

From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers*, Springer Reference. New York: Springer, 2007, pp. 1262-1263

Courtesy of  Springer
science+business media

http://dx.doi.org/10.1007/978-0-387-30400-7_1526

Zhamaluding: Jamāl al-Dīn Muḥammad ibn Ṭāhir ibn Muḥammad al-Zaydī al-Bukhārī

Benno van Dalen

Alternate name

Jamāl al-Dīn

Flourished (Mongolia) and Beijing, China, circa 1255-1291

The Muslim astronomer Zhamaluding (Chinese transliteration of Jamāl al-Dīn) was the first director of the Islamic Astronomical Bureau established in Beijing in 1271. He was involved in the compilation of a *zīj* (astronomical handbook with tables) in Persian, which was largely based upon newly observed planetary parameters and was translated into Chinese, under the title *Huihuilifa*, during the early Ming dynasty. Furthermore, Zhamaluding's name is associated with a "Geography of the Yuan empire," finished in 1291.

Most of the historical information concerning Zhamaluding stems from the official annals of the Yuan dynasty, the *Yuanshi*, and from the "Annals of the Yuan Office of Confidential Records and Books" (*Yuan bishujian zhi*, reprinted in the *Sikuquanshu*). It appears that Zhamaluding was in the service of the Mongol Great Khans from the 1250s onward. A certain Jamāl al-Dīn Muḥammad ibn Ṭāhir ibn Muḥammad al-Zaydī al-Bukhārī, hailing from the region of Bukhara in present-day Uzbekistan and presumably identical with Zhamaluding, is mentioned in the *Jāmi' al-tawārīkh* (World history) of the famous Persian historian Rashīd al-Dīn (died: 1317) as not having been capable of carrying out the construction of an astronomical observatory for Möngke Khan (1251-1259) in his capital Karakorum in central Mongolia. Möngke's successor Khubilai had already consulted Zhamaluding and other Muslim astronomers before he became the first emperor of the Yuan dynasty in 1264 and moved his capital to Beijing (Dadu). Three years later, Zhamaluding presented to Khubilai the *Wannianli* (Ten thousand-years calendar, presumably an Islamic *zīj*), which was for a short period distributed as an official calendar but is no longer extant. Furthermore, Zhamaluding offered models or depictions of seven astronomical instruments of Islamic type, namely an armillary sphere, a parallactic ruler, an instrument for determining the time of the equinoxes, a mural quadrant, a celestial and a terrestrial globe, and an astrolabe.

In 1271, Khubilai Khan founded an Islamic Astronomical Bureau with observatory, which was to operate parallel to the traditional Chinese bureau. He thus maintained the bureaucratic structure of the preceding Jin dynasty, but at the same time allowed Chinese observations and predictions to be

checked against those of the highly respected Muslim astronomers. Zhamaluding became the first director of the Islamic Bureau and headed a staff of approximately 40 persons, including astronomers, teachers, and administrative personnel. Because, in particular during the 1260s, tens of thousands of Muslims had arrived in China, it need not surprise us that the staff included capable astronomers and that a large observational program could be carried out in order to redetermine most of the planetary parameters and to measure anew the longitudes and latitudes of hundreds of fixed stars. The Islamic Astronomical Bureau of Yuan China thus became one of the very few Islamic institutions where observations were carried out at such a large scale. Although the bureau was not abolished until 1656, its direct influence on Chinese astronomy was very limited and no Islamic methods were incorporated into the official calendar of the Yuan dynasty, the *Shoushili*, by **Guo Shoujing**.

Zhamaluding was also one of the directors of the imperial "Office for Confidential Records and Books" (*bishujian*), to which both astronomical bureaus were subordinate. The extant annals of this office contain a list of books and instruments present at the Islamic Observatory and in Zhamaluding's private library. From the Chinese transliterations of the book titles and brief descriptions, it can be seen that the following works were available: the *Almagest* of **Ptolemy**, the *Elements* of Euclid, the *Madkhal* (Introduction to astrology) by **Kūshyār ibn Labbān**, the *Stellar constellations* by **Sūfi**, *zījes*, and books on *hay'a* (cosmology) and the construction of instruments. The transliterations were clearly made from the Persian (rather than from the Arabic), as can be seen from certain grammatical elements and some small variations in terminology.

Zhamaluding was very probably the author of a *zīj* in Persian, or at least was associated with its compilation. The original of this work is lost, but a Chinese translation entitled *Huihuilifa* (Islamic calendar) has drawn the attention of Chinese scholars ever since its publication in the annals of the Ming dynasty (*Mingshi*) prepared in the late 17th century. The translation was made in 1383 by a Muslim astronomer, Ma-shayihei (possibly a *shaykh* who had assumed the common Chinese surname for Muslims, Ma), in cooperation with Chinese scholars. This project, which also included a translation of Kūshyār's *Madkhal*, was carried out at the Astronomical Bureau of the new capital Nanjing on the order of the first emperor of the Ming dynasty, Hong Wu.

In recent years the number of known sources from which the contents of Zhamaluding's original *zīj* may be reconstructed has significantly increased. A late-15th-century restoration of the Chinese translation by the vice director of the Astronomical Bureau in Nanjing, Bei Lin, as well as a Korean reworking made on the order of King Sejong (1419-1451), turned out to be more complete than the version published in the *Mingshi*. An Arabic *zīj* written in Tibet in 1366 by al-Sanjufinī contains many tables taken directly from the *Huihuilifa* and others that were derived from that work. Al-Sanjufinī's solar tables are said to be based on the "Jamālī observations," *i. e.*, probably, those carried out under Zhamaluding. A Persian-Arabic manuscript at the Oriental Institute in Saint Petersburg, Russia, which was clearly copied by someone who did not know Arabic or Persian very well, was presumably a working document of the Chinese translators, since it contains original tables for Beijing besides newly computed ones for Nanjing.

