

How Portolan Charts Could Have Been Assembled Utilising Cartographic Sources from Classical Antiquity

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Abstract:

The exceptionally realistic display of coastlines on portolan charts, which appeared in the late thirteenth century and remained geometrically consistent for centuries, has attracted scholarly interest since the mid-nineteenth century to investigate the origins of the spatial data utilised in their creation, as late mediaeval cartographers did not record the specific sources or datasets employed in their development. Extensive and sophisticated cartometric analyses indicate that they are composites made of sub-parts of comparable planimetric accuracy, that their geometry closely resembles that of a modern map in the Mercator projection (Loomer, 1987), that their geometry is overly advanced to be authentic creations of the late mediaeval period (Nicolai, 2014), and that they are likely reproductions of cartographic sources originally produced in classical antiquity (Marelić 2024, 2025). However, neither study effectively addressed the underlying causes of disparate scales of their sub-parts or the typical slightly increasing anticlockwise tilt of these sub-parts when observed from west to east.

Using the anonymous *Carta Riccardiana* portolan chart (c. 1300–1325) as an example, this study integrates cartometric analyses with historical data and presents the first clear and straightforward proposal regarding how late mediaeval Italian copyist-cartographers could have graphically assembled the cartographic composite known as a portolan chart using classical antiquity sources. The proposed model empirically addresses typical portolan chart map-scale discrepancies (seemingly reduced scale of the Atlantic coasts compared to an increased scale of the northern regions of the Mediterranean Sea and the Black and Azov Seas; see Figure 1) and demonstrates that their anticlockwise tilt of coastline renderings is not attributable to magnetic declination.

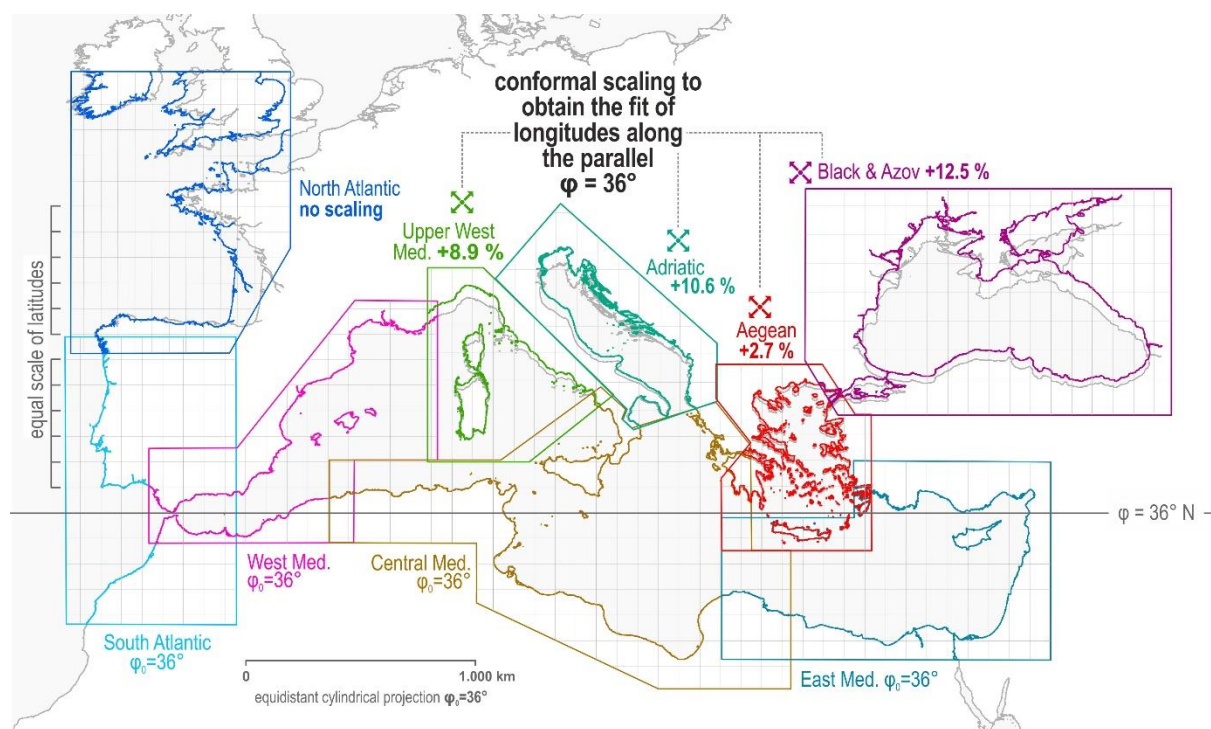


Figure 1. The model illustrating how late mediaeval copyist-cartographers could have straightforwardly merged the hypothesised original maps from classical antiquity (made in the equidistant cylindrical projections adjusted for their mid-latitudes) in terms of map scale to construct portolan charts. Basemap shapefile source: marineregions.org (Claus et al., 2017).

