

An Early Astrolabe from Cordoba in the National Museum of Scotland



Aerial view, Cordoba and Great Mosque (Photo: Salvatorecoco, 2007. CC-BY-SA no changes)

Astrolabes are analogue computers, meant to make it easier for the user to carry out a variety of mathematical functions related to astronomical timekeeping. Historians of science describe astrolabes as models of the universe that can be held in the hand. Along with other early astrolabes and precision instruments preserved in museum collections in Europe, the United States, and the Middle East and North Africa, instruments like this provide the clearest visual evidence of the intimate connections between science, court culture, design, and craft. The NMS astrolabe was created at a dramatic moment in the history of Cordoba, during the period of the 'Amirid regency. This 'Amirid dynasty sponsored tremendous achievements in military, social, and cultural spheres. However, during this period, political faultlines began to emerge that led to unrest and the eventual collapse of the Umayyad caliphate in a drawn-out process starting in 1009 and ending in 1031.

This period of political instability in Cordoba resulted in the dispersal of intellectuals across the Iberian Peninsula, as the territories of al-Andalus broke into a number of independent kingdoms (known as *mulūk al-ṭawā'if*/the Party Kings). For the majority of the eleventh century, kingdoms based in various cities ruled al-Andalus. This astrolabe and its sisters tell a story involving two of the most significant of these kingdoms: Cordoba and Toledo.



Astrolabe, Muhammad ibn al-Ṣaffār, Cordoba, 1026/27. Diameter: 15.5 cm. T. 1959.62. (Photo: National Museums Scotland)

Through close-looking, we see the vast amount of information carried in the astrolabe. Like a coin, this astrolabe carries information not only in its design, but also in the sheer volume of text on the object. This object is inscribed with hundreds of Arabic words, testifying to the world in which it was crafted. We will briefly analyse one of the inscriptions, the signature of the maker on the back. In addition, a quick look at this astrolabe's object biography offers more information, but perhaps more interestingly, raises more questions.

12 words: What close-looking can teach us about this object and the history of al-Andalus

HOW TO CONVERT: AH (Anno Hegirae) → CE (Common Era)

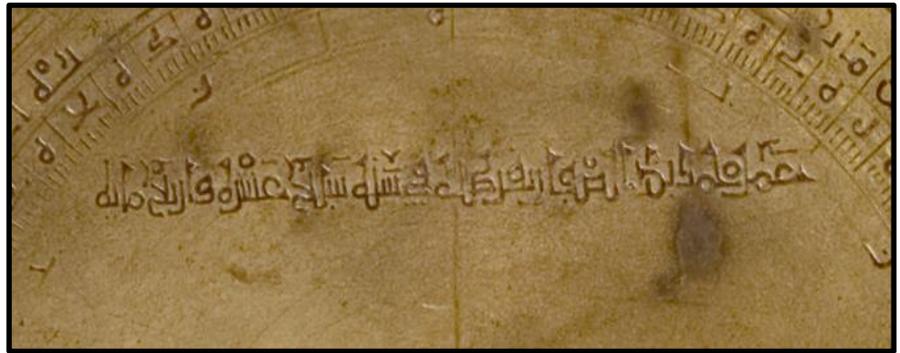
To determine an approximate CE date from an AH date:

- 1) Multiply the AH date by .03
- 2) Subtract the number you calculated in Step 1 from the original AH date
- 3) Add 622 (the date of the early Muslim community's removal to Medina and from which the Islamic calendar is calculated) to the number you computed in Step 2

By doing the following we get:

- 1) $417 \times .03 = 12.51$
- 2) $417 - 12.51 = 404.49$
- 3) $622 + 404.49 = 1026.49$

This gives us a creation date in CE for the astrolabe of halfway through year 1026.



Detail, signature inscription. (@NMS Ref T.1959.62)

Reading the astrolabe:

In this case, using our knowledge of kufic writing in al-Andalus in the eleventh century, we can read the Arabic to be:

عمل محمد بن الصفار بقربة في سنة سبع عشرة واربعمائة

which translates to:

Made by Muḥammad ibn al-Ṣaffār in Cordoba in the year 417 (AH)/1026

A Tale of Two Cities: Cordoba and Toledo in the early Eleventh Century CE

The maker of the astrolabe held in the National Museum of Scotland, Muḥammad ibn al-Ṣaffār, was one of several scholars trained in Cordoba by Maslama al-Majrīti (a name indicating Maslama was from Madrid) under the rule of the Umayyad caliph al-Hakam II (r.961-976). Looking at the instruments of Muḥammad ibn al-Ṣaffār (one in the National Museum of Scotland and one in the Staatsbibliothek zu Berlin) indicates an intellectual shift from Cordoba to Toledo. Under the Banu Dhū al-Nūn, a family that had long held power in central Iberia but became the major power player in the region after the fall of the Umayyads, Toledo invested heavily in astronomy, astrology, and agricultural and botanical studies. Eleventh century Toledo became a seat of scientific learning, attracting scholars from other cities, including Cordoba.

