International Cartographic Association
Commission on Cartographic Heritage into the Digital
15th ICA Conference Digital Approaches to Cartographic Heritage

Conference Proceedings ISSN XXXX-XXXX – Cluj-Napoca, Romania, 24-26 September 2020

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Visualization and GIS Analysis of Ptolemy's One-Sided Globe in the Old and Modern Contexts

Keywords: Claudius Ptolemy, ancient geography, GIS analysis, historical cartography, georeferencing

Summary: In this paper, we frame the results of our multi-year project devoted to georeferencing and visualization of data from Claudius Ptolemy's seminal 'Geography' in the context of other ancient, medieval and modern cartographic sources, some of which were influenced by or derived from Ptolemy's massive and widely venerated classical work. Our GIS analysis involves such relevant old sources as Konrad Miller's consolidated Tabula Rogeriana by Muhammad al-Idrisi, Tabula Peutingeriana, Hellenic Ptolemaic maps, and the Alfonsine tables. We also discuss the challenges of visualizing Ptolemy's one-sided globe of *oikouménē*, the 'known world' of the ancients, using such modern GIS tools for development of 3D virtual globes as Google Earth and Cesium.

Introduction

Claudius Ptolemy was a major Hellenic scholar universally recognized for his prominent role in establishing the foundations of astronomy and geography as scientific disciplines. He is believed to have lived in Alexandria, Egypt, in the 2nd century AD. Ptolemy's classic *Geography* (Stückelberger & Grasshoff, 2006) is a massive work providing numerical coordinates of 6300+ objects of *oikouménē*, the "known world" of the ancients. The set of objects comprises cities, towns, colonies, villages, markets, harbors, temples, altars, mountains, capes, bays, lakes, forests, river sources and mouths, etc. In addition to the objects with coordinates (longitudes and latitudes), Ptolemy offers useful descriptions and lists of tribes that once inhabited different parts, or provinces of the *oikouménē*, along with the information on which Roman legions were stationed in which cities, distance computations, reasoning about the shape and size of the "known world", and map-making instructions for three different projections. Livieratos (2006) stressed the modern need for "a rigorous revisiting of Ptolemy's representations, especially the regional tabulae, in terms of georeferencing."

In this paper, we frame the results of our multi-year project devoted to georeferencing, GIS analysis and visualization of data from Ptolemy's *Geography* in the context of other ancient, medieval and modern cartographic sources, some of which were influenced by or derived from Ptolemy's opus magnum. Our earlier publications concerned Ptolemy's Taprobane and India before the Ganges (Abshire et al. 2016), Arabia (Abshire et al. 2020), the Fertile Crescent including Judaea Palestina, Syria, Mesopotamia, and Babylonia (Abshire et al. 2017: 152–167), Britain and

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Ireland (Abshire et al. 2017), India beyond the Ganges, Serike and Sinae (Gusev and Stafeyev 2018), and West Africa (Filatova et al. 2019). We have demonstrated that additional clarity and understanding can be achieved by working directly with the coordinates, as opposed to merely relying upon visual comparison of old and modern maps in search of similarities. Under our iterative hybrid human-machine approach, the identified known objects mentioned by Ptolemy serve as reference points that help us place and identify previously unknown objects. The georeferencing task still remains very complex, due to the many source distortions and data compilation errors further compounded by the discrepancies between different manuscripts and editions of *Geography* that had been shown to be a significant contributing noise factor in its own right (Dilke 1987). This distortion noise is difficult to quantify in relation to Ptolemy's own errors. In our prior works, we have confirmed that the precision of our methods for numerical prediction of coordinates of the unknown points varied significantly region-to-region, in line with the uneven quality of data. In particular, we proposed and advocated a new hypothesis placing Ptolemy's Sinae province almost entirely in West Africa, along with some of the objects placed by Ptolemy in his India beyond the Ganges. In our paper on Ptolemy's Arabia (Abshire et al. 2020), we introduced object classification dividing all Ptolemy objects into four categories: *known* objects, *tentatively identified* objects, *unknown* objects (placed approximately), and *duplicates*. This classification will continue to serve us here.

While keeping our primary focus firmly on Ptolemy's *Geography*, we have been taking advantage of its rich context comprised of such works as (McCrindle 1927), the anonymous *Periplus of the Erythraean Sea* (Schoff 1912), the *Periplus of Hanno* (Schoff 1972), Herodotus (Marincola and A. de Sélincourt 1996), Pliny the Elder (Pliny 1855), the *Antonine Itinerary* (Cuntz 1929), *Tabula Peutingeriana* (Levi and Levi 1978), and the *Ravenna Cosmography* (Schnetz 1942). We will supply a review of other scientific literature relevant to the GIS analysis of Ptolemy's data in the old and modern contexts in the next section and revisit *Tabula Peutingeriana* in the section after that.

The fourth section of the paper will present our GIS analysis of Konrad Miller's reconstructed *Tabula Rogeriana* by Muhammad al-Idrisi (Miller 1929). The fifth section of our paper will discuss georeferencing a Hellenic Ptolemaic map by Nicephorus Gregoras (c. 1295 – 1360) from Vaticanus Urbinas Graecus 83 (15 c.) to Ptolemy's dataset.

The sixth section will be devoted to the analysis of object coordinates from the *Alfonsine tables* calculated for 1252 AD, the first year of the rule of King Alfonso X of Castile, by Isaac ben Sid and Jehuda ben Moses Cohen (1483), along with the coordinates of the extra objects added in the subsequent printings of the book.

In the seventh section of the work, we will talk about visualizing Ptolemy's one-sided globe of *oikouménē* using such modern GIS tools for development of 3D virtual globes as ESRI

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ArcGlobe, Google Earth, and Cesium. We will draw conclusions and discuss our plans for the future research in the eighth and final section of the paper.

