

The Navicula Sundial

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The National Maritime Museum has acquired an extremely rare and important 15th century portable sundial, the navicula, for its collections.

General information

A navicula is essentially an altitude dial which could be used to measure local time. Its name comes from the fact that it is shaped like a small ship, specifically a Venetian galley, hence its full name *navicula de Venetiis* - 'The Little Ship of Venice'.

To take a reading, one first sets the local latitude. On the NMM navicula, a series of latitudes for English towns are inscribed on the mast of the ship. They read from 51.0 (Exeter's latitude is actually about 50° 28'N); Northampton 52.20 (Northampton) and Eboracum 53.40 (Eboracum = York, which is 54°N). A cursor, to which a plumb line was once attached, slides along the mast to set the correct latitude. One must then sight the sun through the pair of sighting holes at either end of the ship's deck, making use of its projected image. The plumb line then registers the time on the hour scale on the front of the instrument.

Discovery

This particular instrument was found in July 1989 in Suffolk by two gentlemen using a metal detector. Made entirely of brass, and constructed from thin plates rivetted together and smoothed down, the navicula is in remarkably good condition for an object that has been buried for over five centuries. The fine condition of the engraving and the surface of the object would suggest it was lost when almost new.

Specific Characteristics

In structure, the NMM navicula is very similar to the navicula in the Oxford Museum of the History of Science. The main differences are in the accuracy of the latitude markings on the mast (the Oxford instrument is slightly better); in the addition

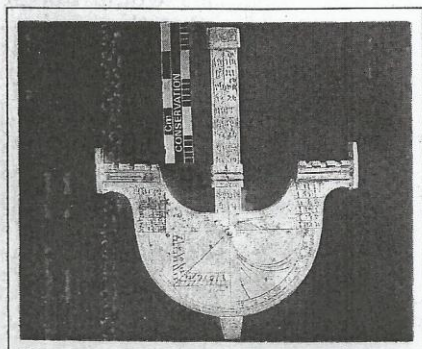


Fig.1 Front View

of a series of abbreviations of the zodiacal signs along the outside edge of the front face of the NMM example; and in the addition of town names on the reverse of the mast of the NMM navicula. Both instruments share a number of common mistakes and they are stylistically similar. This leads one to believe that even though they are not identical instruments, they may have been products of the same workshop. Like the Oxford dial, the NMM navicula appears to accord with the descriptions of the instrument provided in the Bodleian manuscript Bodley 68.

Authenticity

One of the problems in assessing the authenticity of early scientific instruments like the navicula is that we lack the comparative material of contemporary instruments. We know, for example, that the navicula must have been a relatively popular form of dial from the different kinds of dials which have survived. It seems to have been made in a number of different forms in most European countries. The form first appears during the late middle ages and appears to have been popular well into the seventeenth century (witness the navicula in the Museo della Scienza in Florence and another in the Whipple Museum of the History of Science in Cambridge). Nevertheless, only five naviculae have survived to the present day in public collections.

Two important indicators, however, help to authenticate the National Maritime Museum navicula as a genuine late medieval object.

First, the cupric corrosion on the NMM navicula has a very large crystal structure. Cupric corrosion develops very slowly. When it develops naturally, it forms in a series of large crystals; when the process is hastened artificially, the crystal structure is altered radically to a series of small crystals. The cupric corrosion on the NMM navicula suggests that it is over 100 years old and has tarnished very slowly.

So, if the navicula were manufactured some time before 1890, the crystal structure of the cupric corrosion would match well enough. But XRF metal analysis carried out by Dr Hook at the British Museum shows that the mast and body of the navicula consist of a quaternary alloy of copper (78-82%), zinc (6-9%), tin (4-6%) and lead (4-9%); with small traces of silver, antimony and arsenic. This type of metal was known in the Middle Ages as 'latten' (essentially leaded gunmetal). Latten alloys were used extensively from the Roman period onwards, but are a particular feature of metal objects dating from the medieval period.

There are no known instances of any instrument maker from either the 18th or 19th century using a medieval formula as the basis of his alloy in order to reconstruct a "medieval" object. An amateur, creating objects for his own *kunstammer*, would not have had the technology available to him. The sort of sophistication required to "fake" a navicula as authentic-looking as the NMM example would have been unthinkable before the 1920s. The structure of the cupric corrosion in the navicula argues in favour of a much earlier date of manufacture. Therefore, all measurable indicators point toward the NMM navicula being what it purports to be: a genuine late-medieval object.

References

1. A W Fuller, 'Universal rectilinear dials', *Mathematical Gazette* 41 (1957) 9-24.
2. D J Price, 'The Little Ship of Venice - a Middle English Instrument Tract', *Journal for the History of Medicine and Allied Sciences* 15 (1960) 399-407.
3. J Kragten, *The Little Ship of Venice*, published by De Zonnewijzerkring, Eindhoven, 1989.

Exhibition

The dial will be displayed next year in the new Time Gallery, to be opened in the spring.

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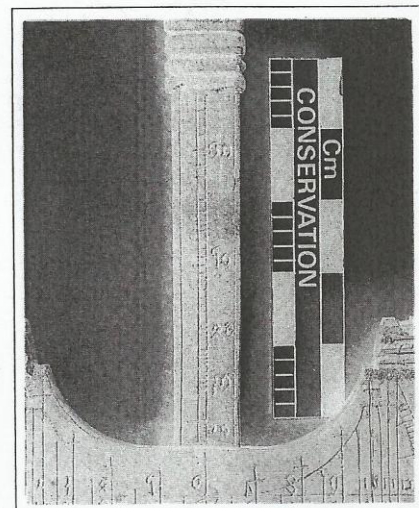


Fig.2 Details of reverse side