

The Third Side of the Coin: Using Google Earth to Visualize Numismatic Data

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Abstract: This article presents one digital approach to ancient numismatics. The proposed methodology maps geo-referenced quantities of coin finds within the platform of Google Earth – a free virtual globe available through the Internet. Especially for the uninitiated scholar, Google Earth efficiently visualizes both the spatial and chronological distribution of thousands of coins and provides an intuitive and interactive space for exploring regional and empire-wide patterns in their movement. While the practical applications of this methodology are many, this article focuses on an ongoing study of Antioch-on-the-Orontes in northern Syria and its regional evolution after Roman annexation. This project draws upon Google Earth as an invaluable first step in synthesizing the wealth of disparate coin data available for the city. After outlining the methodology to achieve such a visualization, this article highlights several promising patterns revealed by Google Earth in the dataset.

Ancient coin finds represent one of the most valuable sources of historical information for the ancient world.¹ From their iconography to the archaeological context in which they are found, the “multi-disciplinary” quality of coins can contribute to questions of state ideology, political formation, economic health, financial policy, and socio-cultural identity.² Scholarship increasingly appreciates this value as digital technologies and digital humanities are opening a new era for channeling large quantities of numismatic evidence.³ In other words, digital programs allow for not only the collection and curation of big, disparate datasets of coin finds, but also for the visualization, examination, and sharing of this material more efficiently than ever before.⁴

With this expansion in the scholarship, it can be difficult for more analog-oriented academics to know where to begin with their own forays into digital numismatics. The following paper presents one digital approach that is specifically geared towards the uninitiated scholar interested in pursuing the potential of both quantitative and digital numismatics. The proposed methodology maps geo-referenced quantities of coin finds across time and space within the

1 Many thanks are due to Dr. Peggy Lindner (Center for Advanced Computing and Data Systems, University of Houston) for her wise suggestions on this article, as well as to the two anonymous readers for this journal.

2 Kemmers and Myrberg (2011) 87-89; Howgego (1995); Howgego (2005), 1-17.

3 The image of the third side of the coin – the edge – is used here in a metaphorical sense. To see something from the edge means to be able to see both sides, to see the „big picture“. While the quantity of coins currently collected cannot compare to the millions of data points available in the modern world, assembling large collections of ancient evidence is one step closer to realizing the potential of “big data” for the ancient world. See Gattiglia (2015), 113-24.

4 Current digital numismatic projects include The Coin Hoards of the Roman Empire Project (<http://chre.ashmus.ox.ac.uk/content/about>), Nomisma (<http://nomisma.org>), Online Coins of the Roman Empire (<http://numismatics.org/ocre/>), and the Portable Antiquities Scheme’s database of British coin finds (<https://finds.org.uk/romancoins>). See also the questions raised by Meadows and Gruber (2014).

platform of Google Earth – a free virtual globe available through the Internet. This accessible program quickly organizes substantial volumes of numismatic material from multiple excavations and hoards into a dynamic visualization of spatial and chronological patterns. Presenting the data in such a format aids in further quantitative analysis of political, economic, and social change within antiquity.

In order to demonstrate the potential of this approach, this paper presents results from an on-going study on the annexation of Antioch-on-the-Orontes and greater Syria into the Roman empire. The dynamic presentation offered by Google Earth proved to be an important first step in identifying regional and long-term patterns of change dependent on the involvement of the different authorities active in Antioch and the East. In other words, while the visualization created by this program was not intended as either a substitute for rigorous data analysis or a generator of publication quality maps, Google Earth did provide a quick and dirty method for cutting through the noise of a large dataset in order to begin exploration of long-discussed problems.

1. A Rationale for a Digital Approach to Coin Finds

The impetus for mapping coin data with Google Earth originated from difficulties encountered in reconstructing the immediate and long-term change experienced by Antioch after Pompey's conquest in 64 BCE. Compared to many other urban centers of the ancient Mediterranean, literary and archaeological evidence for Hellenistic and Roman Antioch can appear limited. Textual records before the fourth century CE only refer to Antioch in short snippets or in passing.⁵ From an archaeological perspective, the joint expedition of Princeton University and several French and American museums in the 1930s did uncover hundreds of stunning mosaics, coins, and pottery sherds. Despite the five-volume publication in the years after excavation, much of the archaeological material is only gradually becoming available through the recent efforts of Princeton University faculty, staff, and students and an international team of scholars.⁶ Survey and salvage work have also added to the topographical understanding of the city and the surrounding settlement, but all archaeological projects are hindered by the modern city of Antakya overtop and the ongoing Syrian war in the region.⁷ Neither texts nor much of the material culture currently provide a consistent standard by which to measure the city's development in both a local and regional context.

This paper proposes coin finds as an untapped resource for the study of Antioch. Many political entities in the East issued coins during the Hellenistic and Roman periods, including Seleucid kings, Roman emperors, and a variety of client-kingdoms, provinces, and individual cities.⁸ The mint or mints at Antioch alone produced coins in both base and precious metals for three different tiers of issuing authorities: the central governments of the Seleucid kings and

5 See Downey (1961), 35-44. This is the case generally for northern Syria in the Hellenistic period. See Millar (2006), 29; Cohen (2006), 3-13.

6 For information about current work on the original publications at Antioch, see <http://antioch.princeton.edu>.

7 Survey projects include the Amuq Valley Regional Projects (AVRP) and the Orontes Delta Archaeological Project. See Leblanc and Poccardi (1999), 91-126; Casana (2003); Pamir (2012), 259-270.

8 According to the estimations of T. B. Jones, over 530 eastern cities, leagues, and kingdoms issued coins at some point during the Roman imperial period (Jones (1963), 310).

Roman emperors, the provincial Roman government of Syria and occasionally other eastern provinces, and the civic government of Antioch and other cities of the region.⁹ Some of these coins circulated in a very restricted territory, whereas others circulated more freely over a wide geographical area; all circulation depended on social, economic, and political factors often related to the original issuing authority.¹⁰ The theoretical foundation to this study is that ancient boundaries to coin circulation can be uncovered through which types of coins appear where, when, and in what quantities within the archaeological record.¹¹ While spatial gaps certainly exist in the archaeological record, mapping the general limits to a particular coin's distribution – such as civic coins issued by the Antiochenes – and how these limits evolved over time and space can draw out the activity and policies of the different authorities issuing the coins and the various public and private groups making use of them. This in turn can point towards broader and more abstract changes experienced by a single city, region, and even whole empire.¹²

The success of such a study first depends on assembling a large dataset, as this will minimize or at least better contextualize discrepancies, gaps, or idiosyncrasies of individual assemblages of coins.¹³ This project initially considered c. 85,000 coins from a total of 75 excavations and 120+ hoards (i.e. deposits of more than one coin) found throughout the Mediterranean.¹⁴ This quantity includes c. 20,000 local and foreign issues recovered from excavation at Antioch and those originally minted at Antioch for various regal/imperial, provincial, and civic authorities and found elsewhere. With the exception of hoards – whose entire deposit was considered – the coins range in date from the time of Antiochus III (223 BCE) through the early centuries of the late antique period (423 CE) in order to provide a context for the material from the Roman imperial period (30 BCE through 235 CE).

