

THE MONUMENTAL SYRIAN ASTROLABE IN THE MARITIME MUSEUM, ISTANBUL

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To the memory of Professor Aydın Sayılı, from an ardent admirer who was born at the end of 1941, just when the monumental doctoral dissertation “Institutions of Science and Learning in the Moslem World” was submitted to Harvard University.

In the Maritime Museum (Deniz Müzesi) in Istanbul, there hangs an enormous brass astrolabe damascened in silver (inv. no. 264).¹ It is, in fact, with a diameter of 56 cm and thickness of 1.1 cm, the largest surviving Islamic astrolabe from the period ending in 1600.² But it has not yet received the attention that it deserves; indeed, it has been unlucky on several accounts. First, it was, until recently, known in the modern literature only by a passing reference.³ Second, the astrolabe was supposed to have been

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¹ The instrument has been assigned the number 4050 in the International Instrument Checklist and is described in detail in the forthcoming catalogue of all medieval astronomical instruments, on which see my reports “Medieval Astronomical Instruments: A Catalogue in Preparation,” *Bulletin of the Scientific Instrument Society*, 31 (Dec., 1991), pp. 3-7, and “1992-A Good Year for Medieval Astronomical Instruments,” *ibid.*, No. 36 (March 1993), pp. 17-18.

² One of the best descriptions of the astrolabe and the relevant astronomical and astrological notions is Willy Hartner, “The Principle and Use of the Astrolabe” in Arthur U. Pope, *A Survey of Persian Art*, III, (London and New York: Oxford University Press 1939), reprinted (without the original plates) in *idem*, *Oriens-Occidens*, Hildesheim: Georg Olms 1968, pp. 287-311, and again (with plates) in *Astrolabica* (Paris: Société Internationale de l’Astrolabe), 1 (1978). A shorter version is in the same author’s article “Aṣṭurlāb” in *The Encyclopedia of Islam*, 2nd. ed., vol. I, Leiden: E.J. Brill 1960, pp. 722-728, reprinted in *idem*, *Oriens-Occidens*, pp. 312-318.

See also King, “Some Remarks on Islamic Astronomical Instruments,” *Scientiarum Historia* 18:1 (Brussels 1992), pp. 5-23, for an overview of Islamic instrumentation, and also *idem*, *Islamic Astronomical Instruments*, London: Variorum 1987, on certain instruments of particular historical interest.

³ Francis R. Maddison, “al-Jazarī’s Combination Lock: Two Contemporary Examples,” in Julian Raby, ed., *The Art of Syria and the Jazīra 1100-1250* (Oxford, *Studies in Islamic Art* 1), Oxford 1985, reprinted 1987, pp. 141-157, especially p. 153, n. 30.

exhibited at the splendid exhibition on Syria held at the Institut du Monde Arabe in Paris during 1993-1994; however, for technical reasons this turned out to be not possible.

Syria was the scene of intense astronomical activity during the Ayyubid and Mamluk periods⁴ and the Syrian astronomical instruments that were exhibited in Paris included some of the most remarkable ever made by Muslim astronomers.⁵ A description of the Maritime Museum astrolabe (in French) was included in the catalogue,⁶ and the purpose of this notice is to bring the instrument to the attention of a wider audience.

The provenance of this instrument is not known. Its rather simple rete design bears some resemblance to that of the astrolabe featured in the miniature from the *Shāhinshāhnāme* in MS Istanbul University Library F-1404, fol. 57r, showing the astronomer Taqī al-Dīn with his staff at the Istanbul Observatory.⁷ But Taqī al-Dīn's astrolabe does not exhibit the distinguishing feature of this piece (see below). And in addition, the instrument depicted in the miniature, held at arm's length in the hand of Taqī al-Dīn or his assistant, is smaller. It is not possible for one man to hold up the Maritime Museum astrolabe; in fact, it takes two men to even move it.⁸