The study establishes that its cartometrically determined subsections (exhibiting an average planimetric accuracy approximately twice that of the Mediterranean and Black Sea regions treated as a whole) were not derived from the old maps originally made in the Mercator or some Mercator-like projection. Instead, its subsections exhibit superior planimetric accuracy relative to equidistant cylindrical projections adjusted for their mid-latitudes, a notion rooted in classical antiquity and credited to Marinus of Tyre (1st century CE). A model was created that accounts for the late mediaeval copyist-cartographers' misunderstanding of the distinctions between the spherical geometry of the Earth's surface and the Euclidean geometry of map projections. It asserts that they visually integrated their replicas of ancient originals to produce a coherent composite, employing a map in equidistant conic projection, credited to Claudius Ptolemy (1st and 2nd centuries CE), as a reference model.

The proposed model illustrates that if regional maps of the northern Mediterranean with high planimetric accuracy and made in the *projection of Marinus of Tyre* are conformally scaled by longitude (to visually align with those representing the southern zone with the standard parallel $\phi_0=36^\circ$) while keeping the scale of the North Atlantic segment ($\phi_0=48^\circ$) intact, the result is a composite image that plausibly corresponds to the coastal contours of the *Carta Riccardiana* in terms of map scale. Furthermore, if one gradually rotates this composite from Gibraltar by roughly half the magnitude of the meridian tilt on the map in *Ptolemy's first projection* centred at Gibraltar, only marginally shifts those segments (which in neither case exceeded 2.6% of its tilted longitudinal extent of the Mediterranean), and conformally additionally enlarges the Aegean Sea segment by 15%, the resulting framework closely resembles the geometry of the *Carta Riccardiana* (Figure 2), likely created by Pietro Vesconte.

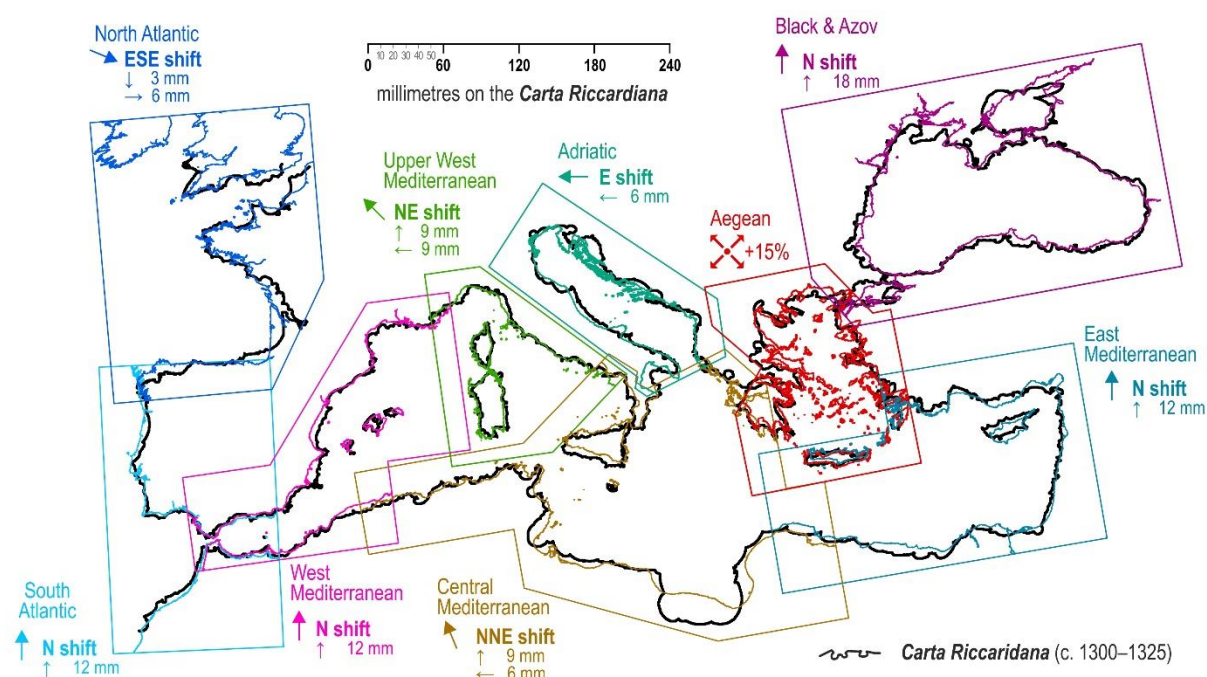


Figure 2. The overlay of coastlines on the *Carta Riccardiana* with the hypothesised original maps from classical antiquity being partially scaled, tilted in accordance with the LSE-computed tilts of the *Carta Riccardiana* subsections in comparison to their best-fit equidistant cylindrical projections, and marginally shifted. The magnitudes of shifts are expressed with the respect to the physical dimensions of the *Carta Riccardiana*. Basemap shapefile source: marineregions.org (Claus et al., 2017).

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