

Magnetic declination on the early modern cartographic representations of the Adriatic Sea

Tome Marelić ^{a,*}, Josip Faričić ^a

^a University of Zadar, Department of Geography - tmarelic@unizd.hr, jfariacic@unizd.hr

* Corresponding author

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Abstract:

The dead reckoning navigation of the late Middle Ages, which was also applied in the early modern period, relied heavily on the pilot's skills in correctly recognizing the surrounding coastal landforms and his ability to use nautical charts and the magnetic compass (Taylor, 1957). The earliest European awareness about the existence of magnetic declination dates back to 1451 (Smith, 1968; Courtillot & Le Mouël, 2007), and it was expanded during the early modern period. Francisco Falero (Faleiro), a Portuguese cosmographer, was the first to offer (three) exact methods on how to determine magnetic declination in his *Tratado del esphera y del arte del marear; con el regimentó de las alturas; co algunas reglas nouamente escritas muy necessarias* book (*Treatise of the sphere and the art of the sea; with the regiment of the heights; with some necessary rules written*) from 1535 (Hellmann, 1899). From 1698 to 1700, Edmond Halley managed a global magnetic declination survey that resulted in isogonic charts (Courtillot & Le Mouël, 2007), while the first systematic survey of magnetic declination for the Adriatic Sea area (albeit partial and very localized in its spatial extent), was conducted by Charles François Beautemps-Beaupré in 1806 and 1808-1809 (Kozličić, 2006).

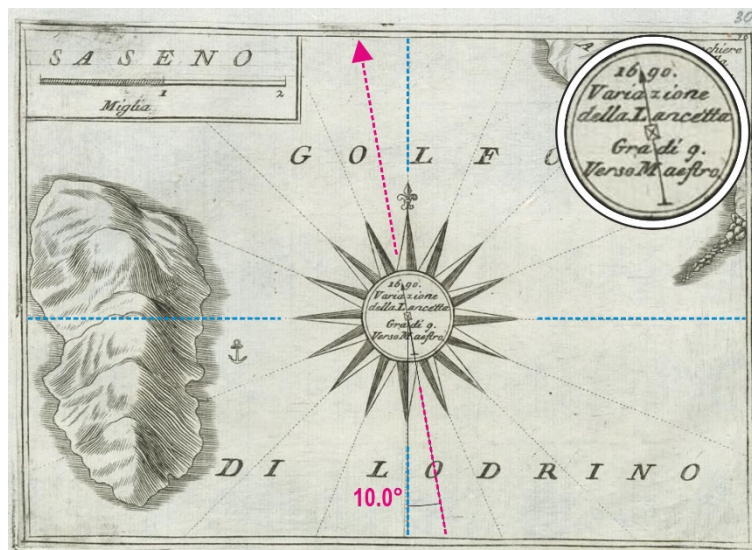


Figure 1. Vincenzo Maria Coronelli's nautical chart (1690-1694) of the island of Sazan. The N-S and W-E rhumbs are highlighted with a dashed blue line, while Coronelli's graphic display of magnetic north is highlighted with a dashed magenta line and additionally shown as enlarged circular inset. Chart source: Vincenzo Maria Coronelli, *Isolario*, Vol. IV, Venice, 1690-1694 (State Archives in Zadar, Library, Zadar, Call number II.A*)

Although the renderings of the Adriatic Sea basin on late fourteenth and early fifteenth-century portolan charts show a correlation with the reference *CALS3k.4* palaeomagnetic model (Korte & Constable, 2011), the tilting of charts produced in the sixteenth and seventeenth centuries does not follow its chronological order (Marelić, 2023). In order to extend the research of the phenomenon to the subsequent historical period, a sample of cartographic representations of the Adriatic Sea on nautical charts and geographical maps (which contain certain elements of maritime cartography) from the early modern age were selected to examine their explicit or implicit indications of their authors' awareness of magnetic declination (δ). To our current knowledge, the earliest explicit evidence of this kind is Vincenzo Maria Coronelli's nautical chart (1690-1694) of Sazan (*Saseno*) island (Figure 1). Its westward orientation is correct, but its value ($\delta_{map} \cong -9^\circ$) shows a significant deviation from the *CALS3k.4* value ($\delta_{1690} \cong -2^\circ$). Contemporary marine cartography was mostly devoid of explicit records of magnetic declination values, apart from a few sporadic exceptions

such as Jacques Nicolas Bellin's *Carte Hydrogéographique du Golphe de Venise* from 1771 (Figure 2) with $\delta = -15^\circ$, which corresponds to *CALS3k.4*. In order to examine the Adriatic Sea alignment in accordance with the contemporary magnetic north (derived from *CALS3k.4* data) – the hypothetical implicit traces of the cartographers' awareness of magnetic declination – charts and maps were georeferenced and cartometrically analysed twofold: A) according to the graphical appearances of their coastline renderings, and B) according to the coordinates-data extracted from those which contain graticules. The preliminary results, obtained from their coordinates-data analysis, show that both charts and maps were drawn in accordance with the geographic north. However, the coastline renderings on printed nautical charts with graticules still contain certain anticlockwise tilts; probably a remnant from its appearance on portolan charts which seem to have been used as graphic templates. The aim of the research is to determine the utilitarian value of early modern cartographic representations of the Adriatic Sea in terms of the safety of navigation and to additionally enrich the insight into the historical development of maritime cartography of the area in general.



Figure 2. Jacques Nicolas Bellin's *Carte Hydrogéographique du Golphe de Venise* (1771) containing magnetic declination data for the Adriatic Sea area (see enlarged circular inset). Chart source: National and University Library, Map and Atlas Collection, Zagreb; S-JZ-XVIII-145

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