The astrolabe was made in Damascus in 619 H [= 1222/23] for the Ayyubid Sultan al-Mu'azzam Sharaf al-Dunyā wa'l-Dīn 'Īsā ibn Abī Bakr, who from 597 H [= 1200/01] to 615 H [+ 1218/19] was Governor of Damascus and thereafter until 624 H [= 1227] was ruler of the entire Ayyubid realm. The name of the maker indicates that his family came originally from Baalbek and the epithet al-Najjār that he was a craftsman; he is previously unknown to the modern literature. The positions of the markings were calculated by 'Abd al-Rahmān ibn Abī Bakr al-Muqawwim al-Tabrīzī, likewise new to the literature. The appellation al-Muqawwim probably

⁴ See King, "The Astronomy of the Mamluks," *Isis* 74 (1983), pp. 531-555, reprinted in *idem*, *Islamic Mathematical Astronomy*, London: Variorum 1986, 2nd. ed., Aldershot (U.K.): Variorum 1993, III, and now the chapter "L'astronomie en Syrie à l'époque islamique," in Sophie Cluzan, Jeanne Moulérac and Adnan Bounni, eds., *Syrie, Mémoire et Civilisation*, Paris: Flammarion (Institut du Monde Arabe), 1993, pp. 386-395.

⁵ *Ibid.*, pp. 432-443.

⁶ *Ibid.*, p. 480.

⁷ Aydın Sayılı, *The Observatory in Islam*, Ankara: Turkish Historical Society 1960, reprinted New York: Arno Press 1981, Pl. 6, and also pp. 294-295.

⁸ It is a pleasure to record my gratitude to Dr. İskender Pala of the Deniz Müzesi, who helped me confront this instrument in 1991 and again in 1994.

refers to his occupation as a compiler of ephemerides (*taqūīm*, pl. *taqūwīm*, from the verb *qawwama*),⁹ but it is not attested elsewhere. The astrolabe was inlaid with silver by al-Sirāj al-Dimashqī, a muezzin and astrolabist known by three surviving instruments, each far more modest than this one.¹⁰

The throne, which stands 4.7 cm above the rim, bears no markings. The scale of the rim is divided and labelled for each 5°, with subdivisions for each 1°, as altitude scales in the upper quadrants and as zenith-distance scales in the lower ones. The throne, the rim and the mater are cast as one piece and there are no markings on the mater besides a peg at the bottom.

The rete is distinguished by a short equatorial bar inside the southern (upper) ecliptic in addition to a much longer one below the northern ecliptic. No other contemporary Islamic instrument exhibits this first feature, and since it is very much typical of certain medieval French astrolabes¹¹ this raises the interesting question whether the basic rete design might have been copied from an instrument brought to the Ayyubid realms during the Crusades. The former is attached to the ecliptic by two rectilinear supports, the latter by three, on the middle one of which there is a semi-circular handle perpendicular to the rete. The horizontal bar is rectilinear and the vertical bar extends from the substantial central disc to the middle of the upper equatorial bar. The scale of the ecliptic is divided for each 1°. The star-pointers are basically triangular in shape, with semi-circular indents at the middle of each side. The stars are named in Kufic and in most cases have been repeated (with minor variants) in an Ottoman hand. The 20 stars represented are the following (arranged in increasing right ascension, starting at the vernal equinox):

⁹ See King, "Lunar Crescent Visibility Predictions in Medieval Islamic Ephemerides," in S. Seikaly, R. Baalbaki, P. Dodd, eds., *Quest for Understanding-Arabic and Islamic Studies in Memory of Malcolm H. Kerr*, Beirut: American University of Beirut 1991, pp. 233-251, reprinted in *idem*, *Astronomy in the Service of Islam*, IV, especially p. 235.

¹⁰ See L. A. Mayer, *Islamic Astrolabists and Their Works*, Geneva: Albert Kundig 1956, p. 83, on two of these. A third is in Hyderabad.

