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Ashraf: al-Malik al-Ashraf (Mumahhid al-Dīn) ʿUmar ibn Yūsuf ibn ʿUmar ibn ʿAlī ibn Rasūl

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Born ***circa* 1242**

Died **(Yemen), 22 November 1296**

al-Ashraf ʿUmar, the third of the Rasulid sultans in Yemen, was a prolific scholar who wrote a number of works with astronomical content. The date of Ashraf's birth is uncertain, and only a few details of his life are recorded. In 1266/1267, Ashraf commanded a military mission for his father to the northern town of Ḥajja and later became governor of al-Mahjam along Wādī Surdud in the coastal region of Yemen. His father, al-Muẓaffar Yūsuf, appointed him coregent in 1295. Four months later Ashraf ʿUmar succeeded him on the throne. In the same year Malik al-Ashraf visited al-Dumluwa and later the coastal town of Zabīd. He reigned in Yemen for about 2 years until his death in 1296. He was buried in the Ashrafiyya school he had founded in Taʿizz. Ashraf left behind six sons and two daughters, both married to sons of Ashraf's brother, Muʾayyad Dāwūd, who succeeded him on the throne.

In contrast to his father's reign, which was long and prosperous, Ashraf's own reign was short-lived and without major historical significance. His minor importance for the political history of his realm is counterbalanced by his considerable contribution to science.

Ashraf wrote some 13 treatises on a variety of scientific fields including medicine, genealogy, agriculture, veterinary medicine, astronomy, and astrology. He made several astronomical instruments, among which were astrolabes. For the sake of brevity, only the extant contributions to astronomy will be mentioned.

In the Metropolitan Museum of Art in New York, an Islamic astrolabe is preserved that is signed by ʿUmar b. Yūsuf b. ʿUmar b. ʿAlī b. Rasūl al-Muẓaffarī, *i. e.*, Ashraf, dated 1291, and measures 15.5 cm in diameter. It is competently made without being particularly sophisticated, but some unusual features make it unique: on the rete, there is a scale for the lunar mansions; and on the back, there is astrological information using planetary symbols that had been adopted by Muslims from Greek sources. The plates are engraved for latitudes in Yemen and Hejaz and were constructed using the tables presented in Ashraf's treatise on the construction of the astrolabe, not by using geometrical construction.

Ashraf's treatise on the construction of the astrolabe as well as other instruments, entitled *Muʿīn* (or *Minhaj*) *al-ṭullāb fī al-ʿamal bi-ʾl-asṭurlāb*, is preserved in two manuscripts in Cairo and Tehran. The

sultan mentions there the extensive treatise on spherical astronomy and astronomical instruments written by **Marrākushī**. Ashraf's treatise contains an explanatory text on the construction of an astrolabe, diagrams of the different parts, and tables for the construction of, for example, the altitude circles and the azimuth circles for specific latitudes in Yemen and the Hejaz, and tables of the shadows-lengths and the altitude of the Sun at the beginning of the afternoon prayer. The two star catalogs use the degree of the ecliptic with which the star culminates and the radius of the day circle of the star and not, as more usual, the ecliptic or equatorial coordinates.

The star pointers on the rete of Ashraf's astrolabe do not correspond with the star positions mentioned in his treatise. Nevertheless, the connection between instrument and text is definite. In particular, the back of the astrolabe made by Ashraf, and the illustration of the back of an astrolabe in his treatise, are virtually identical. It is indeed rare that we find references in the medieval literature to specific instruments that have survived to this day.

In his treatise, Ashraf deals not only with the astrolabe but also with horizontal sundials, the water clock, and the magnetic compass. At the end, the text is supplemented with notes by two of Ashraf's teachers. The section on the sundial contains tables of coordinates for marking the seasonal hours on the shadow traces of the zodiacal signs computed for latitudes in Yemen and the Hejaz, using 23° 30′ for the obliquity of the ecliptic. These tables are of the same kind as those of **Ḥabash** and Marrākushī, who use 23° 51′ and 23° 35′, respectively. The section on the magnetic compass describes the construction and use of a floating compass.