The fusion of such a diverse dataset demands a digital approach for its collection, organization, and visualization. The database management system FileMaker Pro fulfilled the first two requirements of collection and organization. The database used tables for Territory, City, Object, and Bibliography. Within this data structure, all the coins collected from excavation reports and hoard inventories could be sorted and summarized according to a conceptual model of seven attributes (e.g., date, metal; see below).¹⁵ The Territory and City tables allowed us to augment these coin attributes with spatial data (e.g., find spot, mint location). Although Excel can also aggregate data, recording the coins in this way allowed faster searches of the material, such as for all coins dating to a certain period of issue and/or all coins of a specific metal. Drop-down lists for each field also made data entry faster and more consistent than Excel. The results of these queries were still easily exported to other formats or databases, such as Excel, where the dataset could be further analyzed using numerical and graphical methods.

As helpful as the database proved to be in organizing and analyzing coin data, this study also needed a dynamic map to integrate the disconnected finds within their spatial context and

9 See Butcher (2004), 3, 17-22, 239-64, 298-412; McAlee (2007), 1-2.

10 Howgego (1995), 88-110; Burnett (1987), 86-104; Butcher (2004), 143-49; Butcher (2001-2002), 35-41.

11 Casey (1986), 68-113; Butcher (2004), 149-51; Newton (2006), 211-27. This is not to suggest a one-to-one correlation between coin use and coin finds ignoring ancient process and the vagaries of survival.

12 For a similar approach, see Evans (2006); Howgego (1985); Butcher (2004); Beliën (2009), 61-80; Kemmers (2006).

13 See Ryan (1988), 27-37, 60-63. Although some web-based numismatic databases exist (such as the OCRE database by the ANS), they lacked the variables necessary for this study.

14 A full bibliography is available for download at <https://scholar.uc.edu/show/zp38wc66m>.

15 For more on database management systems, see Connolly and Lake (2006), 51-60.

highlight geographical patterns in their distribution.¹⁶ Because the goal was to quickly visualize the data to see if any patterns were worth pursuing, the non-traditional research tool of Google Earth appeared as a viable option.¹⁷ First launched in 2005, Google Earth is an Internet-based, geographical information platform with 3D modeling of the planet based upon high-resolution satellite, aerial photographs, and a modern database of world places.¹⁸

For the purposes of this study, Google Earth facilitated the creation and exploration of an interactive, thematic map charting quantities of coins with specific attributes over space and time (ill. 1).¹⁹



Illustration 1: A screenshot of geo-referenced quantities of coin finds in Google Earth Pro.

Navigation controls granted a wide view of the entire Mediterranean or a narrower focus on a particular region – all in real time and from multiple-angles. Google Earth uniquely supported a top-down examination of coin data distributed across a two-dimensional map and – by tilting the view of the globe – a ground-level comparison of quantities of coin finds represented

16 Bodenhamer (2008), 223-225; Goodchild (2008), 18; Knowles (2008), 18; Shennan (1997), 21.

17 Compared to similar platforms available at the start of this project, such as Google Maps, Google Earth offered stronger aesthetics, additional measuring tools, and the ability to view data through multiple angles (see below).

18 <http://earth.google.com>. For an excellent overview on the mechanics of Google Earth, see Goodchild (2008). According to Goodchild, “Google Earth and other geobrowsers address what previous generations of developers had seen as insuperable challenges: feeding vast amounts of data through comparatively limited Internet pipes, manipulating three-dimensional images in real time, and zooming through a hierarchical data structure over at least four orders of magnitude of resolution” (22). For the updated applications now available in Google Earth and similar software programs, see Goodchild (2012), 11088-11094.

19 Compare with the comments of Henry (2009), 3-4.

by weighted 3D bar charts at each location.²⁰ Search tools simplified locating specific sites or geographical coordinates and adding new placemarks or uploading additional data. Folders organized data and easily toggled what information appeared within a single screenshot or viewing. It was also possible to layer historical maps with ancient trade routes and settlements to contextualize the data beyond its basic geographical location.²¹ The newest model – Google Earth Pro – created videos capturing a tour of places or showing an animated evolution of data. Overall, the flexibility in perspective and the amount of material displayed in its temporal and spatial context by Google Earth surpassed a traditional static map and instead provided a working tool for finding distribution patterns worthy of in-depth exploration.

For the uninitiated scholar, Google Earth can also provide a “child’s play” alternative to more conventional geographical information system (GIS) programs like QGIS or ArcGIS.²² Although developers continue to improve the accessibility of these packages, the steep learning curve and, with the exception of open-source programs like QGIS, the expense limits the scholarly audience. Conversely, as Michael Goodchild argues, Google Earth “represents a distinct democratization” in granting scholars without GIS training “access to comparatively simple ways of displaying geo-referenced data, and gaining the insights that a spatial perspective can provide.”²³ In this project, only a minor investment of time at the outset in setting up and querying the database was needed before the clear and dynamic visualization of coin distribution in Google Earth became possible. For an initial exploration of the data, the basic tools offered by Google Earth were more than sufficient to take simple measurements, draw paths, and create overlays and layers such as with historical maps or information (e.g., roads, settlements).²⁴ Of course, as future iterations of the project have demanded more advanced modeling tools, the data has been easily incorporated into more sophisticated mapping and analysis programs.²⁵ For initial exploratory stages, however, Google Earth more than fulfilled the conditions of this project to engage visually with imperfect material in order to uncover and explore patterns worthy of further study.

2. Methodology for Visualizing Coin Find Distribution in Google Earth

As accessibility and replication of this digital approach to coins was a primary goal of this project, the following section outlines the methodology applied within this study. Several issues needed to be addressed, including which coins to consider, best practices for creating a visual display, and where to store the final maps. As will be pointed out below, many of the decisions made were directed towards analysis of the numismatic material beyond its initial visualization in Google Earth.

20 Such a multiplicity of views – especially in comparing the bar charts through tilting the globe – is not possible in Google Maps.

21 On Google Earth’s capacity for approximately layering historical maps on top of the globe imagery, see Knowles (2008), 12.

