From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers, Springer Reference*. New York: Springer, 2007, p. 574

http://dx.doi.org/10.1007/978-0-387-30400-7_697

Ibrāhīm ibn Sinān ibn Thābit ibn Qurra

Glen Van Brummelen

Born **Baghdad, (Iraq), 908/909**

Died **Baghdad, (Iraq), 946**

Ibrāhīm ibn Sinān was a creative scientist who, despite his short life, made numerous important contributions to both mathematics and astronomy. He was born to an illustrious scientific family. As his name suggests his grandfather was the renowned **Thābit ibn Qurra**; his father Sinān ibn Thābit was also an important mathematician and physician. Ibn Sinān was productive from an early age; according to his autobiography, he began his research at 15 and had written his first work (on shadow instruments) by 16 or 17. We have his own word that he intended to return to Baghdad to make observations to test his astronomical theories. He did return, but it is unknown whether he made his observations. Ibn Sinān died suffering from a swollen liver.

Ibn Sinān's mathematical works contain a number of powerful and novel investigations. These include a treatise on how to draw conic sections, useful for the construction of sundials; an elegant and original proof of the theorem that the area of a parabolic segment is 4/3 the inscribed triangle (**Archimedes**' work on the parabola was not available to the Arabs); a work on tangent circles; and one of the most important Islamic studies on the meaning and use of the ancient Greek technique of analysis and synthesis.

Ibn Sinān composed several astronomical works. *On the Motions of the Sun* presents his approach to the apparent motion of the Sun, including the question of the motion of the solar apogee. He includes a critical analysis of **Ptolemy** and his Arabic predecessors but apologizes for not being able to test his own theory, hoping for someone to make the relevant observations in future. In this work he also takes a stand against **Aristotle**'s authority, especially with respect to meteorological optics, accusing Aristotle's supporters of adopting his positions without question. Ibn Sinān evidently wrote on the trepidation of the equinoxes, a theory that he combined with a variable obliquity of the ecliptic. Though this work has not survived, later writers ascribe such a theory to him and there are hints of it in his work *On the Motions of the Sun*. Ibn Sinān's theory explaining an apparent variation in the obliquity of the ecliptic did not impress **Bīrūnī** sufficiently to change his position that the obliquity is constant. Another treatise by Ibn Sinān, *The Determination of the Anomalies of Saturn, Mars, and Jupiter*, contains a critique of Ptolemy's models of the motions of the planets.

Like his grandfather, Ibn Sinān wrote a book on shadow instruments (such as sundials and gnomons). It contains discussions of sundials erected on plane surfaces, errors in the application of

sundials, how one might use a sundial as a replacement for the astrolabe, and how to draw time lines on various surfaces.

A short tract, *On the Astrolabe*, must have been written late in life, since it is not included in Ibn Sinān's own summary of his works. In it he proves the fundamental theorem of stereographic projection required to construct an astrolabe, namely that circles on the sphere (other than those that pass through the pole) are mapped to circles in the plane.

Selected References

Ali, Jamil (trans.) (1967). *The Determination of the Coordinates of Cities: Al-Bīrūnī's* Taḥdīd al-Amākin. Beirut: American University of Beirut.

Ibrāhīm ibn Sinān (1983). *The Works of Ibrahīm ibn Sinān* (in Arabic), edited by A. S. Saidan. Kuwait.

——— (1999). *Die Schrift des Ibrāhīm b. Sinān b. Ṯābit über die Schatteninstrumente*. Translated and annotated by Paul Luckey, edited by Jan P. Hogendijk. Frankfurt am Main: Institute for the History of Arabic-Islamic Science.

Kennedy, E. S. (1973). *A Commentary Upon Bīrūnī's Kitāb Taḥdīd al-Amākin*. Beirut: American University of Beirut.

——— (1976). *The Exhaustive Treatise on Shadows by Abū al-Rayḥān Muhammad b. Ahmad al-Bīrūnī*. Translation and commentary. 2 Vols. Aleppo: Institute for the History of Arabic Science.

Ragep, F. J. (1993). *Nasīr al-Dīn al-Ṭūsī's* Memoir on Astronomy (*al-Tadhkira fī ʿilm al-hayʾa*). 2 Vols. New York: Springer-Verlag, Vol. 2, pp. 400–408.

Rashed, Roshdi (1997). "Ibrāhīm ibn Sinān." In *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, edited by Helaine Selin, pp. 441–442. Dordrecht: Kluwer, Academic Publishers.

Rashed, Roshdi and Hélène Bellosta (2000). *Ibrāhīm ibn Sinān: Logique et géométrie au Xesiècle*. Leiden: E. J. Brill.

Sezgin, Fuat. *Geschichte des arabischen Schrifttums*. Vol. 5, *Mathematik* (1974): 292–295; Vol. 6, *Astronomie* (1978): 193–195; Vol. 7, *Astrologie – Meterologie und Verwandtes* (1979): 274–275. Leiden: E. J. Brill.