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Wābkanawī: Shams al-Munajjim [Shams al-Dīn] Muḥammad ibn ʿAlī Khwāja al-Wābkanawī [Wābkanawī]

Benno van Dalen

Flourished **(Iran), early 14th century**

Wābkanawī is the author of the important astronomical handbook *al-Zīj al-muḥaqqaq*, which contains valuable historical information on lost earlier works and is one of only two *zīj*es known to be based on the observations carried out at the famous observatory at Marāgha.

Wābkanawī presumably hailed from the village Wābkana (or Wābakna) nearly 20 km from the important cultural center of Bukhara (now in Uzbekistan). Hardly anything is known about his life, and the available information about his astronomical career derives mainly from his astronomical handbook with tables, *al-Zīj al-muḥaqqaq al-sulṭāni ʿalā uṣūl al-raṣad al-Īlkhānī* (The correct *zīj* for the sultan based on the principles of the Īlkhān observations). From the introduction to this work it appears that Wābkanawī made observations during a period of 40 years, presumably at the famous observatory in Marāgha in northwestern Iran, which had been founded by Hülegü Khān at the instigation of **Ṭūsī** in 1258. However, Wābkanawī was also involved in the reform of the Malikī calendar ordered by Maḥmūd Ghāzān Khān (reigned: 1295–1304), who had an observatory built in Tabrīz. It is therefore possible that Wābkanawī spent part of his career in Marāgha and part of it in Tabrīz.

The *Zīj* of Wābkanawī is extant in four or five manuscript copies, of which no. 2694 of the Aya Sofia Library in Istanbul is the most complete. The work is written in Persian even though the title given above (found on f. 4a of the Aya Sofia manuscript) is in Arabic. Wābkanawī started working on the *Zīj* under Öljeytü Khān (reigned: 1304–1316) and finally dedicated it to Abū Saʿīd (reigned: 1316–1335). It consists of five treatises (*maqāla*s) dealing in a very extensive way with all the standard topics of *zīj*es, in particular chronology, planetary positions and eclipses, spherical astronomy, and timekeeping.

Only scattered parts of the work have been studied. The introduction is important because it mentions a number of earlier *zīj*es that are nonextant and not known from earlier sources; these include, in particular, the six *zīj*es of al-Fahhād.

The chronological chapter of the *Zīj* describes the reform of the Malikī or Jalālī calendar carried out on the order of Maḥmūd Ghāzān Khān in 1302. The original calendar had been adopted by the Seljuk Sultan Malikshāh I in 1079. Wābkanawī and various other astronomers appointed by Ghāzan

Khān modified the exact definition of the beginning of the year (*i. e.*, the day of the vernal equinox), adopted a new epoch called "Khānī," and introduced the use of Turkish month names. Wābkanawī writes that he adopted the new calendar in his *Zīj*, although he uses the year 188 Malikshāh (1266) as epoch, possibly in order to cover the dates of observations made at Marāgha. Wābkanawī also presents an extensive explanation of the Chinese–Uighur calendar that was introduced into Iran by the Mongols and first described in the *Īlkhānī Zīj* of Naṣīr al-Dīn al-Ṭūsī.

The present author has made a cursory analysis of the planetary tables in *al-Zīj al-muḥaqqaq*. The mean motions were shown to have been derived from those in the *Adwār al-anwār*, the latest of the three *zījes* by **Ibn Abī al-Shukr al-Maghribī** and known to be based on the extensive observational program carried out by that astronomer at Marāgha. Most of Wābkanawī's tables for the planetary equations were simply copied from the *Adwār*.

A work by Wābkanawī on the astrolabe, the *Kitāb-i maʿrifat-i usṭurlāb-i shamālī* (On the northern astrolabe), likewise in Persian, is extant in a manuscript in the library of the Topkapı Saray Museum in Istanbul. It consists of two chapters: one on the parts of the astrolabe and one on the operations with it. An Arabic fragment by Wābkanawī on the difference in setting times of the Sun and the Moon is extant in Cairo.

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