22 ‘Think Global’ (2006), 763. See also Goodchild (2012), 11088.

23 Goodchild (2008), 22.

24 See Goodchild (2008), 16-17. On the limits of these calculations, see Goodchild (2012), 11089-90.

25 See Henry (2009).

Any digital approach to coins must first begin with a careful selection of which finds to include within the dataset. The aims of this project necessitated that coins could be identifiable by mint of origin and/or issuing authority, had an identifiable find spot (whether a specific site or general region), and were published as part of a wider coin assemblage (i.e., not a lone find). This last criterion extended less from any visualization requirements and more from the long-term aims of the project to study the proportions in which Antiochene coins were discovered. Though not required, this study also gave preference to coins identifiable by metal and type in pursuance of better defining distribution patterns.

Two separate sources best met these criteria: official excavation reports and published lists of coin hoards.²⁶ Because the greater aim of this project focused on applications of big numismatic collections, most of the assemblages in which an individual coin was found – whether excavation or hoard – exceeded 100 total finds. The paucity of information for certain regions of the East also meant including a few smaller assemblages of at least twenty coins in order to construct as comprehensive picture of coin distribution as possible. In the end, this initial study consisted of fifteen publications from Syria, five publications from East of Syria (e.g. Mesopotamia), 22 publications from the Southern Levant, thirteen publications from greater Asia Minor and Cyprus, and twenty publications from Europe and North Africa.²⁷ A few of these reports also included publications of hoards found through excavation, but the majority of hoards considered in this study were from assembled lists.²⁸

All acceptable coins were recorded into a FileMaker Pro database according to seven attributes:

1. Coin “Material”: silver, bronze, antoninianus, or uncertain.²⁹
2. Coin Origin: source territory (e.g., Syria) and minting city/issuing authority (e.g., Antioch).³⁰

26 All selected excavations were occupied during the Roman period; most also had occupation and coin material dating to the Hellenistic and late antique periods. Hoards were included only if the latest datable coin was issued during the chronological span of 223 BCE – 423 CE and only if the hoard contained Antiochene coins. This study excluded other sources of coin information, such as survey data, chance finds, museum catalogs, private collections, and – with the exception of certain hoards – antiquities sales. Not enough surveys have been conducted in Syria to provide a body of evidence that can be internally compared, as is the case with excavation reports or hoards. Many museum and private collections have lost the original context or assemblage of the coin, which does not help in a distribution study.

27 A detailed bibliography of all publications consulted can be found at <https://scholar.uc.edu/show/zp38wc66m>. A map of these sites is located at <https://scholar.uc.edu/show/zp38wc685> (doi:10.7945/C2201C). Some gaps did exist in this geographical span. For instance, excavations in both Armenia and Cappadocia either lacked a large enough quantity of coins or did not meet the necessary standards of publication.

28 e.g., Thompson, Mørkholm, and Kraay (1973); *Coin Hoards* (1975-2010).

29 Although antoninianus refers to a denomination and not an individual material, coins of this denomination were given a separate attribution in order to study how increasingly low levels of silver content affected their distribution. In general, the fiduciary nature of bronze coins is believed to restrict provincial bronze circulation, whereas the high intrinsic value of silver coins greatly expands it (with the exception of Egypt). See Butcher (2001-2002), 22. Gold coins proved to be too rare a find to form a part of this distribution study.

30 In an attempt to retain as many finds as possible, it was sometimes necessary to assign a coin’s origin to the wider province rather than a specific mint or authority. For example, coins of nations without a certain mint (e.g., Jewish coins) were assigned to a province or general geographical territory (e.g., Southern Levant). All locations were given geographical coordinates gathered from Google Maps. For many of the less familiar ancient locations (e.g. Singara in Mesopotamia), approximate locations or the modern equivalent were found using a combination of the Barrington Atlas and additional resources such as the New Pauly. Finds with only a broad classification of a province were tied to a single coordinate in the center of the region with the designation “[Province Name] – GENERAL.”

3. Antiochene Subcategory (if applicable): as mentioned above, the mint or mints at Antioch produced coins for several different issuing authorities, which may have impacted how a coin circulated. Therefore, if a coin was minted at Antioch, it was assigned to a subcategory:

- Central coin: royal Seleucid or imperial Roman
- Provincial coin: provincial Roman
- Civic coin: Seleucid or Roman
- Uncertain

4. Date Range of Coin Issue³¹

5. Find Spot: region (e.g., Syria) and specific find location (e.g., Antioch).³²

6. Nature of Find: single excavation find or hoard.³³

7. Quantity: The recording method for the quantity of finds differed between site finds and hoards:

- For site finds, like coins of a particular issue date, type, and metal were quantified into a single number.³⁴
- Individual hoards were recorded as a single entry, adding all Antiochene coins together into one quantity, regardless of differences in date or type. The rationale for this choice is that whether the hoard resulted from a single or series of deposits over time, intentional or unintentional, the contents represent a collective loss. For the sake of visualization and comparison to the site finds, the hoards were dated by the latest material contained in them rather than by the issuing date of the individual coins.³⁵

31 The date range of a coin issue was recorded to the greatest level of specificity as possible, at times to a single year. The variation in how a publication described coin finds occasionally forced artificial chronological assignments. For example, a numerical date span was assigned (e.g., 200-225 CE) in the place of vague identifications (e.g., Early Third Century). When two dates were provided, the date range was recorded as spanning the earliest to the latest point. This is an admittedly imperfect solution to the lack of standard notation among coin records. See Guest (2012), 108.

32 The locations of several of the smaller excavation sites were poorly described by their publications (e.g., Tell Abou Danne – in the region of Djabboul), so the maps depict the best approximate locations (see Doyen (1987)). Many hoards were discovered outside a controlled excavation and published with little detail about their original location; they were therefore assigned to a general find spot (e.g., Syria).

33 Given the differences between excavation finds and hoard finds, it was important to keep the material separate both within the database and final quantitative analysis. Broadly speaking, excavations yield an assemblage of often base metals left unintentionally by multiple individuals over a long period of time. In this study, only 1% of a total of 5,522 coin finds from the Princeton excavation are silver (Waage (1952); see Butcher (2004), 150. Quite in contrast, hoards are often intentional deposits meant to be recovered later, whether an attempt to hide one's money in an emergency or gradually adding to one's savings. This type of loss was meant to safeguard money and often resulted in hoards of selected precious metal coins like silver and gold. See Casey (1986), 51-60; Harl (1996) 14-16; Kemmers (2006), 132-36.