Literature Review

The best complete modern translation of Claudius Ptolemy's *Geography* is the authoritative translation into German (Stückelberger and Grasshoff 2006). It comes with a Greek version of the original work printed alongside the German translation. The book is accompanied by a database of Ptolemy object coordinates in an electronic format. The database supplies a convenient Ptolemy object ID system that we have adopted in our work. Stückelberger and Grasshoff often suggest modern names for the Ptolemy objects. We have observed that many of their suggestions are based on those from an earlier Latin translation of *Geography* by Müller (1883-1901) that also contains useful thorough lists of different spellings of Ptolemy's object names.

The only complete translation of Ptolemy's *Geography* into English (Ptolemy 1991) has long been known to be of bad quality (Diller 1935). Despite that, we have been using this source to come up with suitable English counterparts for the German object names. Given that the toponyms found in *Geography* have originated from many different ancient languages, we must admit that no set of English name assignments can be quite perfect. Berggren and Jones (2000) published an annotated modern English translation of the theoretical chapters of Ptolemy's *Geography*, and Diller (2009) translated its Book 8.

The atlases by Talbert (2000) and Åhlfeldt (2019) have served us as invaluable sources of information essential for initial identification of the known Ptolemy objects. Tsorlini (2011) developed an excellent catalog that covers Ptolemy's Mediterranean and Black Sea region and provides an original methodology for computation of modern coordinates. Gunn (2018) published a monograph on Ptolemy and discoveries in Asia.

Leo Bagrow provided important insights into the origin, dating, and nature of Ptolemy's *Geography* in his foundational works (Bagrow 1945), (Bagrow 1985). In particular, Bagrow pointed out that the extant manuscripts of *Geography* were created during the last centuries of the Byzantine Empire, and that Ptolemy's work had remained virtually unknown to authors for 1000 years after his death, with few exceptions. According to Bagrow, an anonymous author of a book on Armenia's geography (*Ashkharhatsuyts*), most likely, Anania Shirakatsi, relayed to us that Pappus of Alexandria (c. 290 – c. 350 AD) once reworked and abridged Ptolemy's *Geography*. Furthermore, Marcian of Heraclea (c. 4th c. AD) mentioned Ptolemy in his *Periplus of the Outer Sea* (*Periplus maris exteri*), yet said nothing about his maps. We mentioned these observations by Bagrow to prepare the reader for what we are about to present and illustrate next.

Tobler (1966) pioneered application of mathematical methods to georeferencing of old maps when he derived a set of equations to establish a relationship between the medieval Hereford map and an oblique Mercator projection. Numerous references to other works related to the GIS analysis of old maps can be found in the literature reviews incorporated in our prior works referenced in the introduction section above.

Tabula Peutingeriana and Ptolemy's *Geography*

Tabula Peutingeriana (Levi and Levi 1978) is an ancient *mappa mundi* that made it to modernity as a rectangular copy on parchment, 0.34 m tall and 6.82 m long, discovered in a library in the German city of Worms in 1494. To illustrate how different this map is from Ptolemy's, we have attempted to "georeference" a vertically stretched image of the 1887 *Conradi Milleri facsimile totum* of *Tabula Peutingeriana* to the full dataset of Ptolemy's object coordinates (Stückelberger and Grasshoff 2006) plotted in the Mercator projection so as to match the rectangular shape of

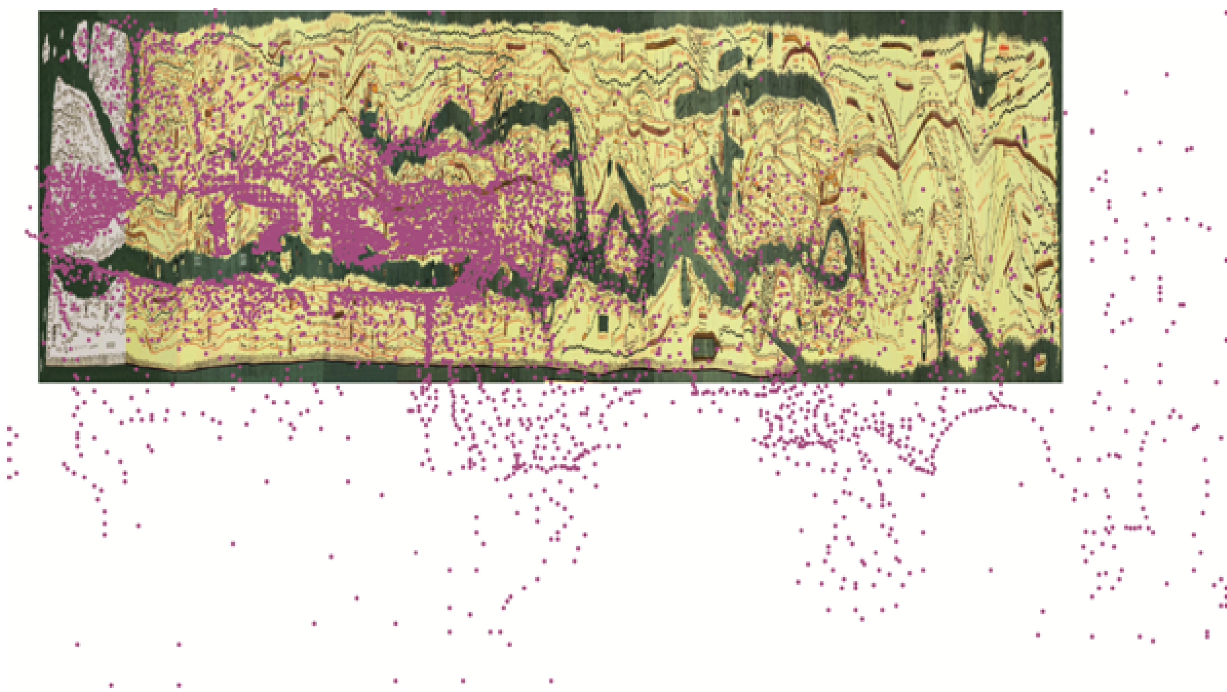

Figure 1: *Tabula Peutingeriana* vs. Ptolemy's *Geography* (the purple points).