An investigation of all these sources has shown that Zhamaluding's original *zīj* contained planetary tables of standard Ptolemaic type, but based on mostly new values for the mean motions, eccentricities, and epicycle radii. For example, the solar mean motion in longitude as found in the *Huihuilifa* implies a length of the tropical year (in sexagesimal notation) of 365;14,31,55 days, one of the most accurate values hitherto found in Islamic sources (the actual year length in 1300 was approximately 365.242236, *i. e.*, 365;14,32,3 days). Zhamaluding's method for predicting solar and lunar eclipses appears to be a mixture of Islamic and Chinese methods. The origin of the star table in the *Huihuilifa*, which lists non-Ptolemaic longitudes, latitudes, and magnitudes of 277 stars near the ecliptic with Ptolemaic as well as Chinese star names, has not yet been completely clarified. The translators in the early Ming dynasty certainly made various modifications to this table, which they

utilized for the calculation of so called encroachments (*lingfan*), i. e., passings of the Moon and planets through stellar constellations, which were highly significant in Chinese astrology.

In 1286, undoubtedly as a senior scholar, Zhamaluding suggested to Khubilai a large-scale geographical survey of the Yuan empire. He became the head of an office especially established for this purpose and, since he did not speak Chinese, was provided with a personal translator. The result of the survey, the *Dayitongzhi* (Geography of the whole empire) in 755 volumes, was offered to the emperor in 1291 and finally printed in 1347. Unfortunately, only the introduction of this work is extant.

Selected References

Chen Jiuji (1996). *Huihui tianwenxue shi yanjiu* (Investigations on the history of Muslim astronomy, in Chinese). Nanning: Guangxi kexue jishu chubanzhe.

Dalen, Benno van (1999). "Tables of Planetary Latitude in the *Huihui li* (II)." In *Current Perspectives in the History of Science in East Asia*, edited by Yung-Sik Kim and Francesca Bray, pp. 316-329. Seoul: Seoul National University Press.

——— (2000). "A Non-Ptolemaic Islamic Star Table in Chinese." In *Sic itur ad astra: Studien zur Geschichte der Mathematik und Naturwissenschaften. Festschrift für den Arabisten Paul Kunitzsch zum 70. Geburtstag*, edited by Menso Folkerts and Richard Lorch, pp. 147-176. Wiesbaden: Harrassowitz.

——— (2002). "Islamic and Chinese Astronomy under the Mongols: A Little-Known Case of Transmission." In *From China to Paris: 2000 Years Transmission of Mathematical Ideas*, edited by Yvonne Dold-Samplonius et al., pp. 327-356. Stuttgart: Steiner.

——— (2002). "Islamic Astronomical Tables in China: The Sources for the *Huihui li*." In *History of Oriental Astronomy*, edited by S. M. Razaullah Ansari, pp. 19-31. Dordrecht: Kluwer Academic Publishers.

Hartner, Willy (1950). "The Astronomical Instruments of Cha-ma-lu-ting, Their Identification, and Their Relations to the Instruments of the Observatory of Marāgha." *Isis* 41: 184-194. (Reprinted in Hartner, *Oriens-Occidens*, edited by Gunter Kerstein et al., pp. 215-226. Hildesheim: Georg Olms, 1968.)

Miyajima, Kazuhiko (1982). "Genshi tenmonshi kisai no isuramu tenmongiki ni tsuite" (New Identification of Islamic astronomical instruments described in the Yuan dynastical history, in Japanese). In *Tōyō no kagaku to gijutsu* (Science and skills in Asia: A festschrift for the 77th birthday of professor Yabuuti Kiyosi), pp. 407-427. Kyoto: Dohosha.

Shi Yunli (2003). "The Korean Adaptation of the Chinese-Islamic Astronomical Tables." *Archive for History of Exact Sciences* 57: 25-60.

Tasaka, Kōdō (1957). "An Aspect of Islam Culture Introduced into China." *Memoirs of the Research Department of the Tōyō Bunko* 16: 75-160.

Yabuuti, Kiyosi (1987). "The Influence of Islamic Astronomy in China." In *From Deferent to Equant: A Volume of Studies in the History of Science in the Ancient and Medieval Near East in Honor of E. S. Kennedy*, edited by David A. King and George Saliba, pp. 547-559, *Annals of the New York Academy of Sciences*. Vol. 500. New York: New York Academy of Sciences.

——— (1997). "Islamic Astronomy in China during the Yuan and Ming Dynasties" (translated and partially revised by Benno van Dalen). *Historia Scientiarum*, 2nd ser., 7: 11-43.

Yano, Michio (1999). "Tables of Planetary Latitude in the *Huihui li* (I)." In *Current Perspectives in the History of Science in East Asia*, edited by Yung-Sik Kim and Francesca Bray, pp. 307-315. Seoul: Seoul National University Press.

——— (2002). "The First Equation Table for Mercury in the *Huihui li*." In *History of Oriental Astronomy*, edited by S. M. Razaullah Ansari, pp. 33-43. Dordrecht: Kluwer Academic Publishers.