34 For example, the excavation records at Antioch reported two bronze civic issues of Antiochene origin dating to 18/17 BCE with an obverse of Zeus. See Waage (1952), no. 297. At times this level of specificity was not possible or necessary and resulted in larger groupings. For instance, as this study was more interested in late antique finds as a block comparison to the earlier periods, all Antiochene finds of this period were added into a single quantity.

35 While the individual contents of hoards are easily compared to other hoards, it is more difficult to compare hoards to site finds. The method proposed may seem like setting up a data set incompatible to site finds, which are recorded here as separate entries and dated by issuing period and not stratigraphic deposit. However, the purpose of including hoards was to serve as a check to the pattern of site finds. Even though it is not yet possible to examine all coin finds according to their date of deposit (perhaps a closer indication to original circulation patterns), the hoard finds may be the best indicator we have at this time. A more practical reason also dictates different recording methods: the hoard lists do not always detail individual issuing periods of the contents, but instead simply describe the quantity of coins by issuing city or mint (e.g., Coin hoards, Royal Numismatic Society 7 (1985), no. 154). Rather than throw out the material, they were grouped into one entry in order to cover such inconsistent records. That said, where detailed information about individual coins was present, it was added to the "Description" section of that entry for later analysis.

After recording all coin finds in the FileMaker Pro database, the data needed to be transformed into a format understood by Google Earth. Google Earth reads Keyhole Markup Language (KML), a file format which is used to display spatially-linked data to its proper geographical coordinates.³⁶ In this study, each KML file was derived from a series of searches on the FileMaker Pro database according to time period, “material,” and, if minted at Antioch, subcategory of coin. For this study there were two distinct sets of queries:

- Antiochene coins generally (keeping hoard data separate from site finds)
- Coins found through excavation at Antioch

This database viewed the summary of the search results by either where the coins originated – important for finds at Antioch – or where the coins were found – important for finds originating at Antioch. For example, a search for all the records of *site finds* of *civic Roman bronze* coins *minted at Antioch* during the *time of Tiberius* (14-37 CE) yielded four cities where this type was found: Antioch (2 coins), Dura-Europos (2 coins), Seleucia Pieria (2 coins), and Tall Seh Hamad (2 coins). These results were gathered and then saved into a single text file. Each query was then exported into a KML file. To organize these searches, each KML file was assigned a code based upon the attributes of the coin.³⁷ If the coin was minted at Antioch, these attributes consisted of the nature of find (site or hoard), the coin subcategory (e.g., Royal Seleucid, Provincial Roman), the “material” (e.g., Bronze, Silver), and date of the issue. For non-Antiochene finds at Antioch, search results were saved simply according to nature of find, material, and date of issue.

The KML files were then imported to Google Earth, which mapped the results of individual searches with a 3D stacked bar chart representing summary coin quantities at each location. Bar charts emerging from the earth were chosen instead of proportional circles in order to take full advantage of Google Earth’s multiple viewpoint capabilities for top-down or horizon-level comparison.³⁸ For finds of Antiochene coins, bar charts appeared at the *find spot* of the hoards or excavations.³⁹ For coin finds excavated at Antioch, bar charts depicted the *origin* of the coins. Each bar chart is tied to the original quantities of coins, but amplified by 10,000 meters above the earth in order to permit analysis over a wide territory. Pink tabs at the top of each bar chart could be clicked to reveal the actual quantity of coins displayed. In addition, each quantity of coins was color-coded to the time-period of site finds issue or hoard deposit date (e.g., Late Seleucid: purple; Julio-Claudian: pink), allowing the display of a third⁴⁰ attribute in addition to geographical location and quantity of coins.⁴¹ Again, the goal of this approach was not in-depth statistical analysis, but rather to provide a quick, initial visual comparison of coin finds in their spatial context.

Following the import of all KML files into Google Earth, a few additional steps were required to improve the visualization of data. First, queries were organized into subfolders under the

36 The export file is originally saved as txt and requires a manual change to a kml extension. See Henry (2009), 3-4; Goodchild (2008), 15: “Google Earth’s API allows users not affiliated with Google to create their own applications and extensions... Clicking on the file name will execute Google Earth, pan and zoom to the [location in the kml file], and add a placemark over the...location at latitude..., longitude... Similar scripts will paste coloured patches, images, three-dimensional structures and many other kinds of features on the Earth’s surface.”

37 A detailed breakdown of the code is available for download at <https://scholar.uc.edu/show/zp38wc642>.

38 Shepherd (2008), 201-02, 210. See Henry (2009), 11-16: Henry generated multiple bar charts in GIS to be depicted in Google Earth’s browser.

39 The polygon tool in Google Earth can be used to create individual bar charts, but Wallrodt included this in the script exported from the FileMaker Pro database.

40 For the reference to the metaphor of the “third side of the coin” see above.

41 Both the amplification of data and color-coding were options in the database before export.

“Places” panel (ill. 2). One subfolder divided queries into different coin “material,” such as silver or bronze. Another subfolder sorted queries by the subcategory of Antiochene coin, whether Roman provincial or Roman civic. A last subfolder organized queries into five major chronological periods⁴²:

- Later Seleucid (223-91 BCE)
- The transitional period between Seleucid and Roman imperial rule (90-31 BCE)
- Roman imperial rule (30 BCE-235 CE) with subdivision by dynastic family
- Third century crisis (236-283 CE)
- Early centuries of Late Antiquity (284-423 CE)



Illustration 2: A screenshot of the Google Earth Pro platform with the Places panel highlighted. Individual data points can be organized into folders in order to control what information is visualized.

Selecting any of these folders in the “Places” panel toggled the appearance of that data and created a straightforward method for easily comparing hoard data to site data or coins of different issuing authorities or metals. Placemarkers were also added for each excavation included in this study in order to account for locations that had been examined, but had no Antiochene coins. Rough maps of ancient trade routes and borders were displayed beneath the coins as a basic method of contextualizing whatever data was viewed.

⁴² This is an imperfect division, but these broad periods do more than a fine-toothed approach in accounting for the many provisions involved in using coin finds: the complex minting, socio-economic, and political history of the Roman east and empire; the longevity of coin circulation; the varying legibility of coin finds; and the different ways of dating site finds (by issue and not deposit) and hoards (by latest datable coin). The one questionable move may be combining the Julio-Claudian and Flavian finds into one period, but based upon hoard evidence, scholars predict much overlap in circulation for the first century CE (see Butcher (2004), 180-92; Butcher (2002), 145-52). The two earliest chronological periods focus on eastern events. For example, 90 BCE was chosen as the end of the Seleucid empire because the minting of royal Seleucid bronze ceased in that year and Antioch began producing its own municipal coin. The Roman imperial dates and following periods of the third century crisis and Late Antiquity follow a more Mediterranean model because the city was then part of the Roman empire. In the end, how closely these divisions correlate to possible “coin-use periods” is uncertain, but this chronological division does represent the best compromise currently available between artificially even segments (e.g., ten year periods) and the complex life cycle of each coin. On “striving towards coin-use periods,” see Lockyear (2007), 218-21.