¹¹ See Emmanuel Poulle, *Un Constructeur d'Instruments Astronomiques au 15^e siècle-Jean Fusoris*, Paris: Honoré Champion 1963, especially pp. 19-26 and pls. I and III, and King, "Rewriting History Through Instruments: The Secrets of a Medieval Astrolabe from Picardy," in Robert G. Anderson, James A. Bennett, and Will F. Ryan, eds., *Making Instruments Count-Essays on Historical Scientific Instruments Presented to Gerard L'Estrange Turner*, Aldershot: Variorum 1993, pp. 42-62, especially pp. 56-57 and fig. 5 on p. 50.

1st quadrant: ra's al-ghūl* ʿayn al-thawr* al-ʿayyūq* rijl al-jawzā'* yad al-jawzā'.

2nd: al-shi'ra al-yamāniya* al-shi'ra al-sha'āmiya* qalb al-asad.

3rd: al-simāk al-a'zal *al-simāk al-rāmiḥ* munīr al-fakka* qalb al-ʿaqrab* ra's al-hawwā'.

4th: al-nasr al-wāqi'* al-nasr al-tā'ir* al-ridf* dhanab al-jady* mankib al-faras* kaff al-khaḍīb* dhanab qaytūs.

There are no construction markings on the back of the rete. The positions of the stars are accurate for the epoch of the instrument,¹² and further investigation is necessary to establish from which star-table they might have been taken.

The one surviving original plate out of an original three (or perhaps only two) has altitude circles for each 1° of argument and curves for the seasonal hours, all constructed with extreme care and accuracy. The latitudes served are 30° and 35°, the associated lengths of longest daylight being given as 13; 58^h and 14; 25^h. The first of these would have been intended for Cairo. There must have been at least one or two other plates which would have served 33° or 33; 30° (Damascus) and perhaps Jerusalem and Aleppo. The lengths of longest daylight are based on the Ptolemaic obliquity of 23; 51°, rather than any of the more up-to-date values found by Muslim astronomers in the 9th and 10th century. (This is typical of many medieval Islamic astrolabes). The seasonal hours are numbered both in *abjad* notation and in words. The side for 35° has two unlabelled curves across the curves for the seasonal hours on the left which serve the beginning and end of the ʿaṣr prayer. The other two plates are not original and bear markings for the latitude of Istanbul.

The back bears an altitude scale subdivided for each 30 above the horizontal diameter. The lower scales are divided for shadows to base 7 and 12 and marked *zill al-aqdām* and *zill al-aṣābi*^ʿ, respectively. There is a zodiacal scale running counter-clockwise from the top: for each sign an illustration of the sign and of the appropriate planet that has its domicile

¹² Preliminary investigations have been conducted in Frankfurt by my doctoral student, Burkhard Stautz.

(Mars for Aries, *etc.*) are superposed on the name of the sign. Inside are the limits and faces, for Aries, for example:

| | | | | |
|-----------|----------|------------|----------|-----------|
| Jupiter 6 | Venus 12 | Mercury 20 | Mars 25 | Saturn 30 |
| | Mars 10 | Sun 20 | Venus 30 | |

Below the horizontal diameter is a table of the triplicities and their lords, organized according to their attributes:

| Triplicities | / | Lords |
|---------------|-----|---------------------|
| Fiery / Aries | Leo | Sagittarius / Sun |
| | | Jupiter |
| | | Saturn, <i>etc.</i> |

The inscriptions (A-E below) translate as follows:

A: “By order of the Treasury of our Lord the Sultan,
the King al-Mu‘azzam, the Just and Pious Scholar,
the Fighter in the Holy War, the Warrior,

Supported (by God), made Victorious (by God) (*al-muzaffar al-manṣūr*)
Sharaf al-Dunyā wa’l-Dīn ʿĪsā ibn Abī Bakr ibn Ayyūb.”

B₁: “Made (*ʿumila*) in Damascus, (the city) protected (by God)
in the year 619 Hijra [= 1222/23].”

B₂: “(The) tables contain the limits and the faces and the triplicities.
The limits are according to the opinion (*zaʿm*) of the Egyptians.
The faces and triplicities are according to the opinion
of the majority of scholars (*raʿy al-jamhūr*).”

C: “Inlaid by (*taṭʿim*) al-Sirāj al-Dimashqī.”
(See the introductory remarks).

