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Mosaics within Mosaics: The Anatomy of Portolan Atlases

Tome Marelić

University of Zadar, Department of Geography – tmarelic@unizd.hr

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Abstract:

The origin of astonishingly accurate renderings of the Mediterranean and Black Sea coastlines on portolan charts, which appeared suddenly and without known cartographic predecessors in the late thirteenth and early fourteenth centuries, has yet to be fully explained by scientific and scholarly efforts. The consensus viewpoint among the majority of historians of cartography who use a descriptive approach is that these are genuine late medieval cartographic products, derived from large bodies of contemporaneous shipborne bearing- and distance-measurements. In contrast, the results of extensive and detailed cartometric studies (Wagner, 1896 (1969); Nicolai, 2014; Marelić, 2023) suggest that their origins could be pre-medieval.

The portolan atlases of Pietro Vesconte (1313), Andrea Bianco (1436), and Battista Agnese (1538) were subjected to extensive cartometric analysis utilising four parallel approaches. The first approach focuses on the standalone geometry of their physical constituents by subjecting each of their sheets to its own individual cartometric analysis. The second approach focuses on the geometry of the union of their geographical content in such a way that the atlas sheets were graphically joined into coherent composites, which were then cartometrically analysed as standalone units. The third approach is the comparison of atlas composites with portolan charts made by the same authors. The fourth approach is an intercomparison of doubly charted sub-basins that were made to both smaller and larger map scales.

As far as is known to the author, this is the first extensive cartometric study of portolan atlases. The results indicate that none of the small-scale atlas sheets were fully aligned with the contemporary magnetic north and that each small-scale sheet exhibits coastline contours that were mapped to different scales. Consequently, the atlas sheets could not provide sailors with consistent navigational accuracy across the charted areas. Moreover, increasing the scale of the charts (in cases of Vesconte's and Agnese's atlases) did not necessarily enhance their accuracy, whereas Vesconte's and Bianco's atlases display the additional layer of map scale inconsistencies in such a way that their *spatium* (50-*miglia*) intervals differ in length after the assembly of their coherent composites (assembly method C in Figure 1). The latter finding explicitly raises suspicion about cartographers' true insight into their own products and is further reinforced by the discovery of significant geometric differences between the composite of Vesconte's atlas and his 1311 portolan chart and between the composite of Bianco's atlas and his small-scale portolan chart bound in the same atlas. The existence of the *oikoumene* map in Ptolemy's first projection and *Toleta de Marteloio* in Bianco's atlas implies he was exposed to knowledge from classical antiquity and that he possessed an advanced understanding of trigonometry, but it was not reflected in the geometry of his atlas' sheets due to inconsistencies in their anticlockwise tilt and map scale and numerous regional planimetric discrepancies between its composite and his small-scale chart.

The average planimetric accuracy of portolan atlas sheets (19.6 km) is approximately 1.5 times greater than the accuracy of their coherent composites georeferenced across their Mediterranean and Black Sea areas (29.5 km). The least accurate unit is the *western sheet* from Vesconte's atlas (49.2 km) because its North Atlantic coasts (made to a significantly smaller scale) negatively affect its accuracy estimation and, in extenso, the average accuracy of the entire atlas. Without the *western sheet* (encompassing the South Atlantic and West Mediterranean as well), its average accuracy is 14.7 km, which is a higher value in comparison to the remaining two atlases' sheets covering the same areas (20.6 km, and 22.6 km, respectively). The only discernible differences between the examined atlases are the variations in the territorial extents of their sheets, whereas the geometry of their composites did not undergo any significant changes during the entire period of their creation.

Figuratively speaking, if atlases were observed as mosaics of physically separated images (portolan charts of smaller extents), this research shows that they are, in fact, 'mosaics within mosaics'. The discovery of cartometrically determined underlaying mosaics of *subsections* encapsulated within their composites with accuracy twice as great (14.3 km on average, which is 1.4 times higher in comparison to the average accuracy of their sheets), whose spatial extents, anticlockwise tilts, relative map scale, and planimetric accuracy have remained practically unchanged during more than two centuries of their production and geometrically correspond to portolan charts created before them (Marelić 2023), suggests that portolan atlases are medieval and early modern copies of earlier cartographic sources.

