Brass astrolabe, in western kufic script, throne decorated with geometric shapes in different mediums, engraved on recto, but embossed on the verso, a plain shackle with a ring on top is attached to the plate by a pin, the chamfered alidade attached by a central pin.

THE SAPHEA – A WONDER OF ISLAMIC SCIENCE

[Universal Astrolabe]

Author
[Anonymous]

Publication date
[c.1250]

Publisher

Publication place

Physical description
Brass astrolabe, in western kufic script, throne decorated with geometric shapes in different mediums, engraved on recto, but embossed on the verso, a plain shackle with a ring on top is attached to the plate by a pin, the chamfered alidade attached by a central pin.

Dimensions
Diameter: 185 mm

Notes
A rare and early Islamic universal astrolabe, produced in Al Andalus (Moorish Spain), during the Islamic Golden Age.

The Astrolabe

The astrolabe, sometimes called the slide rule of the heavens, can trace its history back to Hellenistic times. The smart phone of its day, it could perform numerous functions: calculate the time of day or night; determine your position; show the movement and identify of heavenly bodies; cast horoscopes; help you navigate the oceans, and survey all the land you can see.

Among numerous other advances in the sciences, and mathematics, the early Islamic scholars were responsible for a spectacular leap forward in astrolabe design – the invention of the 'universal' astrolabe – also known as the 'Saphea' or catholic astrolabe.

Whereas the classical astrolabe required a specific plate – a disc that would sit in the body of the astrolabe or 'mater' – for each latitude, its universal cousin could be used at any given latitude. While the idea of the Saphea originated in Baghdad during the ninth century CE, actual instruments would not be produced until the eleventh century CE in Toledo, Spain.

Spain under Islamic rule was, for the time, a beacon of religious tolerance in Europe, with Muslims, Christians, and Jews, living relatively harmonious, multicultural lives. It was within this culture that one of the greatest mathematicians and instrument makers of their (or any other) generation was born: Abu Ishaq Ibrahim ibn Yahya a-Naqqash al-Tujibi al-Zarqali, better known as Al-Zarqali or al-Zarqalluh (c420-480 H / c1029-1087 CE), which literally translates as 'engraver', as he was so proficient at the craft. In the west his name would become Latinized as Azarquiel.

Azarquiel devised a new stereographic projection in which he cast both the equatorial and ecliptic coordinate systems on to a vertical plane that cut the celestial sphere at the solstices. Adding a selection of important stars to this grid system produced a universal projection that was valid for every latitude without sacrificing any of the functionality of a standard projection.

Although the new instrument was a significant step forward, it did require the user to have a much better understanding of mathematics in order to use it effectively, and thus the classical astrolabe would continue to be the more popular instrument. This is reflected in the number of surviving examples from this period. The universal astrolabe would not catch on, in Western Europe, until some 500 years after the first example was made by Azarquiel.

Dating

Although this Saphea is not dated, an approximate date can be ascertained by the Zodiac scale and Julian calendar – to the verso – and the placement of the stars on the projection on the recto.

The scale and calendar show that 0-degree Aries corresponds with approximately 13.8 March. This puts the possible date of construction between 1150 and 1250. The position of the stars corroborates this, with the closest match being from the thirteenth century.

A further comparison was made with two universal astrolabes dating from the thirteenth century: one from 1218/19 by Muammad ibn Fattū al-Khamāiʾrī – housed in the Bibliothèque nationale de France (inv. cote Ge A 408)- and another from 1270/71 made by Ibrāhīm al-Dimashqī – which is in the British Museum (inv. 1890,0315.3). The present astrolabe has a very close match with the star placements on both astrolabes. However, the few misaligned stars indicate a later date when compared to the Khamāiʾrī astrolabe and earlier when compared to the Dimashqī example. This suggests that the present instrument sits somewhere in between the two i.e. from 1219 to 1270. Therefore, a date of around 1250 is not unreasonable.

Attribution

The thirteenth century was a lively period for astrolabe making in the Islamic West i.e. Maghrib and al-Andalus. Khamāiʾrī was arguably the most prominent of the instrument makers of his time. At least fourteen astrolabes by his hand survive, albeit most of them are planispheric. However, as he tends to sign his works it would seem unlikely that the present instrument is by him.

Rarity

We are only able to trace six institutional examples of early, i.e. pre-1300, universal astrolabes: Louvre Abu Dhabi; The Observatory Rome; Bibliothèque Nationale, Paris;; Institutio Historico de Marina, Madrid; The Victoria and Albert Museum; and The British Museum. A seventh formerly in The Time Museum, Rockford, Illinois, is now in private hands.