Tabula Peutingeriana. An attempt was made to achieve a "good fit" in the area of the Mediterranean Sea. The resulting composite image is shown in Figure 1.

Major differences between the two data sets are immediately obvious to the viewer. This outcome is unsurprising, given the difficulties in georeferencing old *mappae mundi* encountered since (Tobler 1966). To say that *Tabula Peutingeriana* is in a very different projection would require us to assume that the very notion of projection was known to the map's anonymous author whose lifetime is dated approximately by the 4th or early 5th century AD, based on the presence of Constantinople (renamed from Byzantium c. 330 AD) and the prominence of Ravenna, the seat of the Western Roman Empire from 402 to 476, suggesting a 5th century revision (Levi and Levi

1967). In fact, it appears that if any numerical data related to Ptolemy's set was ever used in making this parchment at all, that could only be some known latitudes. The reader should bear in mind that the ancient astronomers could measure latitudes of objects on Earth with reasonably good precision at and before the time of Ptolemy. However, for the technical reasons explained in detail by Berggren and Jones (2000), this was not the case with the longitudes and longitude differences. Therefore, the longitude numbers were likely known not be trusted.

And yet, *Tabula Peutingeriana* is far from useless when georeferencing Ptolemy's dataset to the modern map. That's because, unlike Ptolemy's maps, *Tabula Peutingeriana* captures the topology of the Roman road network and other trade route itineraries that it was apparently built from, with some peculiar "glitches". Let us illustrate this statement by inviting the reader to look closely at the West Africa fragment of *Tabula Peutingeriana* shown in Figure 2. (Konrad Miller's facsimile is used, for the sake of better readability.) Observe that both *Tingi* (modern Tangier, Ptol. *Tingis Caesaria*) and *Oppidum Novum* (*Oppido Novo*, Ptol. *Oppinum*) are shown twice, close to each other, as the mapmaker apparently accommodated data about different trade routes. Likewise, both *Baba* (*Babba Iulia Campestris* of Pliny the Elder (1855), Ptol. *Baba*) and *Baballaca* (Ptol. *Babiba* in Libya Interior, also written as *Babida* or *Babyla*) are shown. According to Rebuffat (1967), *Babba*'s existence was confirmed by an inscription found at the archaeological site of Thamusida (*Tamusida* of Ptolemy and *Tabula Peutingeriana,* also Ptol. *Tamusiga* as a likely duplicate located en route south, toward the phantom *Babiba*).
Another object to spot in Figure 2 is *Aquis Daticis*. On the modern map, it corresponds to the known ruins of Aquae Dacicae (lat=34.1466°, lon=-5.8007°). Ptolemy does not mention that place. However, *Baba* is now localized on the road between Aquae Dacicae and another well-known place, Volubilis (lat=34.0731°, lon=-5.5544°). Considering that the route from *Sala* (the modern ruins of Chellah, near Sale) to *Gentiano* (Ptol. *Gontiana*) heads north in Ptolemy's coordinates, we can further conclude that *Baballaca-Babiba* is a mere duplicate of Baba, and the most likely location for *Babba Iulia Campestris* is then the vicinity of Bab Tissera (Filatova et al. 2019), near a mountain pass that would lead a traveler to Volubilis from either Aquae Dacicae, or *Gontiana*.
Another illuminating observation is that *Tabula Peutingeriana* swaps the locations of *Portum Magnum* (Ptol. *Portus Magnus*) and *Portum Divinum* (Ptol. *Deorum Harbor*) compared to Ptolemy. Moreover, the map shows them as if they were located on the road to *Calama* (Ptol. *Kelama*, modern Guelma in Algeria). *Calama* is misplaced by ~700 km, apparently because Guelma was once located near the old western border of the Roman Numidia, and then the borders of the Numidia province were redrawn when Western Numidia was annexed in 40 BC. Filatova et al. (2019) accepted Ptolemy's order of the ports, having taken into consideration that the modern name of one of the locations of interest, Mers El Kebir, literally means the same thing as *Portus Magnus*, i.e., the 'great port'.

In the next section of this paper, we will look at a "better, newer" map, Konrad Miller's reconstruction of *Tabula Rogeriana* by Muhammad al-Idrisi.

Conference Proceedings ISSN XXXX-XXXX – Cluj-Napoca, Romania, 24-26 September 2020

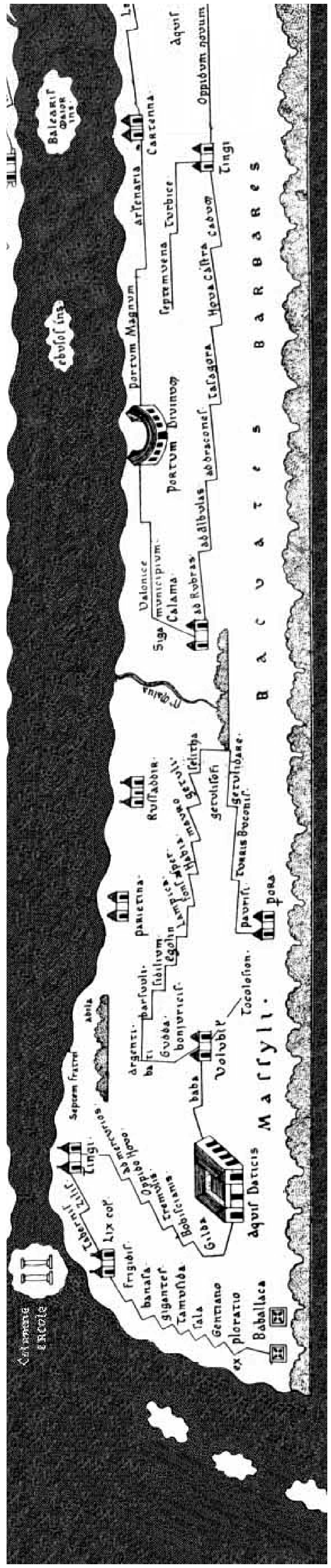

Figure 2: *Tabula Peutingeriana*, a fragment of Konrad Miller's facsimile (1887)