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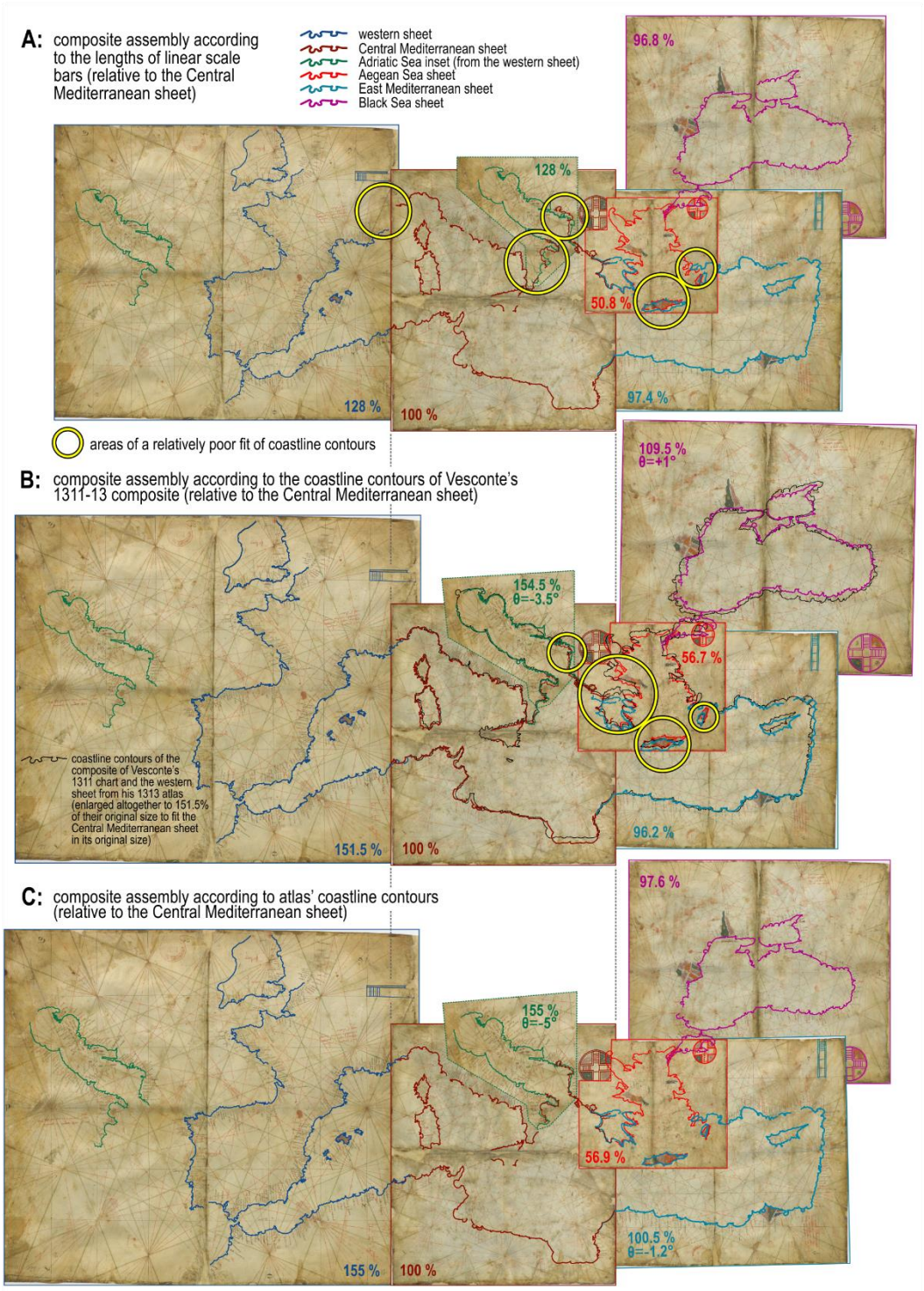

Figure 1. Methods for assembling the composite of Vesconte's 1313 atlas (only the method C provides their coherent composite). Chart source: Bibliothèque nationale de France, CPL GE DD-687 (RES).

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