33%	0.52%	8.06%	0.32%	0.05%	
<b>Antiochos XIII Philadelphus</b>	397	Tetradrachm	Antioch on the Orontes	78.67%	0.47%	19.27%	0.21%	0.03%	0.10%
<b>OTHER COINS</b>									
<b>Ariarathes VI / Laodike and Ariarathes VII</b>	405	Tetradrachm	uncertain mint II in Cappadocia	94.43%	0.51%	3.97%	0.73%	0.29%	
	406	Tetradrachm	uncertain mint II in Cappadocia	94.83%	0.36%	3.91%	0.32%	0.29%	
<b>Ariarathes VII</b>	407	Tetradrachm	uncertain mint B in Kappadokia	96.77%	0.42%	1.98%	0.27%	0.25%	
	408	Tetradrachm	uncertain mint B in Cappadocia	96.73%	0.53%	1.91%	0.36%	0.16%	
<b>„Alexander I Balas“ (imitation)</b>	412	Drachm	Uncertain, barbarized	95.87%	0.49%	2.73%	0.40%	0.03%	0.10%
	413	Drachm	Uncertain, barbarized	97.40%	0.65%	1.32%	0.30%	0.03%	

Ruler	Cat. no.	Denomination	Mint	Ag	Au	Cu	Pb	Bi	Fe
„Antiochos III“ (imitation)	410	Drachm	Uncertain, barbarized	95.83%	0.61%	2.86%	0.24%	0.03%	
Laodikea by the Sea	519	Tetradrachm	Laodikea by the Sea	97.40%	0.69%	0.15%	1.24%	0.03%	
Marcus Antonius and Cleopatra VII	434	Tetradrachm	Antioch on the Orontes	73.47%	0.38%	24.00%	0.31%	0.03%	
Philip I Philadelphus, posthumous issues	398	Tetradrachm	Antioch on the Orontes	94.43%	0.60%	3.58%	0.95%	0.07%	
	399	Tetradrachm	Antioch on the Orontes	69.23%	0.39%	29.40%	0.15%	0.03%	0.10%
	403	Tetradrachm	Antioch on the Orontes	86.33%	0.95%	11.90%	0.48%	0.03%	
Philip I under Augustus	425	Tetradrachm	Antioch on the Orontes	94.50%	0.57%	4.13%	0.37%	0.03%	
Philip I under Aulus Gabinius	422	Tetradrachm	Antioch on the Orontes	97.80%	0.62%	1.02%	0.18%	0.03%	
Philip I under Octavianus	424	Tetradrachm	Antioch on the Orontes	67.00%	0.37%	30.17%	0.33%	0.03%	0.10%
Seleucia in Pieria	507	Tetradrachm	Seleucia in Pieria	98.23%	0.64%	0.58%	0.24%	0.05%	

Tab. 10. Average elemental concentrations of Seleucid coins.

Ruler	Number of coins	Ag	Au	Cu	Pb	Bi	Fe
Seleucus I Nicator	2	0.52%	98.77%	0.39%	0.01%	0.01%	
Seleucus I Nicator	17	97.73%	0.69%	0.91%	0.30%	0.03%	0.03%
Antiochus I Soter	9	98.69%	0.77%	0.28%	0.17%	0.04%	
Antiochus II Theos	8	98.64%	0.82%	0.30%	0.13%	0.03%	0.06%
Seleucus II Callinicus	7	92.78%	0.61%	5.75%	0.18%	0.03%	0.07%
Antiochus Hierax	1	98.23%	0.76%	0.21%	0.54%	0.03%	
Seleucus III Soter (Keraunos)	2	98.07%	0.95%	0.52%	0.27%	0.03%	
Antiochus III	6	98.04%	0.74%	0.41%	0.50%	0.03%	0.03%
Seleucus IV Philopator	3	97.74%	0.93%	0.71%	0.33%	0.03%	
Antiochus IV Epiphanes	4	98.20%	0.76%	0.46%	0.28%	0.03%	0.03%
Antiochus V Eupator	1	98.20%	1.09%	0.31%	0.18%	0.03%	
Demetrius I Soter	9	97.38%	0.82%	0.95%	0.47%	0.06%	0.02%
Alexander I Balas	5	97.41%	0.82%	1.18%	0.48%	0.04%	
Demetrius II Nicator, 1st reign	4	97.75%	0.72%	1.01%	0.44%	0.03%	
Antiochus VI Dionysus	6	97.11%	0.56%	1.21%	1.00%		
Tryphon	1	98.10%	0.91%	0.43%	0.51%	0.03%	0.10%
Antiochus VII Euergetes (Sidetes)	11	97.15%	0.63%	1.32%	0.73%	0.05%	
A Young Antiochus Epiphanes	1	96.65%	0.96%	1.35%	0.92%	0.04%	
Demetrius II Nicator, 2nd reign	7	97.39%	0.48%	1.17%	0.78%	0.11%	0.01%
Alexander II Zabinas	6	96.86%	0.52%	1.53%	0.76%	0.14%	0.03%
Cleopatra Thea and Antiochus VIII Epiphanes	3	97.11%	0.50%	1.75%	0.38%	0.13%	0.03%
Antiochus VIII Epiphanes	8	96.89%	0.56%	1.88%	0.43%	0.07%	0.03%
Antiochus IX Eusebes Philopator	8	95.84%	0.58%	2.55%	0.65%	0.05%	
Seleucus VI Epiphanes Nicator	5	94.37%	0.51%	4.42%	0.19%	0.03%	