Tabula Rogeriana and Ptolemy's *Geography*

Miller (1929) produced a reconstruction of the famous *Tabula Rogeriana*, a world map by a prominent Arab scientist Muhammad al-Idrisi dated 1154 AD. The shape of the original *mappa mundi* drawn for King Roger II of Sicily was circular, but Miller followed the Mercator projection for latitudes between 28°N and 59°30'N, as he consolidated the map from 70 double-page spreads covering the 7×10 rectangular area. The southern portion of the map is compressed in the latitudinal direction, as the reader can readily observe from Figure 3 that shows our overlay georeferencing al-Idrisi's map to the complete Ptolemy dataset.

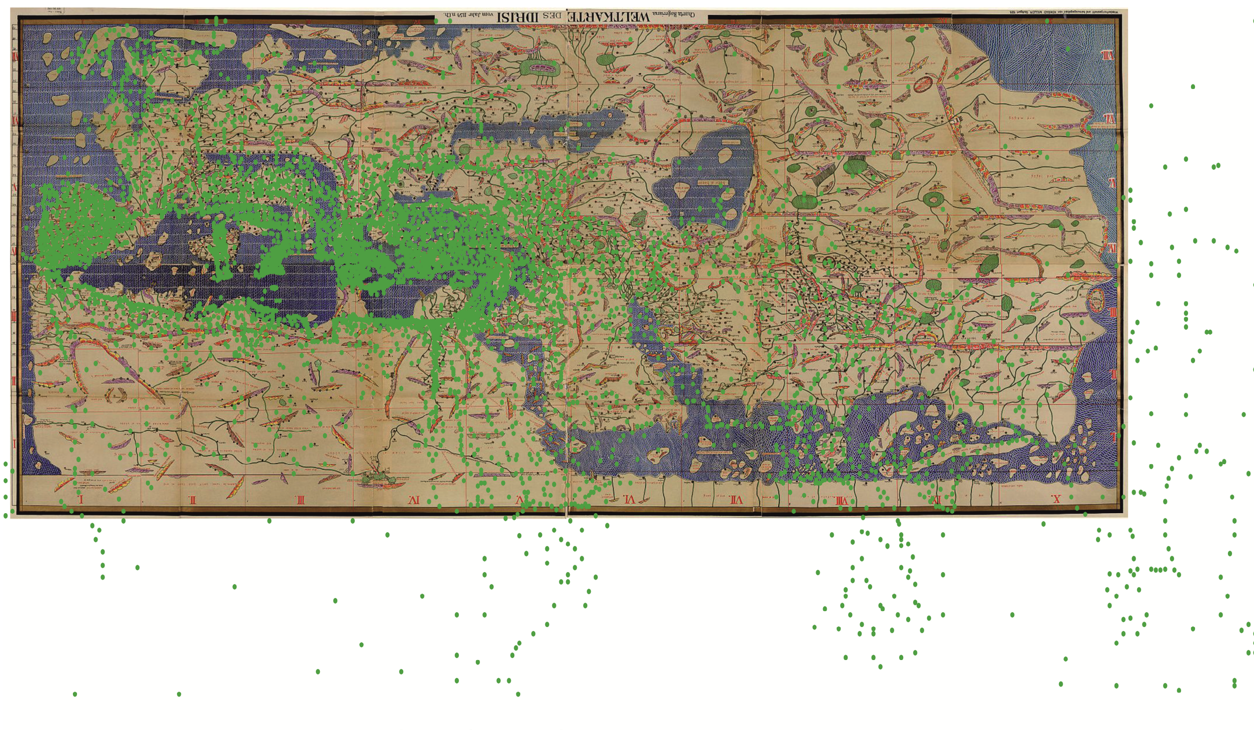

Figure 3: *Tabula Rogeriana* vs. Ptolemy's *Geography* (the green points).

With the best fit for the area of the Mediterranean Sea imposed, we can readily observe that not only the rest of al-Idrisi's map is narrower in the longitudinal direction than Ptolemy's *oikouménē*, but also big differences are noticeable in the Mediterranean area itself and around it. We can practically hear Ptolemy's criticism of "those who allotted the greatest part of the map to Europe in both longitude and latitude for the wealth of data being shown, and the least part in longitude to Asia and in latitude to Libya for the contrary" (Diller 2009). At the same time, al-Idrisi's map is notably free from another "deficiency" mistakenly criticized by Ptolemy, as it is not showing all of Europe, Africa, and Asia surrounded by ocean, as many other round *mappae mundi* did, along with *Tabula Peutingeriana*. This may be due to the influence of Ptolemy's work, as al-Idrisi adds new data on China eastward, past *Katigura* (Ptolemy's mysterious

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Cattigara Sina), most likely a West African location, which Filatova et al. (2019) tentatively identified as the modern Settra Kru in Sinoe county, Liberia. Quoting (Ptolemy 1991), *The Hyrcanium sea, called also the Caspian, is surrounded on all sides by land and has the shape of an island; and we may say the same of the Indian sea, for with its gulfs, the Arabian, the Persian, the Gangetic, and that which is called the Great gulf, it is entirely shut in, like the Caspian, by land on all sides.*