D: “(The positions of the markings were) calculated by (*ḥāsibuhu*)
ʿAbd al-Raḥmān ibn Abī Bakr al-Muqawwim al-Tabrīzī.”
(See the introductory remarks).

E: (The astrolabe was) constructed by (*ṣanaʿahu*)
ʿAbd al-Raḥmān ibn Sinān al-Baʿlabakkī al-Najjār.”

There is no alidade and it is not clear that there ever was one. Certainly it would never have been possible for one person to hold the astrolabe in one hand and adjust the alidade with the other!

This is just one of many Islamic instruments preserved in the museums of Istanbul. The rich collection in Kandilli Observatory has been catalogued by Professor Dr. Muammer Dizer¹³ and those in other museums by myself.¹⁴ They constitute important historical sources whose importance is only now coming to be appreciated.¹⁵ The Maritime Museum astrolabe should eventually be included in a comparative study of two other royal astrolabes made by ‘Abd al-Karīm al-Miṣrī, now preserved in the British Museum, London,¹⁶ and the Museum of the History of Science, Oxford,¹⁷ respectively. Both were made in Damascus in the early 13th century for the ruling sultan and both are large, albeit with diameters of *ca.* 30 cm. considerably smaller than the piece we have described. Alas, only the former is complete; the latter has a replacement rete by an Iranian.¹⁸ The zoomorphic rete on the former, however, is one of the most beautiful pieces of metal-work ever made in the Middle Ages.¹⁹

¹³ See already M. Dizer, *Astronomi Hazineleleri*, İstanbul: Boğaziçi Üniversitesi (Yayınlar No. 404) and Kandilli Rasathanesi 1986. A more detailed catalogue is available for publication.

¹⁴ The descriptions are to appear in the catalogue of all medieval astronomical instruments, Islamic and European, currently in preparation in Frankfurt-see note 1.

¹⁵ See King, “Some Remarks on Islamic Scientific Manuscripts and Instruments and Past, Present and Future Research”, in John Cooper, ed., *The Significance of Islamic Manuscripts*, London: Al-Furqan Islamic Heritage Foundation 1992, pp. 115-144 (also available in Arabic).

¹⁶ Inv. no. 55 7-9 1, International Instrument Checklist # 104. See Robert T. Gunther, *The Astrolabes of the World*, 2 vols., Oxford: Oxford University Press 1932, (reprinted in 1 vol., London: The Holland Press 1976), I, pp. 236-237 (no. 104). On the problem of the inscription see Mayer, *Islamic Astrolabists* (note 10), p. 30. See also note 19.

¹⁷ Inv. no. ICC 103, International Instrument Checklist # 7 (rete) and # 103 (mater and plates). See Gunther, *Astrolabes* (note 16), I, p. 121 (no. 7) and 233-236 (no. 103); Mayer, *Islamic Astrolabists* (note 10), p. 30; and also note 18.

¹⁸ Considerable fantasy prevails in a recent article by Francis R. Maddison entitled “The Barber’s Astrolabe”, *Interdisciplinary Science Reviews* 17:4 (Dec., 1992), pp. 349-355. The author sees in the Oxford piece the astrolabe inlaid in silver mentioned in the *1001 Nights*. He is apparently unaware that 8 out of 13 known Ayyubid and Mamluk astrolabes are inlaid in silver, or that this piece was made in Damascus, not Cairo where the story of the barber with the astrolabe was coined. There is an astrolabe in the Türk ve İslâm Eserler Müzesi (inv. no. uncertain, International Instrument Checklist # 4036), made in Cairo in the late 13th century (681 H) and bearing inscriptions in Coptic and Arabic, which is inlaid in silver all over. It is a modest 11.4 cm in diameter, and would at least have fitted into a barber’s pocket, if there ever was a barber. (The two versions of the barber’s tale in the *1001 Nights* mention conjunctions in 653 and 763 H, respectively; the astronomical and astrological information in the tale is corrupt in all of the published editions and translations, but can be partly restored).