<b>Antiochus X Eusebes Philopator</b>	2	96.62%	0.51%	2.30%	0.19%	0.03%	
<b>Demetrius III Eucareus</b>	2	96.92%	0.66%	1.79%	0.20%	0.03%	
<b>Philip I Philadelphus</b>	6	89.72%	0.50%	8.24%	0.57%	0.04%	
<b>Antiochus XIII Philadelphus</b>	1	78.67%	0.47%	19.27%	0.21%	0.03%	0.10%

**Tab. 11.** Average elemental concentrations of other coins.

<b>Ruler</b>	<b>Number of coins</b>	<b>Ag</b>	<b>Au</b>	<b>Cu</b>	<b>Pb</b>	<b>Bi</b>	<b>Fe</b>
<b>Ariarathes VI / Laodice and Ariarathes VII</b>	2	94.63%	0.43%	3.94%	0.52%	0.29%	
<b>Ariarathes VII</b>	2	96.75%	0.48%	1.95%	0.31%	0.21%	
Non-official imitations of Seleucid coins	3	96.37%	0.59%	2.30%	0.32%	0.03%	0.03%
<b>Laodicea by the Sea</b>	1	97.40%	0.69%	0.15%	1.24%	0.03%	
<b>Marcus Antonius and Cleopatra VII</b>	1	73.47%	0.38%	24.00%	0.31%	0.03%	
<b>Philip I under Augustus</b>	1	94.50%	0.57%	4.13%	0.37%	0.03%	
<b>Philip I under Aulus Gabinius</b>	1	97.80%	0.62%	1.02%	0.18%	0.03%	
<b>Philip I under Octavianus</b>	1	67.00%	0.37%	30.17%	0.33%	0.03%	0.10%
<b>Philip I Philadelphus, posthumous issues</b>	3	83.33%	0.65%	14.96%	0.53%	0.04%	0.03%
<b>Seleucia in Pieria</b>	1	98.23%	0.64%	0.58%	0.24%	0.05%	

An analysis of the time evolution of the silver content was performed for the silver Seleucid coins. Higher denominations (134 of tetradrachms, staters, didrachms and drachms) and lower denominations (one 1/30 stater, five hemidrachms and three obols) were analysed both separately and together. For each ruler and each category of denomination, all the silver content values listed in the corresponding rows in the tabular overview (tab. 9) were taken, and the mean, median and standard deviation of these values were calculated. The results are presented in the tabular overview (tab. 12).

**Tab. 12.** Time evolution of silver content of Seleucid coins.

<b>Ruler</b>	<b>Tetradrachms, staters, didrachms and drachms</b>				<b>Lower denominations</b>				<b>All coins</b>			
	<b>Number of coins</b>	<b>Ag content</b>			<b>Number of coins</b>	<b>Ag content</b>			<b>Number of coins</b>	<b>Ag content</b>		
		<b>Mean</b>	<b>Median</b>	<b>Std Dev</b>		<b>Mean</b>	<b>Median</b>	<b>Std Dev</b>		<b>Mean</b>	<b>Median</b>	<b>Std Dev</b>
<b>Seleucus I Nikator</b>	14	98.54%	98.85%	0.89%	3	94.93%	93.27%	3.39%	17	97.91%	98.83%	2.02%
<b>Antiochus I Soter</b>	9	98.69%	98.73%	0.38%					9	98.69%	98.73%	0.38%
<b>Antiochus II Theos</b>	8	98.64%	98.64%	0.40%					8	98.64%	98.64%	0.40%
<b>Seleucus II Callinicus</b>	6	97.10%	98.25%	3.00%	1	66.83%	66.83%		7	92.78%	98.17%	11.76%
<b>Antiochus Hierax</b>	1	98.23%	98.23%						1	98.23%	98.23%	
<b>Seleucus III Soter (Keraunos)</b>	2	98.07%	98.07%	0.19%					2	98.07%	98.07%	0.19%
<b>Antiochus III</b>	6	98.04%	98.25%	0.70%					6	98.04%	98.25%	0.70%
<b>Seleucus IV Philopator</b>	3	97.74%	97.93%	0.42%					3	97.74%	97.93%	0.42%
<b>Antiochus IV Epiphanes</b>	4	98.20%	98.28%	0.46%					4	98.20%	98.28%	0.46%
<b>Antiochus V Eupator</b>	1	98.20%	98.20%						1	98.20%	98.20%	
<b>Demetrius I Soter</b>	9	97.38%	97.43%	0.84%					9	97.38%	97.43%	0.84%
<b>Alexander I Balas</b>	4	97.23%	97.32%	0.86%	1	98.17%	98.17%		5	97.41%	97.50%	0.86%
<b>Demetrius II Nikator, 1st reign</b>	4	97.75%	98.00%	1.15%					4	97.75%	98.00%	1.15%