Full description of the Astrolabe

Recto

Engraved along the circumference of the recto is four sets of 90-degree scales arranged in four quadrants. Each scale is divided into 5-degrees and labelled with alphanumeric notation (i.e., abjad) and further subdivided into 1-degree. Inside the scales is a double universal astrolabe projection of the same style which was first designed by the 11th-century Andalusian astronomer al-Zarqālī known as saphea azarchelis. The first projection represents the celestial coordinates. The second is superimposed at an angle of approximately 23.5 degrees and represents the ecliptic coordinates.

The equatorial longitudes are labelled in abjad for every 5-degrees from 5- to 180-degree and in reverse 185- to 360-degree along the equator. The equatorial latitudes are also labelled for 5-degrees from the equator to the poles in the order of 5-10-5-20-5-30-… instead of 5-10-15-20-25-…

The poles are inscribed:
The southern celestial pole – Quṭb muʿaddil al-nahār janūbī
The northern celestial pole – Quṭb muʿaddil al-nahār shimālī

On the ecliptic projection the ecliptic and longitude arcs for every 30-degrees are marked with arrow-shaped patterns. The poles are inscribed:
The southern ecliptic pole – Quṭb falak al-burūj janūbī
The northern ecliptic pole – Quṭb falak al-burūj shimālī

The names of the signs of the zodiac are engraved between 35- and 40-degree ecliptic latitude curves on both northern and southern sides. They read:
Signs on the southern side
Jawzā – Thawr – Ḥamal – Ḥūt – Dalw – Jadī
Gemini – Taurus – Aries – Pisces – Aquarius – Capricorn

Signs on the northern side
Qaws – ʿAqrab – Mīzān – Sunbula – Asad – Saraṭān
Sagittarius – Scorpio – Libra – Virgo – Leo – Cancer

There are seventeen stars that are labelled and marked by a small dot inside a circle. These are:
(Starting at northern ecliptic pole towards the ecliptic)
α Lyrae – wāqiʾ
α Cygni – ridf
α Bootis – rāmiḥ
β Pegasi – mankib faras
α Aquilae – ṭāʾir

β Persei – ghūl
α Aurigae – ʿayyūq
? – munīr al-?

(Starting at southern ecliptic pole towards the ecliptic)
α Carinae – Suhayl
α Canis Maioris – ʿabūr
β Sagittarii – ʿurqūb al-rāmī
β Leonis – ṣarfa
α Sagittarii – rukbat rāmī
β Canis Minoris – ghumayṣā
α Tauri – dabarān
α Scorpionis – qalb
α Virginis – aʿzal

Alidade
Attached by a central pin on the recto is a chamfered alidade. On the chamfer is a ruler with 5-unit divisions and 1-unit subdivisions. Each 5-unit is labelled in abjad. Divisions are engraved neatly and correspond well with the engravings on the universal astrolabe projection on the recto. Style of inscription and near-perfect match of the divisions indicate that the alidade is highly likely to be the original.

Verso
On the upper half of the circumference is a double 90-degree altitude scale, divided into 5-degree and labelled in abjad, and further subdivided into 1-degree. Lower half of the circumference carries non-linear shadow scales or cotangent scales for 12-base on the right and 7-base on the left. The scale for 12-base is divided and labelled for 3, 6, 9, 12, 17, 22, 27, 39, and 48 units. The scale for 7-base is divided and labelled for 1, 2, 3, 4, 5, 6, 7, 8, 10, 12, 15, 20, and 30 units.

Inside these are two nested circular scales, one for the zodiac calendar and the other for the Julian calendar. The Julian calendar is also divided into 5-day intervals and labelled, and further subdivided into 1-day intervals.

The inscription for the zodiacal calendar reads:
al-Sunbula – al-Asad – al-Saraṭān – al-Jawzā – al-Thawr – al-Ḥamal
Virgo – Leo – Cancer – Gemini – Taurus – Aries

al-Ḥūt – al-Dalw – al-Jadī – al-Qaws – al-ʿAqrab – al-Mīzān
Pisces – Aquarius – Capricorn – Sagittarius – Scorpio – Libra

The inscription for the Julian calendar reads:
August – July – June – May – April – March
February – January – December – November – October – September

At the centre of the verso is an orthographic projection on three quadrants while the lower right quadrant carries a sine graph (mujayyab) with 59 parallel lines for the sexagesimal (60-base) system. The divisions of the projection are labelled for each 5-degree.

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Bibliography

Provenance

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