As the ibn al-Ṣaffār astrolabe of 1026 attests, Muḥammad ibn al-Ṣaffār crafted this instrument in Cordoba, yet perhaps due to the political turmoil in Cordoba moved to Toledo, working there under the patronage of the Banu Dhū al-Nūn. Currently we know of three astrolabes made by al-Ṣaffār; he fashioned the first two, bearing dates of 1020 and 1026, respectively, in Cordoba; the last, dating to 1029/30, in Toledo. In the eleventh century, Toledo eclipsed the Majrīti school in Cordoba as a center of astronomical learning, and as the astrolabe of the Staatsbibliothek zu Berlin testifies, by 1029/30 CE Muḥammad ibn al-Ṣaffār was working in Toledo, along with his brother, Aḥmad ibn al-Ṣaffār (d.1035), who was renowned for his treatise on the astrolabe.

Aḥmad ibn al-Ṣaffār became an astronomical celebrity in the medieval world due to his penning of *Kitāb al-ʿamal bi-l-aṣṭurlāb wa-dhikr ālātihi wa-ajzāʾihi* (*Treatise on the Use of the Astrolabe and Mention of its Pieces and Parts*). Today only a portion of this work survives in Hebrew; it is held in the Bibliothèque Nationale in Paris. Latin translations of the treatise circulated in Europe until the fifteenth century and it is likely that both Geoffrey Chaucer in his *Treatise on the Astrolabe*, published in 1391, and Johannes Kepler, the seventeenth-century astronomer known for his discussion of elliptical orbits in his laws of planetary motion, were familiar with al-Ṣaffār's work.

Toledan Astronomers: The Next Generation

The patronage of the Banu Dhū al-Nūn continued throughout their rule of the city (until 1085) and this initial cohort of astronomers and philosophers trained future famed Andalusī astronomers including the famous qādī (judge) Ṣā'īd al-Andalusī (b. 1029; d. 1070). al-Andalusī oversaw the team that created the Toledan Tables, one of the first original developments of Andalusī astronomy. The calculations in the tables advanced the theory of trepidation, which showed that planetary objects do not move with constant velocity. This observation made possible by the detailed records of the Toledan Tables, which noted slight variants in the equinoxes. In addition to al-Andalusī, astronomers who owed their training to the Toledan school include Ibn al-Zarqāllah (b. 1029; d. 1087), sometimes referred to as the most important astronomer in the western Islamic world and frequently referenced by Copernicus; and 'Alī ibn Khalaf who partner with al-Zarqāllah to create the universal astrolabe.

The many lives of al-Ṣaffār's Cordoban astrolabe

Though this astrolabe testifies to the culture of eleventh century Cordoba, the story does not end here. We might ask ourselves, how many lives did this object live between 1026 CE and today? How did this astrolabe end up in Scotland? Taking an archaeological approach to the astrolabe, we start with the most recent information we have and work backwards.

In 1959, James H. Farr of Edinburgh gifted the astrolabe to the Royal Museum of the National Museum of Scotland. James H. Farr was a motor engineer with a particular interest in scientific instruments, which led him to purchase this astrolabe from a local antique shop. However, how the astrolabe found its way from Cordoba to Edinburgh remains a bit of a mystery and provides some of its allure.

Working backwards, the next date we can affix to the astrolabe is ca. 1320, when a new rete and throne were fashioned for it, as these reflect an aesthetic more in keeping with traditions in the eastern Islamic world. We thus know that not only did al-Ṣaffār's instrument remain in use for at least two centuries after its creation, speaking to the quality of craftsmanship and knowledge of eleventh century al-Andalus, but also that at some period this object either traveled to the east or came into the possession of an instrument-maker trained in the east.



14th century rete of al-Ṣaffār's astrolabe, (@NMS Ref T.1959.62)

Thinking like a curator:

During your visit to the National Museum of Scotland, we encourage you to consider the following questions:

- 1- Write a paragraph description of the vitrine and the display of Muḥammad ibn al-Ṣaffār's astrolabe. Where is the display? How large is the display? What other objects are on display with the astrolabe? What do the labels read?
- 2- In your visit to the museum, did you see other objects that you feel might speak in conversation with the astrolabe? If you had to "re-curate" the exhibit, how might you re-contextualize Muḥammad ibn al-Ṣaffār's astrolabe?
- 3- Consider the display of this object. What is gained by its pairing with the other objects in the case? What might be lost by its pairing with the other objects in the case?