<b>Antiochus VI Dionysus</b>	6	97.11%	96.87%	1.46%					6	97.11%	96.87%	1.46%
<b>Tryphon</b>	1	98.10%	98.10%						1	98.10%	98.10%	
<b>Antiochus VII Euergetes (Sidetes)</b>	10	96.99%	97.07%	1.12%	1	98.73%	98.73%		11	97.15%	97.13%	1.19%
<b>A Young Antiochus Epiphanes</b>	1	96.65%	96.65%						1	96.65%	96.65%	
<b>Demetrius II Nicator, 2nd reign</b>	7	97.39%	97.40%	1.50%					7	97.39%	97.40%	1.50%
<b>Alexander II Zabinas</b>	6	96.86%	97.30%	1.62%					6	96.86%	97.30%	1.62%
<b>Cleopatra Thea and Antiochus VIII Epiphanes</b>	3	97.11%	97.50%	0.88%					3	97.11%	97.50%	0.88%
<b>Antiochus VIII Epiphanes</b>	8	96.89%	97.05%	1.19%					8	96.89%	97.05%	1.19%
<b>Antiochus IX Eusebes Philopator</b>	7	95.76%	96.67%	2.44%	1	96.43%	96.43%		8	95.84%	96.55%	2.27%
<b>Seleucus VI Epiphanes Nicator</b>	3	92.12%	89.97%	3.76%	2	97.75%	97.75%	0.12%	5	94.37%	96.47%	4.07%
<b>Antiochus X Eusebes Philopator</b>	2	96.62%	96.62%	0.87%					2	96.62%	96.62%	0.87%
<b>Demetrius III Eucareus</b>	2	96.92%	96.92%	0.97%					2	96.92%	96.92%	0.97%
<b>Philip I Philadelphus</b>	6	89.72%	89.10%	3.43%					6	89.72%	89.10%	3.43%
<b>Antiochus XIII Philadelphus</b>	1	78.67%	78.67%						1	78.67%	78.67%	

As expected, the silver content of the coins of the two last analysed kings, i.e., Philip I and Antiochus XIII, is significantly lower than that of the previous rulers. For Seleucus I, Seleucus II, Antiochus IX and Seleucus VI, a significantly lower average value of silver content can be observed compared to its median value measured on all denominations. This is accompanied by a higher standard deviation and is due to the outlying observations that can be seen across both high and low denominations. All outliers are shown in the tabular overview (tab. 13) which contains all coins with silver content below 95%. The tabular overview (tabs. 12-13) indicate that although the proportion of coins with silver content below 95% is higher for silver fractions (3 obols out of 9 silver fractions, i.e., one third of these small coins), it cannot be said that low denominations were systematically minted with a lower proportion of silver. However, the number of analysed silver fractions is too low for a reliable conclusion.

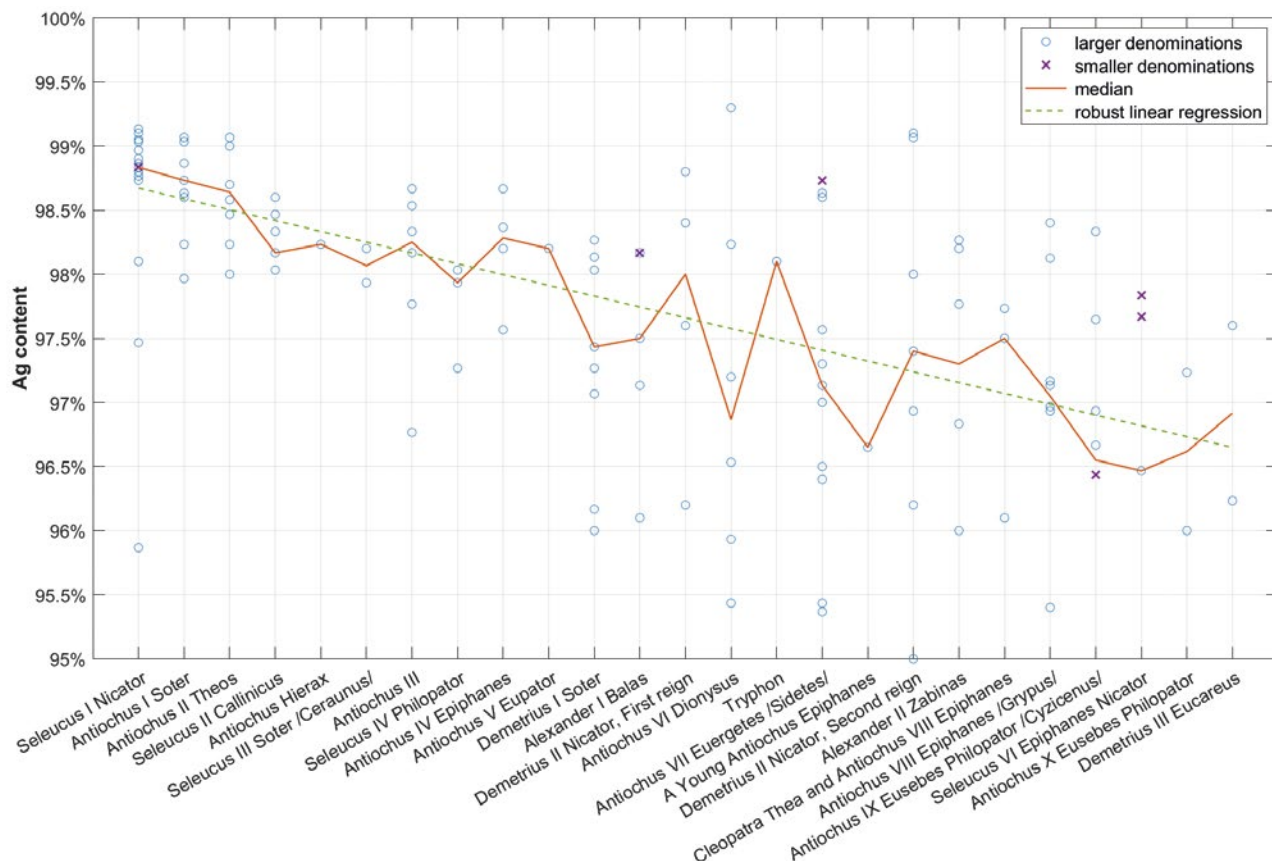
The evolution of the silver content is shown graphically in figure (fig. 1). Blue circles indicate values for higher denominations and purple crosses for low denominations. For clarity, the y-axis range is limited to values between 95% and 100%. For this reason, outliers presented in the tabular overview (tab. 13) are not plotted on the chart but have been included in the calculations, and the x-axis ends with Demetrius III because the silver content of the coins of Philip I Philadelphus and Antiochus XIII is below 95%. The red curve shows the median values for each ruler (the median was chosen instead of the mean because the mean is affected by outliers). The medians are calculated for all coins including outliers outside the range of y-axis values and thus correspond to the values in the penultimate column of table (tab. 12).