¹⁹ See the description by an art historian, Michael J. Rogers, in *Circa 1492*, Washington, D.C.: The National Gallery of Art, 1992, pp. 215-216.

These instruments stem from a scientific tradition which by the 9th century, as Aydın Sayılı established several decades ago and more recent research has confirmed, was well underway to achieving what one modern scholar has called “a level of institutional organization, in observational practice and in theoretical outlook, that would not be equalled in Europe until the sixteenth century.”²⁰ The astrolabe in the Maritime Museum is but one more example of the sophistication of that tradition.

²⁰ Kristiaan P. Moesgaard in Ivor Grattan-Guinness, ed., *Companion Encyclopaedia of the History and Philosophy of the Mathematical Sciences*, 2 vols., London and New York: Routledge 1994, I, p. 246, citing Professor Sayılı’s monumental work on the Observatory in Islam.

Captions to plates

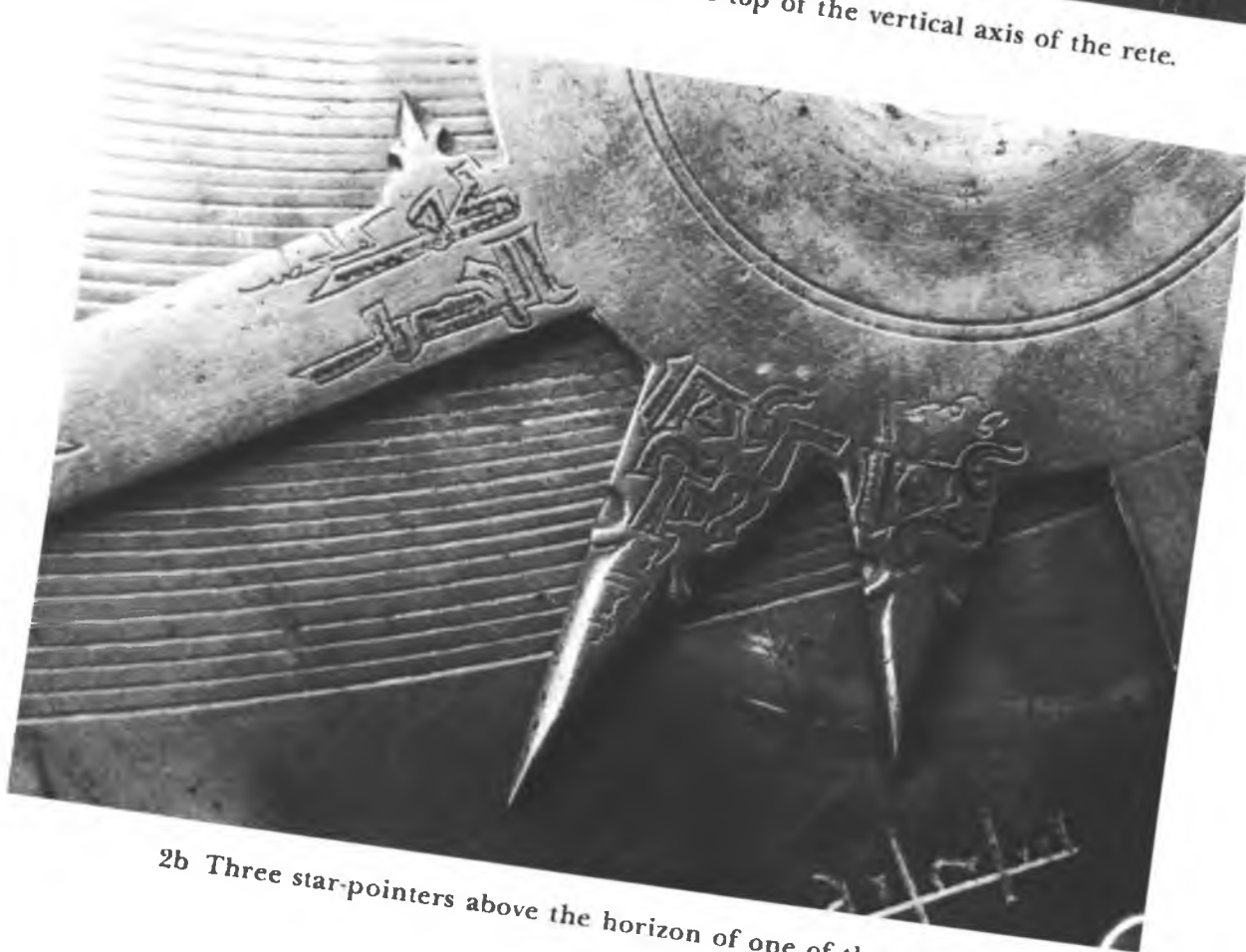
Note: These photographs were taken by the author in May, 1994, with the help of Dr. Iskandar Pala. They were taken in bright sunlight on the floor near a window of the Museum.