Ashraf explains the making of the compass bowl, with the rim and the scales engraved there, and the preparation of the magnetic needle, which is inserted crosswise in a stalk. He continues with the determination of the meridian under bad weather conditions, using the magnetic compass, and the use of this information to find the *qibla*, the sacred direction of Islam to Mecca, which one should know to fulfill several Islamic religious obligations such as the five daily prayers. This is the first time the magnetic compass is mentioned in a medieval astronomical treatise and also the first time that it is used as a *qibla*-indicator.

The notes by two of his teachers inform us that they have inspected four or six astrolabes, made by Ashraf himself, which are most accurate and skillful. They testify to Ashraf's excellence in the construction of astrolabes and give him permission to make whatever he likes in the way of astrolabes. Additionally, they mention two water clocks made by Ashraf. So it is probable that Ashraf also made other instruments, such as the sundials described in his treatise.

Ashraf's third contribution to the science of the stars is his extensive collection of astronomical texts and related subjects entitled *Kitāb al-Tabṣira fī ʿilm al-nujūm*, preserved in Oxford. It contains 50 chapters on astrology and astronomy, timekeeping, and an almanac. In essence, it represents an introduction to medieval astronomy that includes basic zodiacal and planetary astrology as well as a range of information on timekeeping systems. The subjects covered include the zodiac, the course of the Sun, the course of the Moon, planets, fixed stars, eclipses, astrolabes, lunar mansions, calendar systems, determination of the *qibla*, weather, medicinal regimes for each season, the agricultural calendar, and systems of numbers. Most of the chapters deal with astrology, but there are also lengthy chapters on timekeeping including tables displaying the solar altitude and longitude of the horoscope as functions of the solar longitude for each seasonal hour of the day. Another table gives the geographical coordinates of different localities. The *Tabṣira* draws on a wide variety of earlier texts and authors; among others, Dorotheus and **Kūshyār ibn Labbān** are mentioned.

In Chapter 32, Ashraf documented the seasonal reckoning of changes in nature and human activities. This almanac is the earliest known treatise of this kind written in prose about Yemen and was probably compiled in about 1271. It is arranged in tabular form. Each page contains daily data for half of the solar Christian month (beginning in October). Each bears information on the entry of

the Sun in each sign, the hours of daylight and darkness, and the shadow-lengths for the beginning of the midday and afternoon prayers (for the beginning and midpoint of each month). For the *anwā'* (certain stars used for weather prognostication), Ashraf relied upon Ibn Qutayba. The information in the almanac derives both from the general almanac tradition and from knowledge of local practices and folklore.

Ashraf was not a great genius but a teachable pupil and a versatile scholar. His astronomical treatises bear a great deal of information about earlier texts. The uniqueness of his astronomical work is due in part to the vicissitudes of history. It is Ashraf who, for the first time, documented in tabular form the yearly astronomical and agricultural events in medieval Yemen. It is Ashraf's description of the magnetic compass that, for the first time, proves that the magnetic compass was used as a *qibla*-indicator, though the author makes no claim to have invented the device. And it is a real windfall that one of the sultan's astrolabes and his treatise on the construction of the astrolabe are preserved.

Selected References

King, David A. (1983). *Mathematical Astronomy in Medieval Yemen: A Biobibliographical Survey*. Malibu: Undena Publications. (On Ashraf in the context of Yemeni astronomy.)

——— (1985). "The Medieval Yemeni Astrolabe in the Metropolitan Museum of Art in New York City." *Zeitschrift für die Geschichte der Arabisch-Islamischen Wissenschaften* 2: 99–122. (Reprinted in King, *Islamic Astronomical Instruments*, II. London: Variorum Reprints, 1987. Supplement in King, *Zeitschrift für die Geschichte der Arabisch–Islamischen Wissenschaften* 4 (1987–88): 268–269. (On Ashraf's actual astrolabe and the treatise on its construction.)

Schmidl, Petra G. (1996–97). "Two Early Arabic Sources on the Magnetic Compass." *Journal of Arabic and Islamic Studies* 1: 81–132. (On the magnetic compass.)

Varisco, Daniel Martin (1994). *Medieval Agriculture and Islamic Science: The Almanac of a Yemeni Sultan*. Seattle: University of Washington Press. (On Ashraf's almanac.)