For illustrative purposes, the graph is supplemented with a line estimated using a robust linear regression model (Holland – Welsch 1977).<sup>5</sup> The robust regression model has the following form: “Ag content (%)” = 98.7244 – 0.0834 × “serial number of the ruler”. This means a drop in silver of approximately 0.08% per ruler. This model should, of course, for several reasons be taken only as a very rough indicator of the gradual decline in the silver content of Seleucid coins. First, it is unlikely that the silver content decreased under all rulers. Second, the order of the rulers is not unambiguous due to the overlapping periods of reign of some of them. Third, the number of coins analysed was relatively low for some rulers. And fourth, the limitations of the XRF method mentioned above must be considered. Despite these reservations, the evolution of the median silver content and this approximate model show the gradual decline in the purity of silver Seleucid coins.

5 The iteratively reweighted least squares method (IRLS) was used.

**Tab. 13.** Seleucid coins with silver content below 95%.

Ruler	Ag	Denomination	Weight (g)	Cat. no.
Seleucus II Callinicus	66.83%	Obol	1.002	114
Antiochus XIII Philadelphus	78.67%	Tetradrachm	15.375	397
Philip I Philadelphus	85.17%	Tetradrachm	15.493	388
Philip I Philadelphus	88.87%	Tetradrachm	16.084	384
Philip I Philadelphus	88.93%	Tetradrachm	15.058	382
Philip I Philadelphus	89.28%	Tetradrachm	14.647	386
Seleucus VI Epiphanes Nicator	89.93%	Tetradrachm	15.832	369
Seleucus VI Epiphanes Nicator	89.97%	Drachm	3.853	371
Philip I Philadelphus	90.33%	Tetradrachm	15.312	389
Seleucus II Callinicus	91.00%	Drachm	4.148	115
Antiochus IX Eusebes Philopator	91.11%	Tetradrachm	15.156	362
Seleucos I Nicator	92.70%	Obol	0.933	27
Seleucos I Nicator	93.27%	Obol	0.565	38
Alexander II Zabinas	94.07%	Tetradrachm	16.594	313
Antiochus IX Eusebes Philopator	94.73%	Tetradrachm	16.154	356
Antiochus IX Eusebes Philopator	94.88%	Drachm	3.682	353
Antiochus VIII Epiphanes	94.97%	Tetradrachm	16.469	351



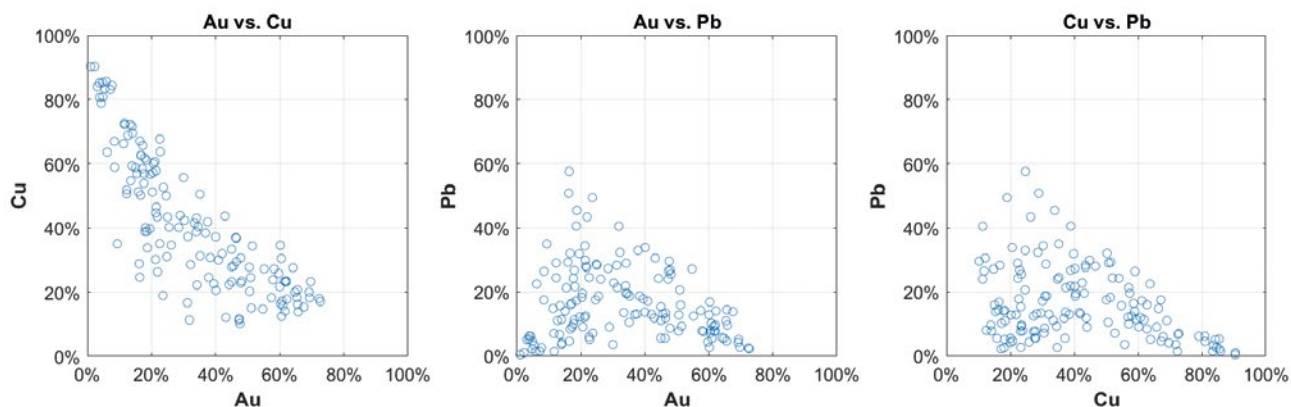
**Fig. 1.** Development of silver content.