We found that the roots of Ptolemy's error also present in al-Idrisi's map can be elucidated by reading *The Geography* by Strabo (64 or 63 BC – c. AD 24), an ancient Greek geographer who offered a detailed discussion on how to interpret Homer's quote on the Ethiopians "sundered in twain" (Strabo 1917-1932). Strabo was a predecessor of Ptolemy who did subscribe to the correct view that the whole "known world" was surrounded by Oceanus. While the most obvious way to separate the Ethiopians into two parts is to do so by the Nile, an alternate explanation proposed by Crates involved dividing them by Oceanus, so they would end up "abiding both where Hyperion sets and where he rises." This helps explain sudden emergence of "fish-eating Aethiopians" in Ptolemy's Sinae, even though he had mistakenly placed it in East Asia. Neither *Tabula Peutingeriana* nor the map of Juan de la Cosa dated 1500 (Martín-Merás 2000) placed Sinae to the east from India. The latter fact is of special significance, given that Juan de la Cosa accompanied Christopher Columbus in his expeditions and demonstrated detailed knowledge of the African coast. Yet another, particularly striking explanation offered by Strabo is found in the following quote.

But Ethiopia may be divided in still another way, quite apart from this. For all those who have made coasting-voyages on the ocean along the shores of Libya, whether they started from the Red Sea or from the Pillars of Heracles, always turned back, after they had advanced a certain distance, because they were hindered by many perplexing circumstances, and consequently they left in the minds of most people the conviction that the intervening space was blocked by an isthmus; and yet the whole Atlantic Ocean is one unbroken body of water, and this is particularly true of the Southern Atlantic.

It definitely looks like Ptolemy has accepted this explanation, along with all other explanations that had the Ethiopians "sundered in twain" one way or another, and placed a very wide "isthmus" of unknown land south from the southernmost known land of Aethiopia, as if to directly counter Strabo's argument that "All those voyagers have spoken of the last districts to which they came in their voyagings as Ethiopic territory and have so reported them." Meanwhile, the concept of the *oikouménē* surrounded by ocean remained so pervasive that six out of ten extant copies of al-Idrisi's work have been reported to begin with a circular *mappa mundi* **not** mentioned in the text of his *Kitab Rujar* and looking like the image adopted from Wikipedia (2020) and shown in Figure 4.

In the next section, we will apply the same approach to georeference a known Hellenic Ptolemaic map by Nicephorus Gregoras from Vaticanus Urbinas Graecus 83 (15 c.) to Ptolemy's dataset. Whether or not al-Idrisi's work was influenced by Ptolemy's *Geography*, newer, better maps were coming!

Figure 4: Map from 'Alî ibn Hasan al-Hûfî al-Qâsimî's 1456 copy of al-Idrisi's *Kitab Rujar*.

Georeferencing a Hellenic Ptolemaic Map to Ptolemy's Dataset

Figure 5 shows the results of georeferencing a Hellenic Ptolemaic map of Europe by Nicephorus Gregoras from Vaticanus Urbinas Graecus 83 (early 15 c.) to Ptolemy's partial dataset. The points of different colors and shapes represent Ptolemy objects from several (not all) provinces of *oikouménē.*

If one discounts the anisotropy of the ancient medium and the manuscript-to-manuscript discrepancies in Ptolemy object coordinates, the match is perfect. This result is unsurprising. We can conclude that some medieval cartographers faithfully performed their tasks without contributing much extra information to the Ptolemy dataset, if any. The limitations on the size of the paper does not allow us to show a couple of similar results that we have obtained for old Ptolemaic maps.