The final step in this methodology was to ensure permanent and open access to the visualizations created in Google Earth. All maps for and information related to the distribution of coins finds in Google Earth were stored in the University of Cincinnati's digital repository: Scholar@UC (<http://scholar.uc.edu>). Three interactive maps are available for download in KMZ format (a zip file for a collection of KML files): the location of excavation sites consulted for the distribution study of Antiochene coins⁴³; the quantities and find spots of coins minted by the ancient mint(s) at Antioch, as sorted by metal, Antiochene subcategory, and chronology⁴⁴; and the origins and quantities of coins found through excavations at Antioch with material sorted by metal and chronology.⁴⁵ These files are not only readable in Google Earth, but can be viewed as text files to examine the data directly or transfer to other visualization platforms.

3. Sample Patterns from Google Earth

Visualizing coin finds in Google Earth quickly connected these disparate data points and revealed both empire-wide and more regional patterns in their spatial and chronological distribution. This visualization was not intended to be the end of analysis, but rather a method for contextualizing the data in order to uncover paths for future research and further quantitative study. The following section highlights select, broad patterns gleaned from Google Earth alone, which prove promising for addressing questions of change to Antioch and the region following Roman annexation. Although these patterns are intended to be viewed within the platform of Google Earth, for visual ease within this publication format, several screenshots are provided with the columns representing the quantities of coin flattened to circles.⁴⁶

Beginning with a broad look at the data, mapping coins in Google Earth provided a clear visualization of how the city of Antioch realigned from a capital of the Seleucid empire to first a provincial Roman center in Syria and then an imperial center oriented to the west in the late Roman empire (ill. 3). In other words, the data in Google Earth illustrated that the authority or authorities who controlled Antioch and its mint(s) had a significant impact on the outward boundary limits of Antiochene coin distribution. That said, other influential factors were already apparent from even these overarching distribution patterns.

43 doi:[10.7945/C2201C](https://doi.org/10.7945/C2201C)

44 doi:[10.7945/C25P4B](https://doi.org/10.7945/C25P4B)

45 doi:[10.7945/C25P4B](https://doi.org/10.7945/C25P4B)

46 This adjustment can be done directly within Google Earth by modifying the display altitude of the data points. Right click on an individual folder within the places file, and then select "get info." This will display an edit window, which allows multiple modifications in how the data is displayed.



Illustration 3 a: The distribution of Antiochene coins during the Seleucid period (c. 223-91 BCE).



Illustration 3 b: The distribution of Antiochene coins during the Roman imperial period (c. 30-235 CE).



Illustration 3 c: The distribution of Antiochene coins during the late third century CE through late antique period (c. 235-423 CE).

During the Hellenistic period, bronze and silver coins minted at Antioch exclusively for the Seleucid kings spread from Asia Minor far into the eastern reaches of their empire. Based upon the relative quantities of the coin finds from each location, Antiochene coin finds were not evenly distributed within this span, but appeared in a higher concentration within Syria. This aligned with what is already known about the initial distribution of royal mints within Seleucid territory and the subsequent importance of Antioch as the Seleucid empire crumbled under other governmental powers.⁴⁷ Even though these ever-shrinking political boundaries greatly limited the movement of Antiochene coins out of Syria, small quantities of both silver and bronze nevertheless appeared in the Parthian empire and likely reflect commercial traffic still connecting the Mediterranean to further east.⁴⁸

After the Romans annexed Antioch, finds of Antiochene silver and bronze coins stayed predominately within the confines of Syria and the Levant. Antioch minted chiefly for the provincial government of Syria and the city itself with only irregular imperial issues in the early centuries of Roman rule.⁴⁹ Traditional divisions created by the fallout of the Hellenistic kingdoms, denominational differences, as well as stronger provincial borders under the Romans presumably contributed to keeping Antiochene finds within Syria and the Levant.⁵⁰ Large-scale change in the distribution pattern only occurred in the third century CE and late antique periods, when Antiochene coin finds stretch far into the western Mediterranean. Antioch now minted coins exclusively for the Roman state, which enforced a homogenized currency throughout the

⁴⁷ Houghton (2002), 354-55; Aperghis (2004), 235-36, 245; see Mørkholm (1984), 93-97; Duyrat (2015), 375.

⁴⁸ Seyrig (1955), 101-04. See Raschke (1978), 604-1361; Young (2001).

⁴⁹ Antioch minted silver denarii for the central Roman state under Vespasian, Titus (see Tacitus (Hist. 2.82)) and Hadrian. As these issues had an express military purpose, it is possible that these coins were shipped outside Syria and then reabsorbed by the imperial government to produce newer issues. See Butcher (2004), 95-98.

⁵⁰ See Butcher (1996), 101-09.

empire.⁵¹ While previous scholarship has discussed such a reorientation from the Hellenistic period to Late Antiquity, the visualized data within Google Earth clarified when and in what ways that change occurred within a spatial context.⁵²

Google Earth also helped illuminate finer patterns in the relationship between Antioch and the wider Mediterranean and East. For instance, this program opened up new possibilities for the diverse body of single finds of non-Antiochene coins from the excavations at Antioch. These coins have not attracted significant study, largely because the vast majority of coins from Antioch's own mint(s) overwhelms their numbers (ill. 4).⁵³ While the dominance of Antiochene coins testifies to the continued importance of the city's mint(s) in meeting its own currency demands, Google Earth provided the perfect platform for making sense of the disparate foreign coins that arrived in the city.⁵⁴ When these coins were mapped according to where they originated, several patterns materialized in their spatial and chronological distribution.



Illustration 4: A screenshot in Google Earth Pro of the distribution by origin of Roman era coins found through excavation at Antioch. The three highest quantities of coins are highlighted: those from Rome, those from Antioch, and those from the southern Levant.

The overall geographical spread of the coins was immediately apparent (ill. 5). The Roman east contained a diversity of local communities issuing their own coins, many of which are represented by one or two coins found at Antioch. Their origins span from Rome, down the coast

⁵¹ Butcher (2004), 260-61.

⁵² See for instance Jones (1940); Jones (1971); Sartre (2005); Millar (1993).

⁵³ Waage (1952).