In addition to the silver content, the proportions of Au, Cu and Pb in the alloys were also analysed for silver Seleucid coins. Bismuth and iron were not included in this analysis due to their low proportion in the alloys (tab. 9). For each coin, the relative proportion of Au, Cu and Pb in the non-silver part of the alloy was calculated. Scatter plots of all pairs of these three elements for all Seleucid silver coins are shown in figure (fig. 2). The figure shows the expectable inverse relationship between the residual content of gold and copper. For the other pairs of elements, no clear mutual relationship can be observed.

Figure shows (fig. 3) the content of Au, Cu and Pb in the non-silver part of the alloy depending on the silver content in the alloy. The values at the top of the graph represent the number of observations in each category. Note that the sums of the percentages of these three elements are equal to approximately 91% in each category. The remaining 9% of the non-silver volume of the alloy is accounted for by bismuth, iron and trace impurities. Measurement errors must also be taken into account, which usually cause the sum of the measured elemental contents to differ slightly from 100% for individual coins. The figure (fig 3) again confirms the natural inverse relationship between the residual proportion of gold and copper. The residual lead content shows a slightly concave dependence on the silver content categories.

One of the interesting questions is whether the composition of the non-silver part of the alloy in Seleucid silver coins is somehow dependent on the region of mintage. Due to the relatively small number of coins analysed, only the distribution between the western and eastern mints was examined (111 coins were included in the western mints, 32 coins in the eastern mints).<sup>6</sup> The ternary plot for the three main residual elements, i.e. Au, Cu and Pb, is shown in figure (fig. 4). For the purposes of this plot, the residual proportions of these elements have been normalized to sum to 100%. Blue circles indicate observations for western mints and red stars indicate observations for eastern mints. Two sizes of these symbols are used: larger symbols indicate higher denominations (tetradrachms, staters, didrachms and drachms) and smaller symbols indicate lower denominations (1/30 stater, hemidrachms and obols). The lower copper content and higher gold content of most of the eastern coins can be explained by the fact that most of these coins date from the early period of the Seleucid Empire (27 of the 32 coins were minted in the period of Seleucus I to Antiochus III, 5 coins in the period of Antiochus IV to Antiochus VII). Taking this into account, it can be concluded that there seems to be no difference between the western and eastern mints in terms of the proportion of Au, Cu and Pb in the non-silver part of the alloy.



**Fig. 2.** Scatter plots of Au, Cu and Pb.

<sup>6</sup> Western mints: *Ake-Ptolemais, Alinda or Mylasa, Antigonea on the Orontes or Seleucia in Pieria, Antioch on the Orontes, Carrhae, Commagene* or Western Mesopotamia, *Damascus*,  $\Delta$ I mint, in Southern or Eastern Syria, perhaps *Edessa, Lampsacus, Magnesia on the Meander, Nisibis, Pergamum*, “Rose” mint, *Sardes, Sidon, Soli, Tarsus, Tyre*, unattributed drachm issues of Northern Syria, uncertain mint 111 in Northern Syria, uncertain mint 87 (Northern Syria), uncertain mint 101 (Syria, Northern Mesopotamia or Cilicia). Eastern mints: *Alexandria in Aria (Artacoana), Antioch on the Persian Gulf, Ai Khanoum, Babylon I, Babylon II, Ecbatana*, Northern Media or Hyrkana, *Seleucia on the Tigris, Seleucia on the Tigris I, Seleucia on the Tigris II, Susa*.