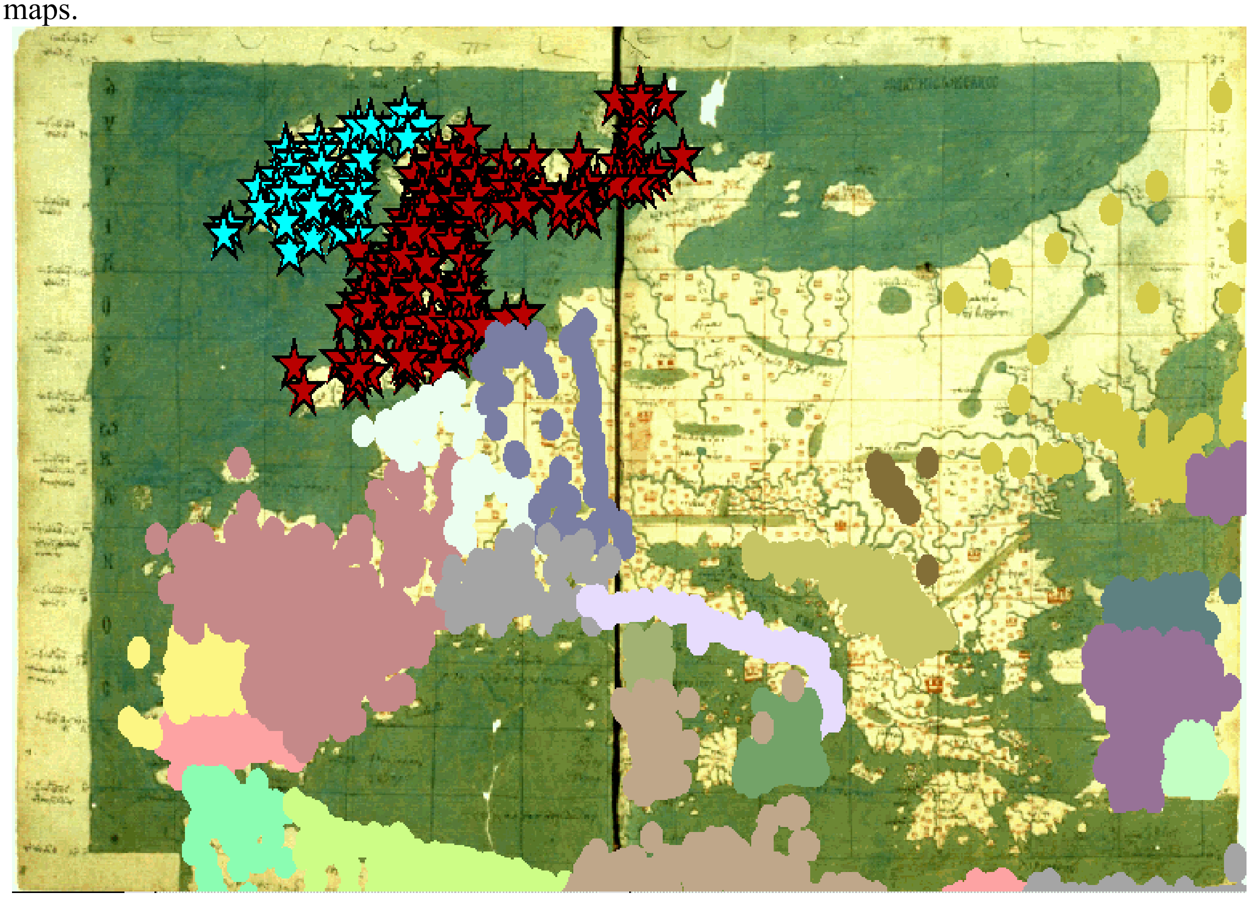

Figure 5: Hellenic Ptolemaic Map of Europe vs. Ptolemy's *Geography* (points of different colors and shapes correspond to different provinces of *oikouménē*).

The *Alfonsine Tables* and Ptolemy's *Geography*

The *Alfonsine tables* were primarily astronomical tables calculated for 1252 AD, the first year of the rule of King Alfonso X of Castile, León and Galicia, by Isaac ben Sid and Jehuda ben Moses Cohen (1483). On p. 6 of the above-referenced 1483 edition of the *Alfonsine tables*, we found a list of coordinates for 48 geographic objects, 2 of which turned out to be duplicates. We have listed all 48 objects, along with their Alfonsine, Ptolemaic, and modern coordinates in Table 1 of Appendix A. The 46 unique objects are mostly cities (43), 2 islands (Sardinia and Mallorca), and one mountain (apparently, Peñalara in Spain). 32 of the objects are located in Europe, 8 in Africa, and 6 in Asia, including *Xeanateh* (Xanadu), the capital of Kublai Khan since 1260. Out of the 32 European objects, 21 are located in the continental Italy, one more in Sicily (Palermo), and one is the Island of Sardinia, its coordinates matching the Ptolemy location of the Raging (*Mainomena*) Mountains in the middle of the island. The Alfonsine coordinates of Babylon match Ptolemy almost exactly (the longitude is off by 1 degree, 78° instead of 79°). The longitude of Damascus is reduced by 9 degrees, while the longitude of Jerusalem is reduced by 10 degrees and its latitude is rounded off to the nearest degree, compared to Ptolemy. The Alfonsine coordinates of Paris are those of Ptolemy's *Lutetia*, rounded off to the nearest degree. The coordinates of Rome match Ptolemy's *Geography* almost exactly. The coordinates of *Florentia* (Florence) happen to erroneously duplicate those of *Colonia* (Populonia). Given that the book was printed in Venice, it's amazing that the latitude of that city is off to the north by 5 degrees, perhaps, out of secrecy. Meanwhile, the latitude of Genoa is improved by a degree and a half. Overall, it looks like the author of the tables made a conscious attempt to correct Ptolemy's wrong turn of the Italian peninsula, this impression pointing toward the Venetian, or otherwise Italian origin of the Italian part of the coordinate set from 1483.

Two very different tables of geographic objects were printed in two subsequent editions of the Alfonsine tables — (Ben Sid and ben Moses Cohen 1492) and (Ben Sid and ben Moses Cohen 1533). Unfortunately, in both cases, the longitudes were converted to hours and minutes from *Toletum* (Toledo, Spain) and the latitudes were rounded off to whole degrees. Our GIS analysis for these two newer sets of coordinates involved plotting them in the modern projection using ArcGIS so that a good match is achieved for Rome and Prague. The results are shown in Figure 6, with a last-minute correction that Mediolanium is the modern Milan, and Ulma is the modern Ulm.

Figure 6: GIS analysis of European objects listed in the Alfonsine tables (1492 and 1533).

The round symbols with black inscriptions are the modern sites and their names. The pink triangles with red inscriptions correspond to the Alfonsine sites from the 1492 and 1533 editions. The black straight lines show correspondence between the Alfonsine and modern locations. While this figure reports work in progress, it should be sufficiently obvious to the reader that the quality of longitude measurement was still poor in the late 15th – early 16th centuries, and the latitudes are far from being precise in many cases.

Visualizing Ptolemy's One-Sided Globe

We have plotted Ptolemy's dataset in ArcGlobe as shown in Figure 7 and began to convert our Ptolemy reconstructions to a KML file for Google Earth and Cesium (Gusev and Stafeyev 2020).

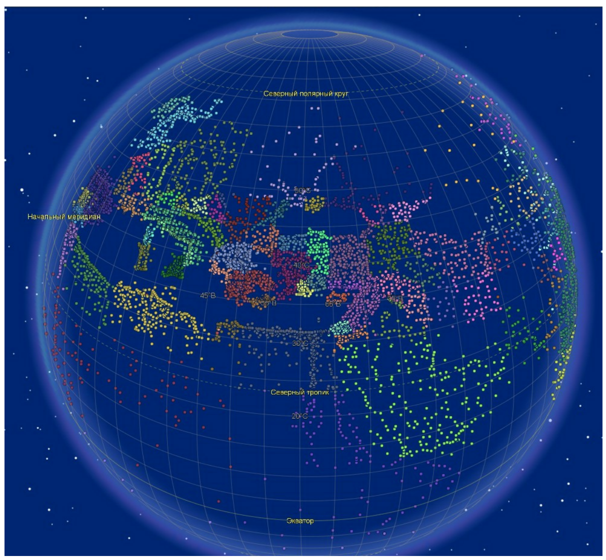

Figure 7: Ptolemy's One-Sided Globe of *oikouménē* in ArcGlobe.