⁵⁴ Based upon a count of 5,522 identifiable finds from 223 BCE-423 CE, 76% are Antiochene in origin (see Waage (1952)). Butcher ((2002), 145-51; see also (2004), 174-76) has argued that civic authorities within Syria regulated which coins would be accepted as currency within city limits. In the case of Antioch, Butcher proposes that city officials limited acceptable currency to only Antiochene coin. While an attractive proposal, one has to wonder whether the uneven coin finds at Antioch represent an active and strict policy by the Antiochene municipal government to set currency limits or are the indirect result of the relatively strong and consistent production of coins at Antioch compared to other regional mints. In other words, the products of the Antiochene mint(s) may simply have overwhelmed what else could be used within the city and what therefore appears within the archaeological record. Deciding between these two explanations is equally difficult in assemblages comparable to Antioch's (e.g., Athens, Corinth), where local production appears to overwhelm all other sources of coinage. See MacDonald (1976), 45; Johnston (2007), 5-6; Kroll (1993), xviii-xxvi, 166-70.

of Asia Minor, past Cilicia and into the southern Levant. Ancient and modern sources have commented on Antioch's strategic location, through which many traders and travelers passed.⁵⁵ The Google Earth maps provided a partial visualization of that movement into the city.

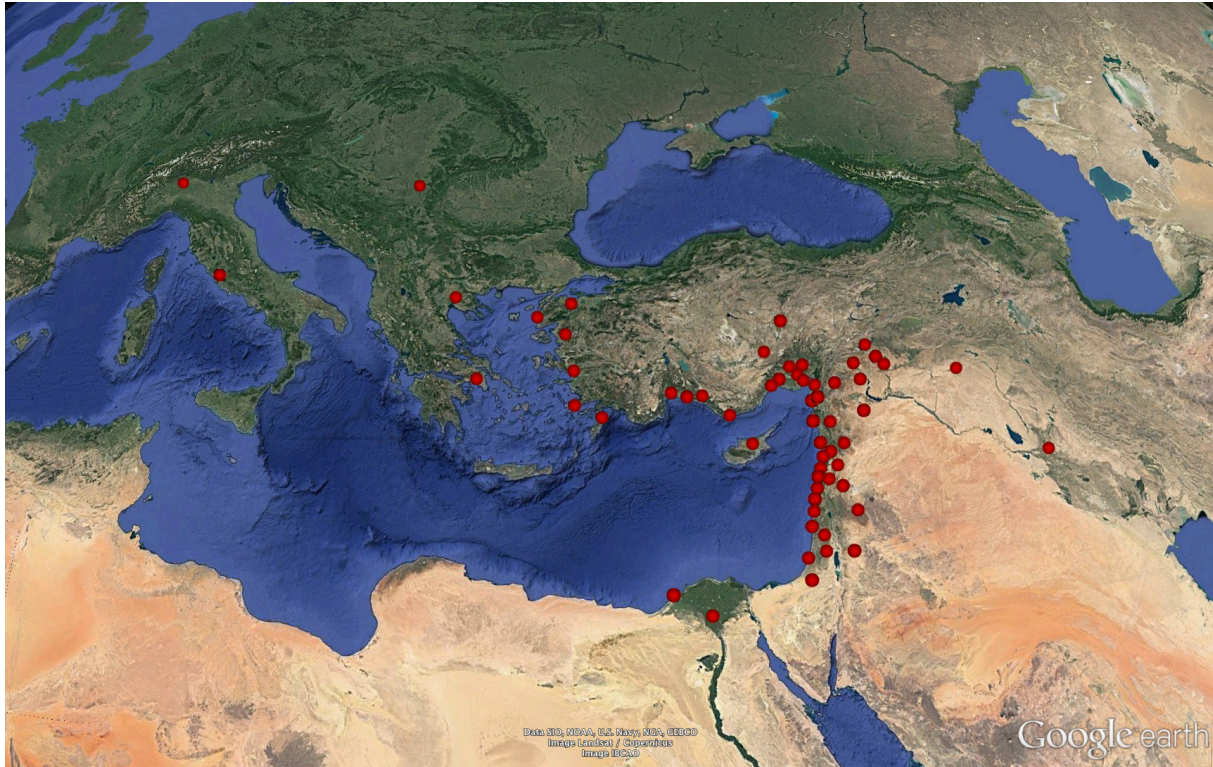


Illustration 5: The geographical spread by origin of foreign coins found at Antioch as visualized in Google Earth Pro.

When this spread was broken down over time, an interesting pattern emerged within Google Earth. Despite Antioch's inclusion within the Seleucid and Roman empires, not until the Severan period did a true diversity of coins from a wide geographical span appear in the city's assemblage.⁵⁶ Scattered finds dating to the earlier periods originated from places like Egypt and Athens, but only after the wave of civic self-promotion through coins in the later second and early third centuries CE do issues regularly appear from greater Syria, Mesopotamia,

⁵⁵ Str. 16.2.1, 5-8; Libanius *Or.* 11.34-41, 258-65; see Downey (1961), 46; Butcher (2003), 11-15.

⁵⁶ Finds dating to the late Seleucid period originated predominately from northern Syria and Phoenicia with a few exceptions from places like Tarsus, Egypt, Athens, and Rome. Their makeup provides a partial reflection of coins generally circulating within the northern Seleucid empire (compare with the maps of Seleucid and civic mints of the east in Newell and Mørholm (1977), 3; Hoover (2009), 282); Duyrat (2016). Coins from eastern Seleucid mints – like Seleucia on the Tigris, Carrhae, and Dura – do appear in the Antiochene assemblage before the reign of Antiochus III, but their absence in the later assemblage is likely because of the gradual loss of Seleucid territory in the East. All the same, such a collection overall is not as diverse as one could expect with the Seleucid's open currency policy and Antioch's position on major trade routes. As for the first centuries of the Roman period, besides two clusters discussed, the origins of non-Antiochene coins were even more constrained to regions close to the city with a smattering of finds from Egypt, Cyprus, Pamphylia, Cappadocia, and Mesopotamia. However, it bears repeating that the majority of these finds are bronze, rather than silver, which may explain the strong localization of the finds.