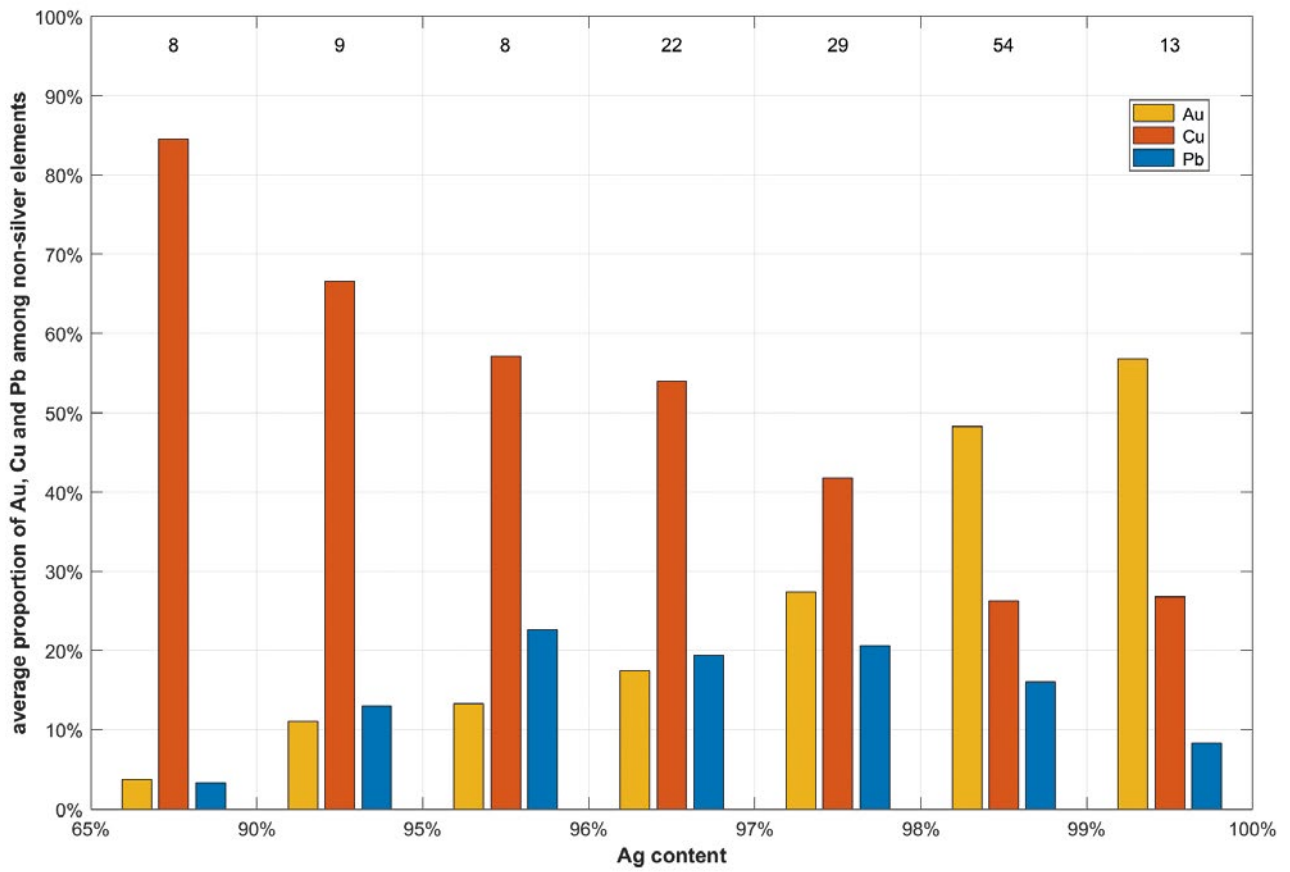


Fig. 3. Residual proportion of Au, Cu and Pb depending on the silver content in the alloy.

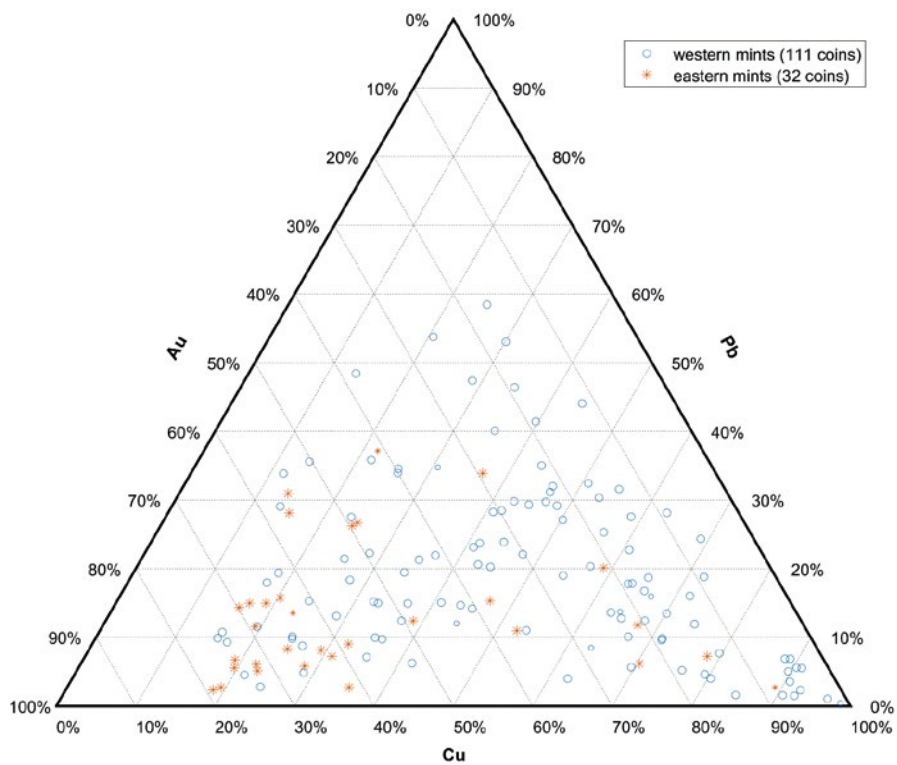


Fig. 4. Au, Cu and Pb in the non-silver part of the alloy.

## JUDAEAN COINS

A total of 30 coins minted in the period from John Hyrcanus I to Bar Kokhba Revolt were analysed. Only copper alloy coins were analysed. The following twelve elements were measured on these coins: copper (Cu), lead (Pb), tin (Sn), silver (Ag), antimony (Sb), zinc (Zn), arsenic (As), nickel (Ni), gold (Au), mercury (Hg), bismuth (Bi) and iron (Fe). A different number of independent XRF measurements were made for individual coins: one measurement for three coins, two measurements for six coins, three to four measurements for twenty coins, five measurements for one coin. This seemingly chaotic fluctuation in the number of measurements can be explained by the current condition of the coin in combination with the visual assessment of the sample during the measurement (various colour spots – e.g. corrosion, suspected plating of the copper alloy core with precious metals, etc.).

For copper, lead and tin, all measurements of all coins showed values safely above the detection limit. For silver, antimony, arsenic, nickel and iron, some measured values were below this limit. The measured values were adjusted in these cases in the same way as in the analysis of Seleucid and related coins. Zinc, gold, mercury and bismuth were omitted from the analysis because their content was below the tolerance limit for all measurements.