1 The front.



2a The distinctive upper frame at the top of the vertical axis of the rete.



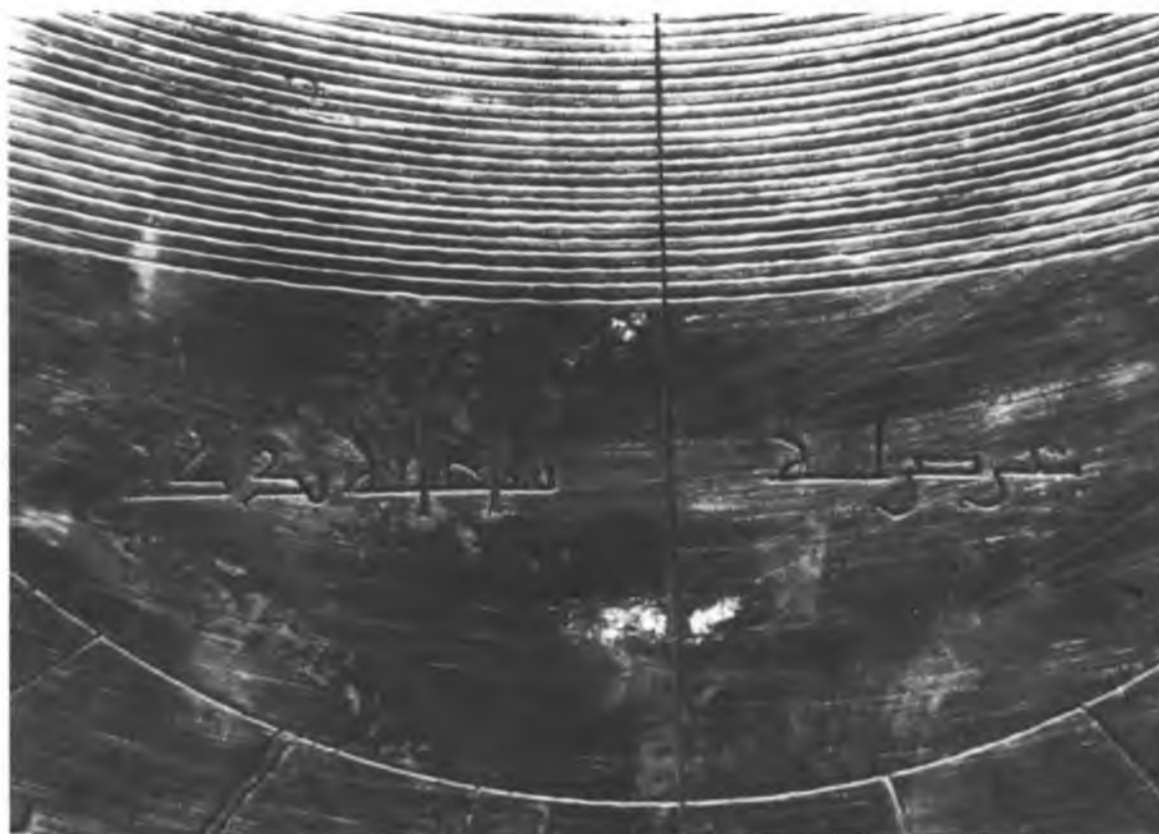
2b Three star-pointers above the horizon of one of the plates.