Cilicia, and Cappadocia.⁵⁷ Once the empire transitioned as a whole to a more uniform body of imperial currency in the late third century CE, finds from western mints formed an integral part of assemblage at Antioch.⁵⁸

Because of this chronological disparity, two clusters of higher quantities stood out within the finds of the earlier Roman imperial period (ill. 4). The first group consisted of coins from the Nabataean kingdom and what Waage described in her catalog as “coins of the Jews.”⁵⁹ Both Nabataean and Jewish coins dating to the first century CE are common finds throughout the northern Levant. Their appearance at Antioch may be an indication of loose territorial boundaries in the Levant during the early years of Roman control or – in the case of the Jewish coins – the presence of like ethnic communities or associations between the south and the northern Syrian city.⁶⁰ The latter explanation may be more likely considering the striking absence of Phoenician coins within the first century CE assemblage at Antioch. Granted, a small number of cities issued their own currency during this period, but Phoenician coins do not have strong representation at Antioch even in the previous century.⁶¹ This may indicate that Syrian coins continued to circulate differently in the north and south, even after Roman reorganization of the Levant.⁶² In any case, both the presence of Jewish and Nabataean coins and the absence of Phoenician coins at Antioch during this period offer interesting clues to Antioch’s connections within its region, clues which may have been missed without their visualization in Google Earth.

The second quantity standing out among the distribution of non-Antiochene coin finds were those originating from Rome (ill. 4). A negligible presence among the finds dating to the first centuries BCE and CE, these coins make their strongest appearance within the Antonine

57 In the second and third centuries an increasing number of cities issued coins in celebration of their own mythological foundations, civic cults, and honorific titles (see Millar (2006), 120-25). The finds from Cilicia and Cappadocia are the first relatively substantive body of coins from these territories to appear in the Roman imperial assemblage. This is somewhat surprising, because of the proximity of these regions to Syria and the common traffic passing through them. Then again, it may be that either denominational or political restraints limited the movement of these coins. The general rarity of coins from Cilicia and Asia Minor in the northern Levant would suggest that whatever the political, geographic, or economic ties between the two regions, these coins did not circulate in Roman Syria. Cappadocian bronze coins more commonly appear than silver, but also not in extensive quantities within Syria; they too did not likely circulate within the Levant. See Butcher (2004), 176-77.

58 The late antique finds are still weighted towards the mints of the eastern Mediterranean, such as those in Asia Minor and at Alexandria. However, much like the pattern of late antique finds of Antiochene coins mentioned above, the geographical span reflects one way in which Antioch had transitioned into a fully integrated part of the empire.

59 See Waage (1952), 87. Waage includes in the latter group one coin for King Archelaus, two coins for Herod Agrippa I, four coins of the procurators, and one coin of the first Jewish revolt.

60 Millar (1993), 31; Butcher (2004), 177; Butcher (1996), 108.

61 See the map in Jones (1963), 311. See also Burnett, Amandry, and Ripollès (1992), 581-582; Butcher (2004), 177.

62 The distribution of Antiochene silver tetradrachms reinforces this conclusion: not until the second century CE do these coins appear in noteworthy quantities within southern Syria and the Levant. The continued production of civic silver at Tyre possibly provided a denominational or a preference barrier to the circulation of Antiochene silver further south. This changed during the reign of Nero, when Antiochene tetradrachms were switched to a Tyrian standard and type, and the mint at Tyre stopped producing silver. Butcher has argued that these changes prompted the circulation of Antiochene tetradrachms within Phoenicia and the southern Levant. If the evidence is weak for the end of the first century CE, the hoards from the second century CE do reveal the distribution of Antiochene coins to the south alongside other Syrian issues, Roman denarii, and a few other silver issues from the East. Roman annexation of the region therefore appears to have increased the circulation of Antiochene silver coins (see Butcher (1996), 104-06). It is probable that the Roman bureaucracy orchestrated these changes. Within the diverse currency pool of the Near East, the tetradrachms acted as a bridge between local bronze and the denominations of the Roman state for substantial transactions within the public and private sectors. See Harl (1996), 98-99; Butcher (2004), 245-53, 257-61.

period.⁶³ The majority of these coins are regular imperial bronzes and a few silver denarii of the Roman mint dating from Trajan through Marcus Aurelius. Almost a third of the coins, however, are provincial issues struck at Rome for circulation in Syria.⁶⁴ Since all these coin finds date to the reign of Trajan, it is reasonable to link their presence to the emperor's Parthian campaigns. After all, Antioch became the focus of Roman investment as a political and military center during this period.⁶⁵ A few Roman coins also appear in the Severan period, but at remarkably lower quantities than in the previous era, despite the continuation of military activity in the region. Once again, mapping pages of coin find tallies in Google Earth linked the data together in such a way as to facilitate comparison of the Roman coins both against other finds of the period and against other finds over time.

In addition to highlighting changes within the assemblage of foreign coins at Antioch, Google Earth also helped uncover finer patterns in the distribution of Antiochene coins outside of the city. This is best illustrated with a comparison of the bronze provincial and civic coins minted at Antioch during the Roman imperial period. Scholars have generally claimed that because of the difference in issuing authority, provincial coins moved widely around the province, whereas civic coins stayed close to their city of origin.⁶⁶ The same should be expected for coins from Antioch, as the iconography on the coins clearly defines the civic authority from the Roman provincial authority. The provincial coins normally bear the emperor's portrait on the obverse with either Latin or Greek inscriptions and a wreath encircling the letters SC, presumably for *senatus consulto* – “by the decree of the senate” – on the obverse.⁶⁷ Quite in contrast, the civic coins of Antioch often celebrate the city with the name of the Antiochenes (e.g., ANTIOXEΩN) boldly displayed, titles usually in Greek, and civic iconography celebrating both Antioch's history and its mythology.⁶⁸

When both types of coins were mapped in Google Earth, nuances in the pattern were revealed suggesting that coin distribution in the East was not as simple as previously thought. The provincial Roman coins were introduced at latest around 5 BCE and, according to the visualization in Google Earth, had a strong presence throughout Syria for the following century (ill. 6).⁶⁹

63 Because Waage's report combines the central Roman finds from Antioch and Seleucia Pieria, it is possible that the number of Roman coins is inflated. Still, as coin assemblages from other Syrian sites demonstrate that Roman coin was more prevalent in the East by the second century BCE, it is certain that a number reached Antioch as well.

64 For the provincial SC issues, see Waage (1952), nos. 1016-17. Waage attributed these to the mint at Antioch, but see Butcher (2004), 35-38, 406-12. For the coins of the Koinon of Syria, see Waage (1952), nos. 400-01. Waage had also attributed these to the mint at Antioch, but see Butcher (2004), 409. For coins bearing the legend ΔΗΜΑΡΧ ΕΞ ΥΠΙΑΤ Β, see Waage, nos. 390-99. Traditionally attributed to Caesarea in Cappadocia, Waage argues that the amount found at Antioch meant that they were struck in this city. For the attribution to Rome, see McAlee (2007), 192; Butcher (2004), 35-38, 408-09.