The average values of all adjusted measurements of Cu, Pb, Sn, Ag, Sb, As, Ni and Fe are shown in the tabular overview (tab. 14). Aggregated values for individual rulers are presented in the tabular overview (tab. 15). The order of the rulers in the table corresponds to their order in the catalogue and thus to their chronological sequence. The values in this table were calculated by averaging the values of the corresponding rows in the tabular overview (tab. 14). Note that the row sums in the tabular overviews (tabs. 14–15) do not equal to 100%. This is partly due to the possible presence of other elements, partly due to the above approximation for sublimit measurements and measurement errors.

**Tab. 14.** Elemental concentrations of the coins from Judaea.

Ruler	Cat. no.	Cu	Pb	Sn	Ag	Sb	As	Ni	Fe
<b>John Hyrcanus I</b>	598	87.85%	0.65%	9.25%	0.03%	0.03%	0.05%	0.10%	0.03%
<b>Judas Aristoboulos I</b>	599	82.15%	4.10%	9.05%	0.40%	0.45%	0.05%	0.03%	0.70%
<b>Alexander Jannaeus</b>	600	80.07%	10.47%	8.07%	0.03%	0.08%	0.30%	0.08%	0.23%
	601	79.30%	14.85%	4.54%	0.10%	0.03%	0.05%	0.04%	0.24%
	602	77.80%	14.55%	6.15%	0.07%	0.09%	0.22%	0.08%	0.12%
	603	67.55%	21.80%	8.75%	0.28%	0.55%	0.15%	0.03%	0.03%
	605	82.50%	12.03%	4.40%	0.18%	0.08%	0.14%	0.06%	0.10%
	606	59.30%	19.25%	15.33%	0.80%	0.26%	0.30%	0.03%	4.40%
	607	64.26%	25.97%	7.63%	0.03%	0.27%	0.15%	0.10%	0.32%
	610	45.20%	35.95%	15.55%	0.03%	0.03%	0.05%	0.05%	0.93%
	612	75.33%	11.08%	8.90%	0.45%	0.03%	0.18%	0.03%	3.72%
	613	65.03%	14.69%	15.39%	0.60%	0.53%	1.43%	0.06%	1.90%
	614	71.38%	3.72%	13.20%	0.03%	0.03%	0.15%	0.03%	9.27%
615	49.30%	29.20%	17.80%	0.03%	0.30%	0.13%	0.07%	1.80%	
<b>Mattathias Antigonus</b>	616	68.10%	19.73%	10.55%	0.50%	0.12%	0.05%	0.08%	0.15%
<b>Herod the Great</b>	617	55.95%	24.50%	18.00%	0.03%	0.03%	0.05%	0.03%	0.20%
	618	28.80%	44.80%	22.90%	0.03%	0.20%	0.05%	0.03%	0.60%
<b>Herod Archelaus</b>	619	69.90%	13.80%	14.70%	0.03%	0.10%	0.11%	0.06%	0.40%
<b>Herod Agrippa I</b>	621	80.18%	9.93%	7.69%	0.23%	0.15%	0.05%	0.03%	0.03%
	624	65.70%	15.48%	11.18%	0.03%	0.19%	0.05%	0.03%	3.90%
	626	80.33%	6.18%	11.15%	0.16%	0.21%	0.11%	0.03%	0.17%
<b>Valerius Gratus</b>	631	75.66%	0.29%	19.64%	0.13%	0.03%	0.11%	0.03%	2.40%
<b>Pontius Pilatus</b>	634	73.88%	11.08%	14.13%	0.40%	0.23%	0.05%	0.03%	0.06%

<b>Antonius Felix</b>	639	65.93%	27.23%	5.27%	0.09%	0.08%	0.05%	0.03%	0.06%
	640	57.20%	18.18%	20.85%	0.68%	0.19%	0.05%	0.03%	1.63%
<b>First Jewish Revolt</b>	656	79.33%	5.85%	12.08%	0.26%	0.03%	0.05%	0.03%	1.30%
	658	57.72%	25.30%	15.03%	1.14%	0.21%	0.05%	0.03%	0.24%
	660	82.63%	7.48%	7.83%	0.27%	0.18%	0.05%	0.03%	0.05%
	670	69.21%	20.73%	8.35%	0.08%	0.20%	0.05%	0.01%	0.38%
<b>Bar Kokhba Revolt</b>	677	42.50%	38.60%	13.27%	0.17%	0.19%	1.65%	0.03%	1.65%