3a The pointer for rijl al-jawzā' above the hour-curves of a plate.



3b The pointer for al-nasr al-wāqi' above the altitude circles around the zenith of one of the plates.



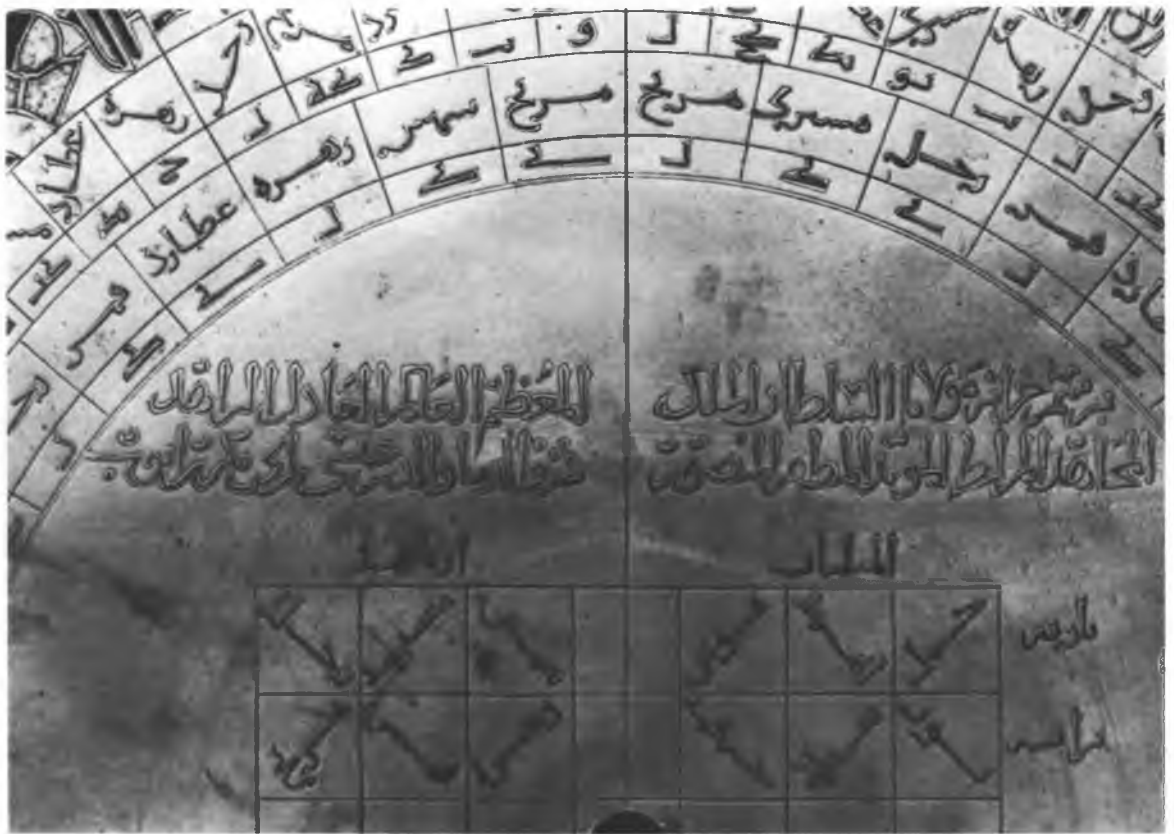
4a The inscription on the plate for latitude 35°.



4b The meridian scale on the plate for atitude 35°.



5 The back.



6a Detail of the middle of the upper back.



6b Detail of the middle of the lower back.



7a/b The dedication to the Sultan.



8a Mention of Damascus as the place of construction.



8b The date of construction.



9a The signature of al-Ba'alabakkī, with the constellation of Virgo (al-mīzān) and Mercury.



9b The signature of al-Tabrīzī, with the constellation of Libra (al-saratān) and Venus



10a The signature of al-Sirāj.



10b The throne.