65 See Downey (1961), 211-13.

66 See Butcher (2004), 18-22; Harl (1996), 107-13; Wallace-Hadrill (1986), 72-73.

67 Unlike the civic coins, the provincial coins bore Latin legends until the time of Trajan (98-117 CE), when they switched to Greek; the reason for the change in language is uncertain. The significance of the letters SC is also a matter of debate. Compare Burnett (1987), 19; Butcher (2004), 235-236; Bay (1972), 118-19; Grant (1946), 97-98, 101; McAlee (2007), 3-5.

68 For a succinct overview of these types, see the examples in McAlee (2007), 88-107.

69 Antioch began to mint the bronze SC coins during the reign of Augustus. Many scholars link their introduction to Quinctilius Varus, who served as governor of Syria beginning in 7/6 BCE, but it is possible that their production started earlier. The titles for the emperor Augustus appearing on these coins only signify that the coins must have been minted after 23 BCE. Howgego (1982), 7-11; Butcher (2004), 28-29; Downey (1961), 167. The RPC editors suggest between 20 and 10 BCE (see Burnett, Amandry, and Ripollès (1992), 603, nos. 4101-5).



Illustration 6: The roughly weighted distribution pattern of provincial SC coins as visualized in Google Earth Pro. All orange circles represent coins dating to the first century CE. The teal circles represent provincial SC coins dating to the second and third century CE. Inset of a provincial SC coin image is used with permission of wildwinds.com and George Clegg.

These coins were likely part of an attempt by the Roman government to standardize regional bronze coinage in the immediate years after annexation.⁷⁰ The military also affected the distribution of these coins as those with legionary countermarks appeared in small quantities beyond the limits of Syria to the east and further south.⁷¹ Despite this use, however, the maps in Google Earth did not reinforce scholarly claims that this type acted as “the official Roman bronze coinage of the far eastern provinces of the Empire.”⁷² Additionally, the distribution of provincial finds dating to the later second and third centuries CE suggested a lessening of importance in this type of coin even within the provincial confines of Syria.⁷³ It is possible that the increase of individual cities minting their own bronze coinage lessened the need or enforcement of the provincial coin’s circulation. Only at Antioch did the quantities of provincial SC coins appear to increase, which may point to the city’s role as a regional center of the Roman government rather than a completely independent city.⁷⁴

As for the city coins of Antioch, a different pattern surfaced within Google Earth. For the most part, the maps showed what could be anticipated – that Antiochene civic coins predominately

⁷⁰ Butcher (2004), 29. See Burnett (1987), 19.

⁷¹ See Howgego (1985), 17-23; Howgego (1982), 10-11. For examples of the legionary countermarks on these coins, see Brunk (1980), 63-76; Bellinger (1949), nos. 1604a, 1604b, 1604c, 1625d.

⁷² Carradice (1983), 17. See also Howgego (1985), 84; Reece, et al. (2008), 424.

⁷³ Cf. Butcher (1996), 108; Butcher (2004), 257.

⁷⁴ See Downey (1961), 163-164; Tacitus Hist. 2.78.

circulated around the city with a few stray finds moving further away with travelers (ill. 7). After all, the coins celebrate the internal values of Antioch's own citizens and were likely directed toward use by this audience within the confines of the city and the immediate territory.⁷⁵ Neighboring cities may have adopted the same practice and possibly refused to accept Antiochene coin as currency within their borders.⁷⁶



Illustration 7: The roughly weighted distribution of Antiochene civic coins as visualized in Google Earth Pro. The circles are weighted to relative quantities. Inset of Antiochene civic coin image used with permission of wildwinds.com (ex Pegasi Numismatics Auction 140, lot 218).

Although this should have been the general case throughout Syria – cities relying on their own coins or those of cities closest to them – the Google Earth maps revealed an unexpected line of relatively high percentages of Antioch's civic issues running east of the city, along a major communication route well towards Mesopotamia. This unusual extension of the civic coins away from their issuing city may partially be explained by the lack of a local mint in this eastern region during this period. However, other Syrian cities along the Orontes and Mediterranean issued their own civic coinage in the first century BCE, but they are rare finds along this line eastward from Antioch.

It is therefore conceivable – though in need of further evidence – that Antiochene civic coins were somehow more legitimate among the people of this region because of their clear identification with the previous Seleucid capital of Syria (ANTIOXEΩN / ΤΗΣ ΜΗΤΡΟΠΟΛΕΩΣ - “of the metropolis of the Antiochenes”). The Antiochenes started to produce these coins regularly in the waning years of Seleucid control over the city, which may have initially contributed to their eastward movement within the kingdom.⁷⁷ The fact they continued to appear through

⁷⁵ Heuchert (2005), 40. See also Howgego (1985), 89-91; Harl (1987), 11, 21-22.

⁷⁶ See Butcher (2002), 145-52.

⁷⁷ Nixon (2002), 298-99. See also Waage (1952), 24; Butcher (2004), 24-27, 307-12; McAlee (2007), 60-61.

later decades may be related to an established precedent and/or their explicit ties to a city at the top of the civic hierarchy. Even though the Romans were strengthening their control of the region, perhaps coins boldly printed with Antioch's name held more weight abroad than coins of other cities. This connection or influence did not last past the first century CE.

Without the visualization provided by Google Earth, it would have been incredibly difficult or perhaps even impossible to synchronize and compare the distribution of these two bronze types out of Antioch. By rendering the data in a digital platform which accounted for quantity, space, and chronology, the necessary connections could be made and developments in the coins' distribution highlighted.

4. Conclusion

These few sample patterns to emerge from Google Earth are certainly not the only ones of significance, nor is noting their presence the end of analysis. In this project on the annexation of Antioch, every pattern appearing on the maps has been quantitatively analyzed on the level of individual site assemblages and regional groupings from the city of Antioch and sites within Syria, Mesopotamia, the southern Levant, Asia Minor, and the western Roman Empire. Explicit testimony about the city and region from other sources has been brought into conversation with this analysis, both as comparison and check to the results surfacing from the numismatic material. This multi-faceted approach already suggests that even as Antioch was a metropolis of great regional stature, its importance was much more mutable in the hands of the different authorities making use of it than previous scholarship has assumed.

Even with the need for further analysis, the maps provided by Google Earth have nevertheless proved to be an invaluable first step within this project. The program quickly rendered endless pages of disparate data points from multiple excavation reports and hoards lists into a cohesive, interactive map. This map could account for change across both time and space, thereby offering a much more comprehensive picture of Antioch within its regional and imperial contexts. As a result, Google Earth's visual translation of the quantified data offered by the numismatic evidence created new entry points into old material and long-discussed questions.

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