**Tab. 15.** Average elemental concentrations of Judean coins.

Ruler	Number of coins	Cu	Pb	Sn	Ag	Sb	As	Ni	Fe
<b>John Hyrcanus I</b>	1	87.85%	0.65%	9.25%	0.03%	0.03%	0.05%	0.10%	0.03%
<b>Judas Aristoboulos I</b>	1	82.15%	4.10%	9.05%	0.40%	0.45%	0.05%	0.03%	0.70%
<b>Alexander Jannaeus</b>	12	68.08%	17.80%	10.48%	0.22%	0.19%	0.27%	0.05%	1.92%
<b>Mattathias Antigonus</b>	1	68.10%	19.73%	10.55%	0.50%	0.12%	0.05%	0.08%	0.15%
<b>Herod the Great</b>	2	42.38%	34.65%	20.45%	0.03%	0.11%	0.05%	0.03%	0.40%
<b>Herod Archelaus</b>	1	69.90%	13.80%	14.70%	0.03%	0.10%	0.11%	0.06%	0.40%
<b>Valerius Gratus</b>	1	75.66%	0.29%	19.64%	0.13%	0.03%	0.11%	0.03%	2.40%
<b>Pontius Pilatus</b>	1	73.88%	11.08%	14.13%	0.40%	0.23%	0.05%	0.03%	0.06%
<b>Herod Agrippa I</b>	3	75.40%	10.53%	10.01%	0.14%	0.18%	0.07%	0.03%	1.36%
<b>Antonius Felix</b>	2	61.57%	22.70%	13.06%	0.38%	0.13%	0.05%	0.03%	0.84%
<b>First Jewish Revolt</b>	4	72.22%	14.84%	10.82%	0.44%	0.15%	0.05%	0.02%	0.49%
<b>Bar Kokhba Revolt</b>	1	42.50%	38.60%	13.27%	0.17%	0.19%	1.65%	0.03%	1.65%

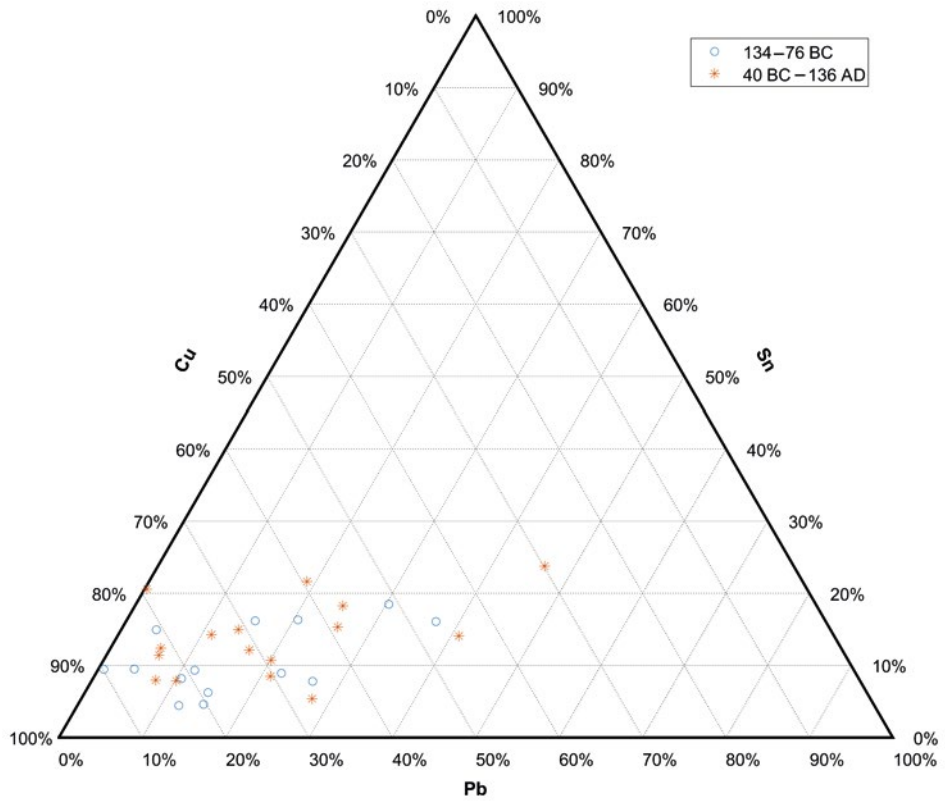
Due to the low number of analysed coins, it was not possible to carry out a more detailed analysis of the development of the coin alloy over time. The analysed sample was therefore divided into only two groups: 14 coins minted under John Hyrcanus I, Judas Aristoboulos I and Alexander Jannaeus, and 16 coins minted from the reign of Mattathias Antigonus until the Bar Kokhba Revolt. The first group thus covers the period 134–76 B.C., the second group the period 40 B.C.–136 A.D. Mean, median and standard deviation of the content of copper, lead and tin were calculated for both groups (tab. 16).

**Tab. 16.** Concentrations of copper, lead and tin up to 76 B.C. and since 40 B.C.

Period	Number of coins	Cu content			Pb content			Sn content		
		Mean	Median	Std Dev	Mean	Median	Std Dev	Mean	Median	Std Dev
<b>John Hyrcanus I – Alexander Jannaeus 134–76 BC</b>	14	70.50%	73.35%	12.77%	15.59%	14.62%	10.07%	10.29%	8.98%	4.37%
<b>Mattathias Antigonus – Bar Kokhba Revolt 40 BC–136 AD</b>	16	65.81%	68.65%	14.67%	18.07%	16.83%	12.06%	13.29%	12.67%	5.07%

The tabular overview (tab. 16) indicates a decrease in the proportion of copper and an increase in the proportion of lead and tin in the second group. However, these changes are inconclusive due to high standard deviations. Wilcoxon rank sum test also does not reject the hypothesis of an equal representation of copper in the coins of both groups at the 5% level (p-value of 0.467).

The ternary plot for these three main residual elements is shown in figure (fig. 5). For the purposes of this plot, the residual proportions of these elements have been normalized to sum to 100%. Blue circles indicate observations in the first group and red stars indicate observations in the second group. This graph also does not indicate a change in the composition of the coin alloy.



**Fig. 5.** Normalized content of Cu, Pb and Sn.