Brass astrolabe, elaborate throne, mater, womb, rete, six plates of later manufacture, with text, alidade.

THE EARLIEST EXTANT SANSKRIT ASTROLABE

यन्त्रराज [Yantraraja]

Author
CANDIDASA

Publication date
1605].

Publisher

Publication place
Ahmedabad,

Physical description
Brass astrolabe, elaborate throne, mater, womb, rete, six plates of later manufacture, with text, alidade.

Dimensions
Diameter: 276mm (0 by 10.75 inches)

Notes
The earliest extant Sanskrit astrolabe, commissioned by an Indian astronomer for his son’s education.

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.

From its Mediterranean origins, the astrolabe was preserved and developed by Islamic scholars in the Middle East for centuries. In 1017 Persian polymath Al-Biruni travelled to India, bringing with him the instrument. His treatise on the land's culture and religion, known simply as 'India', mentions a manual on the astrolabe that the author claims to have written in Sanskrit verse. Although no such manual exists today, it seems clear that the astrolabe was introduced into India in the early eleventh century.

Astrolabes first began to be manufactured in India over three hundred years later, following the establishment of a new sultanate at Delhi, which encouraged the migration of Islamic scholars learned in astronomy and astrology. Under Sultan Firuz Shah Tughlaq a Jain astronomer named Mahendra Suri received royal patronage to compose a Sanskrit manual on the instrument, which he named 'Yantraraja' ('the king of astronomical instruments'). Over the subsequent centuries hundreds, if not thousands, of astrolabes were manufactured in India, of which the present item is the earliest surviving example.

Dating

The astrolabe has a six-line inscription in the womb of the mater, written in a combination of Sanskrit and medieval Gujurati common at this time. It reads:

"In Samvat 1663, Saka 1528 current, on the first of Magha, on Sunday, at the city of Ahmedabad, during the reign of the illustrious Salim Shah, [this] astrolabe was caused to be made by the astrologer Candidasa for the purpose of the reading of [his] son Damodara."

This date was originally thought to correspond to February 1, 1607, but more sophisticated conversion programmes have led experts more recently to conclude that Sunday December 25, 1605, is the date on which manufacture of the astrolabe was completed. Supporting this earlier date is the fact that just two months earlier, Salim Shah had ascended to the throne of the Mughal Empire at Agra and assumed the royal name Nur al-Din Jahangir. It is much more likely that an instrument completed two months after this change, and perhaps begun before it, would bear the old name than one made a year and a half later.

As a result, the present item is the earliest extant Sanskrit astrolabe. Although it is likely that the instruments were being produced in India as early as the fourteenth century, since the first Sanskrit manual on astrolabes was made in 1370, no earlier example has been discovered.

Attribution

The inscription notes that the astrolabe was commissioned ("caused to be made") by Candidasa for the instruction of his son Damodara. Unlike among Islamic scholars, and despite the popularity of the astrolabe among Indian astronomers, the manufacture of astrolabes never became a specialist occupation in Indian, where skilled Hindu metal-workers produced the instruments on commission. It would generally be the responsibility of the astronomer to prepare drawings of the astrolabe they wanted made, and give them to a willing bronze-worker to be produced. As a result, inscriptions in Sanskrit astrolabes typically name the patron rather than the maker. Another result is that often display typographical errors, especially to the names of celestial bodies, as the craftsmen responsible for them were not themselves experts in astronomy.

Rarity

Sreeramula Rajeswara Sarma, Professor of Sanskrit at Aligarh Muslim University and expert on Sanskrit astrolabes identifies 130 extant Sanskrit astrolabes, made in Gujurat and Rajasthan between 1605 and 1903. They are mainly held in museums and institutions, and their appearance on the market is rare. The present astrolabe is the earliest known example of such an instrument.

Full description of the Astrolabe

Recto

The mater of the astrolabe consists of a brass disc 10.3mm in thickness with a raised rim, the limb, engraved with the degree scale in two bands. The inner band is graduated in single degrees, and the outer every three degrees, identified with Devanagari numerals in western Indian style. At the centre of the womb beneath the attribution inscription is a pin hole and pin, with which the latitude plates are held firmly in position.

The mater is surmounted by an elaborate throne with a wide base, pierced to form an ornate pattern of foliage. A short inscription reads “salutation to the divine eye”. A hole at the top of the throne above the inscription allows the astrolabe to be attached to the suspension shackle and ring, on which it is hung vertically and is able to rotate 360 degrees.

The Plates

The womb of the mater accommodates six thin circular discs bearing stereographic projections of the heavens from distinct terrestrial latitudes. These latitude discs are 252mm in diameter and have two holes, one in the centre at the site of the North Pole, through which they are slotted onto the mater’s central pin, and another on the lower half to keep the plates from rotating.