Figure 8 shows the northern part of Ptolemy's Mauretania Tingitana province in *Cesium ion*.

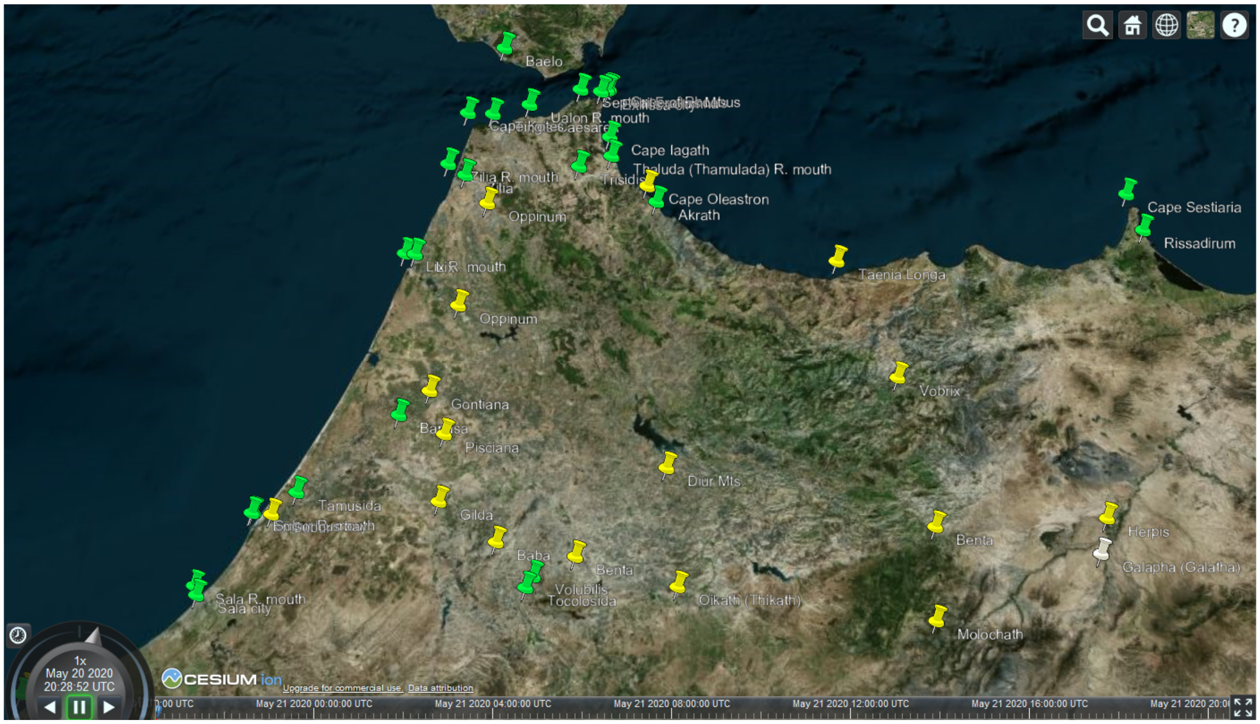

Figure 8: Ptolemy Globe in *Cesium ion*: The northern part of Mauretania Tingitana.
The green markers correspond to the known objects, the yellow ones mark the tentatively identified locations, and the white marker belongs to a suspected duplicate. An approximately placed unknown object would be displayed using a red marker. This part of Mauretania Tingitana is relevant to our earlier discussion of *Tabula Peutingeriana*, as the reader can see the route from the tentative location of Ptolemy's *Gontiana* (Souk el Arba?) to *Volubilis* via *Baba*.

Conclusions and Future Work

We have compared Claudius Ptolemy's quality of map-making to *Tabula Peutingeriana* (c. 4th or 5th century AD), *Tabula Rogeriana* by Muhammad al-Idrisi (12th c.), and three editions of the *Alfonsine tables* (13th c.; published in 1483, 1492, and 1533). Our GIS analysis visually demonstrates that his achievements remained largely unsurpassed until the end of the 15th century AD. This result helps emphasize the special role of Ptolemy's *Geography* as an invaluable tool for better understanding of development of civilization in antiquity and the middle ages. In the near future, we expect to expand our iterative GIS reconstruction of Ptolemy's "known world" to other regions, such as East Africa, while continuing to transfer our existing knowledge to the formats for convenient visualization in the modern GIS tools in order to make our results more accessible to the history of cartography researchers and the general public.

Conference Proceedings ISSN XXXX-XXXX – Cluj-Napoca, Romania, 24-26 September 2020

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Appendix A. Table of Objects from the *Alfonsine Tables* (1483)

Table 1. 48 Objects from the Alfonsine Tables (1483).

