

Biographical Encyclopedia of Astronomers

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Banū Mūsā

Jafar Muhammad

Born Baghdad, (Iraq), beginning of the 9th century.

Died January or February 873

Abū al-Qāsim Ahmad

Born Baghdad, (Iraq), beginning of the 9th century

Died in Baghdad, (Iraq), 9th century

Hasan

Born in Baghdad, (Iraq), beginning of the 9th century

Died Baghdad, (Iraq), 9th century

The three brothers, the three sons of Musā ibn Shakir, generally known under the single name of the Banū Mūsā, were among the most important scientists of Baghdad in the 9th century; they played a prominent role as private patrons of scientific translations and research, and excelled in the fields of astronomy, mechanics, and mathematics.

It is quite impossible to write separate biographies of them. Their father, Mūsā ibn Shākir, is described as a reformed bandit who became a renowned astronomer or astrologer and a close friend of Ma'mun (reigned 813–833) before he was caliph, while residing in Marw in Khurāsān. After Mūsā's death, the brothers became Ma'mun's wards, who oversaw their education and sent them to the House of Wisdom (Bayt al-hikma), the major scientific institution of his time. After completing their studies, the Banū Mūsā collaborated with Ma'mun and his successors in a variety of activities, ranging from scientific matters (such as geodetic surveys) to managerial affairs (such as contracting for the construction of public works and infrastructure), thus becoming wealthy and powerful. This allowed them to devote a significant portion of their acquired fortune to sponsoring scientific research. They actively sought out classical works by ancient authors, sending agents or traveling to Byzantium themselves to purchase manuscripts which they translated upon returning to Baghdad. On one such trip, Muhammad met the renowned mathematician and translator Thabit ibn Qurra of Harran and brought him back to Baghdad, where Thabit joined the circle of scientists and translators working under the patronage of the Banu Musa. The Nestorian Christian Hunayn ibn Ishaq (died circa 877), considered one of the most prolific and significant translators of 9th-century Baghdad, was also part of the Banu Musa team. In sum, these brothers greatly promoted the translation movement that enabled the assimilation of major classical scientific works into Arabic. Their significance to science and astronomy is not limited to this sponsorship of translations alone; like the scholars gathered around them, the Banu Musa also authored very important original scientific works, of which there is a known list of some 20 books on astronomy, mechanics, and mathematics.

Almost a dozen of the works attributed to the Banū Mūsā are related to astronomical research. Muhammad, the eldest son, wrote a treatise *On the Visibility of the Crescent*, a *Book on the Beginning of the World*, and a book variously known under the titles *Book on the*

Motion of Celestial Spheres (Kitāb Harakat al-aflāk), *Book of Astronomy (Kitab al-Haya)*, or *Book on the First Motion of the Celestial Sphere (Kitab Harakat al-falak al-ūlā)*, which contains a critique of the Ptolemaic system of the universe. In it, Muhammad explains the daily motion of the heavens by the rotation of all the spheres of the Sun, the Moon, the five planets, and the fixed stars, denying the existence of the ninth sphere, which is the origin of movement in Ptolemy. Ahmad is reportedly the author of a book on the mathematical proof by geometry that there is not a ninth sphere outside the sphere of the fixed stars; two texts on two questions that he discussed with his contemporary Sanad ibn 'Alī; and a *zīj* (astronomical handbook), which is mentioned by the Egyptian astronomer Ibn Yūnus, who also states that there is another *zīj* by the three brothers. Finally, listed under the name of the Banu Mūsā are: a book of degrees on the nature of zodiac signs, which the manuscript states is a translation of a Chinese work; a book on the construction of the astrolabe, quoted by Bīrūnī; and a book on the solar year. The latter has traditionally been attributed to Thabit ibn Qurra, but recent research has shown that this is most likely a misattribution and that the treatise is actually by the Banu Musa. The majority of these books are now lost; however, the list of titles and the studies on the extant works show that the Banu Musa dealt extensively with the major concerns of astronomy in their time. Moreover, the interest of the Banu Musa in astronomy is also attested by reports that the brothers were involved in various activities, such as leading the astronomical observations that were made in Baghdad during the course of the 9th century or collaborating in the expeditions mounted by Ma'mūn for the purpose of making a geodetic measurement of the length of a degree along a terrestrial meridian.

The Banu Musa produced major work in the field of mechanics. Their efforts represent significant advances over those of their Greek predecessors: writers such as Philo of Byzantium (end of the third century BCE) and Hero of Alexandria (middle of the first century), whose works were extensively known to Muslim engineers. The Banū Mūsā also wrote numerous works in the field of mathematics, many devoted to geometrical problems. One of their most important works, *Book on the Measurement of Plane and Spherical Figures*, was the subject of a recension by Naṣir al-Din al-Tūsī in the 13th century and of a Latin translation by Gerard of Cremona in the 12th century under the titles *Liber trium fratrum de geometria* and *Verba filiorum Moysi filii Sekir*. This treatise was one of the fundamental texts on geometry in the Middle Ages, and its contents (in both Arabic and European contexts) are found in the works of authors such as Thabit ibn Qurra, Ibn al-Haytham, Leonardo Fibonacci of Pisa (died 1250), Jordanus de Nemore (died 1260), and Roger Bacon (died circa 1292). Other works on geometry attributed to the Banū Mūsā include three books related to the *Conic Sections* of Apollonius of Perga (third century BCE), a *Book on a Geometric Proposition Proved by Galen*, a *Reasoning on the Trisection of an Angle* (by Ahmad), and a *Book on an Oblong Round Figure*. The latter concerns the ellipse and contains a description of what is known as the gardener's construction, a procedure for drawing an ellipse by means of a string fastened to two pegs and based on the fact that the sum of the two focal radius vectors of any point belonging to a given ellipse is constant.

Finally, the family tradition of the Banū Mūsā seems to have been continued to a certain extent by a son of the eldest brother, Nu'aym ibn Muhammad ibn Mūsā, who wrote *Book on Geometric Propositions*.

Josep Casulleras

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