On each of the plates the four cardinal directions are marked, with east-west and north-south lines. Three concentric circles represent the tropics and the celestial equator. The local horizon is presented, and above the horizon circle, parallel altitude circles, or almucantars, are drawn. Unlike on Islamic astrolabes, Sanskrit instruments rarely bear azimuth lines, which do not appear on the present example.

The lower half of each plate has the three semi-circles formed by the tropics and equator divided into 12 parts. Connecting lines, which are not arcs as usually found but rather straight lines, designate unequal hour lines or seasonal hour lines, the former numbered from one to 12, west to east. While the Islamic and European custom was to measure time in unequal hours, Hindu and Jain practice was to divide the day into equal 24-minute periods, called ghatis. The fact that the astrolabe describes the former system indicates that it was made for use by Muslims, not Hindus or Jains.

Between the local horizon and the tropic of Cancer, each side of every plate has four pieces of data engraved concerning its specific projection: the name of the town or city from which it could be used; its latitude; the length of the midday equinoctial shadow; the length of the longest day at this latitude. Contemporary and earlier Sanskrit astronomical manuals and gazettes would have equipped the user with the formulas required to convert any one of the three latter values into another, but each is listed here to expedite the use of the instrument.

Although the engraving is well-executed, the calligraphy of the letters and numerals is by a different hand to that found on the mater, and the overall workmanship is also less fine. These details suggest that the plates originally made for the astrolabe, being thinner sheets of metal, may have been damaged and had to be replaced at a later date, with the present six manufactured by another

metalworker.

The Rete

The rete is an openwork disc of 250mm in diameter, bearing the stereographic projection of the sphere of fixed stars. 24 prominent stars are marked according to their longitudes and latitudes, with their names engraved, with occasional errors, on their respective curved star pointers:

samudrapaksi – Deneb Kaitos
maghodara – Mirach
[illegible]
pre – Algol
Rohini – Aldeberan
sanmusa – Capella
mithunapadapa – Saiph
vamaskada – Bellatrix
mithunaha – Betelgeuse
adralu – Sirius
pra.va – Castor
lubdhakavadha – Procyon
magha – Regulus
uttarapha – Denebola
kakaskanda – Gienah
citra – Spica
svati – Arcturus
visasa – Alphecca
dhanukoti – Rasalhague
dhanusira
abhijit – Vega
sravana – Altair
kubha – Deneb
pu bha – Sheat

Three concentric circles represent the tropics and the celestial equator. The ecliptic is drawn with a radius of 21;26 units from a centre situated on the meridian at 8;34 units south of the plate's central point.

The ecliptic circle is divided into the 12 signs of the Zodiac in unequal divisions, in proportion to the rising times of the signs at the equator. Each sign is further subdivided into ten units of three degrees and numbered, except those of Gemini. The signs are named in Sanskrit, sometimes misspelled:

masa – Aries
vasa – Taurus
mithana – Gemini
karka – Cancer
simha – Leo
kanya – Virgo
tula – Libra
vrscika – Scorpio
dhana – Saggitarius
makara – Capricorn

kubha – Aquarius
mina – Pisces

The workmanship of the rete is far inferior to that of the maker, with several star pointers not clearly cut. The calligraphy of the letters and numerals is also different from that found on the plates and mater. The rete therefore seems to be the work of a distinct craftsman, perhaps of a different period, from the maker of the mater. It is likely that it was made later as a replacement for the original damaged rete, which would have been directly, although imperfectly, copied.

Alidade
Attached by a central pin on the recto is the alidade, 265mm in length. It is a straight metal bar with pointed ends, and a sighting tube (290mm) is attached by upright supports. Neither Islamic nor European astrolabes have sighting tubes attached to the alidade, perhaps because, although they naturally facilitate sighting, they prevent the calibration of the upper surface of the alidade, thereby impeding its functionality for trigonometric uses.

Verso
The perimeter of the verso is banded by a degree scale, again with the inner band graduated in single degrees and the outer by threes. The upper left-hand quadrant contains a sexagesimal sine graph with 60 horizontal parallel and equally-spaced lines, numbered in threes along the vertical radius. An arc is engraved at 24 degrees to mark to the obliquity of the ecliptic. The quadrant is divided into three sectors of 30 degrees by three radii, with the numbers one to 12 engraved in four rows.

The upper right-hand quadrant presents a series of curves for unequal hours, numbered one to 12. This feature is unique to this astrolabe, and does not appear on any other extant Sanskrit instruments, which usually show a declination graph in this quadrant.

The lower half of the verso is engraved with a shadow square, with 12 digits inscribed on the left-hand half, and seven on the right. As expected of a Sanskrit astrolabe, the verso contains much less information than those of its Islamic and Indo-Persian counterparts.

Bibliography

Provenance

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