Alfonsine Name	*Ptolemy Name*	*Modern Name*	*Alf. Lon.*	*Alf. Lat.*	*Ptol. Lon.*	*Ptol. Lat.*	*Mod. Lat.*	*Mod. Lon.*
Constantinople	Byzantium	Istanbul	58° 40'	43° 40'	56° 00'	43° 05'	41.0085	28.9800
Cialia	Caelia	Ceglie Messapica	36° 00'	39° 00'	42° 10'	40° 15'	40.6444	17.5182
Alosandria	Alexandria	Alexandria	51° 20'	31° 00'	60° 30'	31° 00'	31.1946	29.9041
Damasai	Phatnitic mouth of the Nile	Damietta, former Tamiathis	54° 00'	32° 00'	62° 30'	31° 10'	31.4165	31.8133
Horaclia	Herakleopolis Mikra	Tall Tulaym (Tell Belim)	54° 40'	31° 00'	63° 20'	31° 00'	30.9784	32.1746
Egyptus	Koptos	Qift	59° 00'	30° 09'	62° 30'	26° 10'	25.9967	32.8159
Babilonia	Babylon	Tell Babil	78° 00'	35° 00'	79° 00'	35° 00'	32.5420	44.4212
Jerusalem	Aelia Capitolina = Hierosolyma	Jerusalem	56° 00'	32° 00'	66° 00'	31° 40'	31.7767	35.2342

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Tur	Tyros	Tyre	57° 00'	33° 00'	67° 00'	33° 20'	33.2693	35.1959
Panormus	Panormus	Palermo	37° 30'	38° 16'	37° 00'	37° 00'	38.1123	13.3559
Damascus	Damaskos	Damascus	60° 00'	33° 00'	69° 00'	33° 00'	33.5114	36.3074
Tolosa	Tolosa	Toulouse	23° 47'	49° 00'	20° 10'	44° 15'	43.6147	1.3977
Parisius	Lutetia	Paris	23° 00'	48° 00'	23° 30'	48° 10'	48.8549	2.3475
Marsilia	Massilia	Marseille	27° 30'	44° 00'	24° 30'	43° 05'	43.2975	5.3746
Cremona	Cremona	Cremona	31° 00'	45° 00'	32° 00'	43° 40'	45.1350	10.0293
Bononia	Bononia	Bologna	33° 35'	44° 00'	33° 30'	43° 30'	44.4946	11.3424
Roma	Roma	Rome	36° 42'	41° 50'	36° 40'	41° 40'	41.8926	12.4843
Corduba	Corduba	Córdoba	9° 00'	37° 00'	9° 20'	38° 05'	37.8848	-4.7764
Xeanateh	-	Xanadu, Shangdu	153° 00'	10° 45'	-	-	42.3595	116.1805
Cartago	Karchedon	Carthage ruins (Byrsa)	27° 00'	32° 00'	34° 50'	32° 40'	36.8524	10.3236
Meca	Macoraba	Mecca	67° 00'	21° 00'	73° 20'	22° 00'	21.4234	39.8250
Insula Sardinia	Raging (Mainomena) Mts., Sardinia	Monte Rasu	31° 00'	38° 00'	31° 00'	38° 00'	40.4214	9.0047
Mediolanum	Mediolanium	Milan	30° 20'	44° 40'	30° 40'	44° 15'	45.4582	9.1810
Forlinium	-	Forli	33° 36'	45° 24'	-	-	44.2227	12.0407
Neapolis	Neapolis	Naples	36° 38'	40° 20'	40° 00'	40° 55'	40.8509	14.2581
Ancona	Ancona	Ancona	36° 00'	44° 30'	36° 30'	43° 40'	43.6253	13.5103
Firmium	Firmum	Fermo	36° 00'	43° 42'	37° 30'	42° 55'	43.1611	13.7168
Pisae	Pisae	Pisa	33° 00'	43° 00'	33° 30'	42° 45'	43.7223	10.4020
Mantua	Mantua	Mantua	31° 39'	45° 15'	32° 45'	43° 40'	45.1600	10.7968
Ferraria	-	Ferrara	32° 00'	[45° 15']	-	-	44.8381	11.6198
Salernum	Salernum	Salerno	38° 00'	41° 00'	40° 00'	40° 20'	40.6780	14.7659
Osama	Ausum?	Akbou?	19° 00'	35° 00'	23° 00'	30° 40'	36.4617	4.5355
Brandusui	Brundisium	Brindisi	40° 30'	41° 20'	42° 30'	39° 40'	40.6411	17.9469
Padua	Patavium	Padua	32° 30'	45° 24'	32° 50'	44° 30'	45.4115	11.8790
Tullectum	Toletum	Toledo	11° 00'	39° 54'	10° 00'	41° 00'	39.8585	-4.0252
Monte Pesulanium	-	Peñalara Mtn.	14° 30'	43° 00'	-	-	40.8501	-3.9562
Colonia	Populonium	Populonia	33° 25'	42° 30'	33° 30'	42° 30'	42.9881	10.4897
Axinus	Auxume	Aksum, Axum	27° 30'	0° 00'	65° 30'	11° 00'	14.1319	38.7192
Capua	Capua	Capua	37° 15'	40° 30'	40° 00'	41° 10'	41.1061	14.2130
Tunix	Catadas R. mouth	Tunis / Oued Miliane	29° 00'	37° 00'	34° 50'	32° 30'	36.8065 36.7716	10.1815 10.2921
Florentia	Florentia	Florence	33° 25'	42° 30'	33° 50'	43° 00'	43.7692	11.2599
Venetie	Atrianus R. mouth	Venice / Po di Levante	35° 20'	52° 20'	34° 00'	44° 30'	45.4340 45.0505	12.3390 12.3638
Maiorica	Palma	Palma de Mallorca	13° 26'	36° 00'	16° 10'	39° 15'	39.5696	2.6502
Cialia (duplicate of #2)	Caelia	Ceglie Messapica	36° 00'	39° 00'	42° 10'	40° 15'	40.6444	17.5182
Panurmus (duplicate of #10)	Panormus	Palermo	37° 30'	38° 16'	37° 00'	37° 00'	38.1123	13.3559
Janua	Genua	Genoa	30° 30'	44° 00'	30° 00'	42° 50'	44.4067	8.9333
Verona	Verona	Verona	32° 14'	44° 30'	33° 00'	44° 00'	45.4390	10.9944
Civitas Sanpie (*conj.* Candie)	Kydonia	Chania	52° 00'	36° 00'	52° 45'	35° 00'	35.5182	24.0230