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Khāzinī: Abū al-Fatḥ ʿAbd al-Raḥmān al-Khāzinī (Abū Manṣūr ʿAbd al-Raḥmān, ʿAbd al-Raḥmān Manṣūr)

Mohammed Abattouy

Flourished **Marw, (Merv near Mary, Turkmenistan), first half of the 12th century**

Khāzinī was known for scientific activity in the fields of astronomy, mechanics, and scientific instruments. A slave of Greek origin in his youth, he later converted to Islam and received a distinguished scientific education. He had a reputation for asceticism, devotion, and piety. Khāzinī worked in the court of the Saljūq ruler Sanjar ibn Malik-Shāh (reigned: 1118–1157), and dedicated two of his most important writings to him: *al-Zīj al-Sanjarī*, an astronomical handbook with tables for Sanjar, and his encyclopedic *Kitāb mīzān al-ḥikma*, a major work on mechanical knowledge, specific gravity, and the like. His other known works include a treatise on astronomical instruments (*Risāla fī al-ālāt*) and a text on a self-rotating sphere (*Maqāla fī ittikhādh kura tadūru bi-dhātihā*).

Khāzinī's main astronomical work is the *Zīj al-muʿtabar al-sanjarī al-sulṭānī*, a lengthy astronomical handbook with tables, dedicated to Sultan Sanjar and compiled after 1118, in the aftermath of the work done reforming the solar calendar (the "Jalālī calendar"). It is preserved in two incomplete manuscript copies (British Library MS Or 6669 and Vatican Library MS Ar 761), and in a revised abridgment called *Wajīz al-zīj al-muʿtabar al-sulṭānī*, made by Khāzinī himself in 1130/1131. This version was translated into Greek in the late 1290s by **Gregory Chioniades**, an Orthodox bishop, upon his return to Constantinople from Tabrīz and then utilized by Byzantine scholars such as George Chrysococces (in Trebizond, *circa* 1335–1346) and **Theodore Meliteniotes** (in Constantinople, *circa* 1360–1388). It became a basis for the revival of astronomy then taking place in the Byzantine Empire. Since the two extant manuscripts of Khāzinī's *Zīj* lack several parts, the existence of the *Wajīz* is very helpful for the recovery of some of the missing material, although the canons and the tables contained within it have both been drastically revised; for example, the original *Zīj* contains 145 tables, whereas the *Wajīz* has only 45.

Among other things, *al-Zīj al-sanjarī* includes numerous tables related to chronology and calendars as well as various tables for calculating holidays and fasting, material related to the theory of Indian cycles, important developments in the theory of planetary visibility, and an elaborate set of eclipse tables. The section on visibility tabulates the arcs of visibility for the five planets as well as those for the Moon, and it also presents differences according to climes.

Khāzinī undoubtedly made a certain number of astronomical observations, though they seem to be limited in number. **Quṭb al-Dīn al-Shirāzī** implied that Khāzinī must have had technical competence and access to good instruments since his determination of the obliquity was carefully made. In the introduction to his *Zīj*, Khāzinī describes several astronomical instruments and observational techniques, and he asserts in the canons that he bases his astronomy on observations and sound theory. Further, he states at the beginning of the *Wajīz* that he compared, observed, and calculated positions for all the planets as well as for the Sun and Moon, at conjunctions and eclipses.

Khāzinī was familiar with the astronomy of his predecessors, especially **Bīrūnī**, **Thābit ibn Qurra**, and **Battānī**. His *Zīj* seems to be influenced by their work in addition to his own observations. Throughout his *Zīj*, he reports the methods and conclusions of Thābit and Battānī. For instance, for predicting the crescent visibility, Khāzinī proposes a sophisticated mathematical method that can be traced back to Thābit's *Fī Ḥisāb ruʾyat al-ahilla*.

Another astronomical work by Khāzinī is his treatise on astronomical instruments. The text, a short work in 17 folios, is composed of seven parts, each devoted to a different instrument: a triquetrum, or parallactic ruler, a diopter for measuring apparent diameters, an instrument in the shape of a triangle, a quadrant (but called a *suds* or sextant), an instrument involving reflection, an astrolabe, and devices for aiding the naked eye. All the instruments in this text are treated in a general way, and there is no reference to any special observatory.

Khāzinī's text on *The Self-Rotating Sphere* demonstrates his interest in connecting astronomy and applied mechanics. This text, probably the earliest of his extant works, describes a celestial globe that works with weights. An instrument, in the shape of a solid sphere and marked with the stars and the standard celestial circles, is suspended halfway within a box. The sphere is mounted so as to rotate once a day propelled by a weight falling from a leaking reservoir of sand. This automated celestial instrument may be used to find arcs of importance in spherical astronomy.

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