

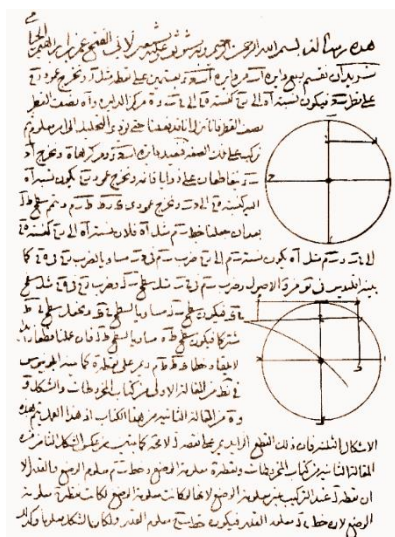
SELJUQS CULTURAL HISTORY – Science

Overview –

The 11th century conquests by the Great Seljuqs incorporated lands with a long scientific tradition such as Khorasan and Iran into their empire. As a result, the sciences, mathematics and astronomy in particular, continued to thrive and develop under Great Seljuq rule. The situation in the Sultanate of Rum, however, was quite different. The recently-conquered Byzantine lands in Anatolia had been unstable for centuries with the result that there was no tradition of scientific investigation comparable to the Great Seljuq Empire. Nonetheless, the Seljuqs of Rum welcomed visitors who came to their lands to conduct research and teach.

Great Seljuq Science

Three major scientists were active in the Great Seljuq Empire: Omar Khayyam (عمر الخيام), 'Abd al-Rahman al-Khazini (عبد الرحمن الخازني), and Sharaf al-Din al-Tusi (شرف الدين طوسي). While some were true polymaths with talents in a number of different fields, their main scientific contributions were in the fields of mathematics and astronomy.



Omar Khayyam (1048-1131) was a native of Nishapur who wrote a number of scientific treatises on different areas of mathematics. Among them were a commentary of Euclid's *Elements*, a treatise on cubic equations, a treatise on arithmetic, and a number of works related to algebra.

In the field of astronomy, he was commissioned by the Seljuq Sultan Malik to head a group to revise the Persian solar calendar. To conduct the astronomical observations necessary to determine the precise start and end of the solar year, Malik Shah had an observatory built for the group in Isfahan. The result was the Jalali calendar which was more accurate than the later Gregorian calendar. A by-product of Khayyam's work on the calendar revision was his *Astronomical Tables for Malik Shah (Zij Malik Shahi / زيج ملك شاهي)*.

Page from a mathematical work by Omar Khayyam

In addition to these, Khayyam apparently also wrote at least two treatises on specific gravity that are included in the better-known work on this subject written by Khayyam's pupil, al-Khazini, and a work on musical theory. Later historians mention other works by Khayyam on natural sciences and geography, but texts of these works have not survived to the present day.

The second important scientist of the Great Seljuq era, 'Abd al-Rahman al-Khazini (fl. 1115-1130) is the also the one about whom the least information has survived. All that is known is that he was the young Greek slave of the treasurer at the Great Seljuq court in Marv and that his owner provided him with the best education he could. The only other information about al-Khazini is that he may have been a student of Omar Khayyam, he was noted for living a simple, pious life, he had some students, and that he was highly regarded at the Seljuq court.

Al-Khazini's three major surviving works are *The Balance of Wisdom (Mizan al-Hikma / ميزان الحكمة)*, the *Treatise on Astronomical Wisdom (Risala fi'l-Alat / رسالة في الآلات)*, and *The Astronomical Tables for Sanjar (Zij al-Mu'tabar al-Sanjari al-Sultani / زيج المعتمد السنجري السلطاني)*. The first work, *The Balance of Wisdom*, is comprised of eight books divided into fifty chapters and is dedicated primarily to questions related to mechanics and hydrostatics. The remaining two works are both related to the field of astronomy. The

Treatise on Astronomical Wisdom describes and discusses the uses of seven different instruments that were employed in making astronomical observations. The final work was a series of tables of astronomical information used in determining the dates of religious holidays, fasts, etc.

The last major scientist active in the Great Seljuq Empire was Sharaf al-Din al-Tusi (c.1135 – c. 1213), a mathematician and astronomer born in the city of Tus in northeastern Iran. Little is known of his life, but his surviving works are a work dedicated to the solutions of third-degree equations, *Kitab fi'l-Jabr wa'l-Muqabala* (كتاب في الجبر والمقابلة), and a number of writings, such as the *Treatise on the Linear Astrolabe* (رسالة في السطرلاب الخطي) on the linear astrolabe (sometimes referred to as “al-Tusi’s staff”) he invented. Al-Tusi claimed that his linear astrolabe was inexpensive and could be made by an amateur in about an hour. Despite this, al-Tusi’s linear astrolabe was less accurate than a standard astrolabe, and was less decorative; perhaps for these reasons it never gained widespread popularity.



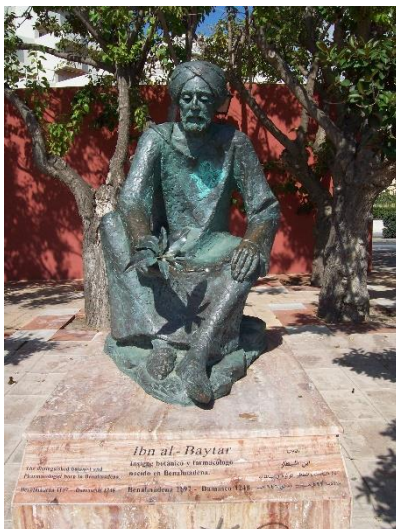
Modern reconstruction of al-Tusi’s linear astrolabe



Standard medieval brass astrolabe

Rum Seljuq Science

As a newly established state whose borders were in an almost constant state of flux for almost a century, and which was creating an Islamic society from the ground up, the Sultanate of Rum had neither established centers of Islamic learning nor the stability to create them in the 12th century. When the Seljuqs of Rum finally achieved the level of political stability and economic prosperity in the first half of the 13th century that might have allowed them to create such centers of learning, the Mongols defeated the Seljuq armies and made the Sultanate of Rum a vassal state. Nevertheless, at least two notable scientists of the early 13th century are known to have spent time in the Sultanate of Rum conducting research, studying and teaching: Ibn al-Baytar (ابن البيطار) and ‘Abd al-Rahim al-Jawbari (عبد الرحيم الجوبري).



The son of a veterinarian, Ibn al-Baytar was born in Málaga, Spain in the 1190s and studied botany, pharmacology and medicine. Around 1220 he left Spain and traveled east across the North African coast and eventually reached Anatolia where he collected plants for a period of time. Ibn al-Baytar eventually went to Egypt and entered the service of the Ayyubid al-Kamil as his chief herbalist in 1224. Three years later when al-Kamil took control of Damascus, Ibn al-Baytar followed and continued his research and official duties there until his death in 1248.

Statue of Ibn al-Baytar in Spain

Ibn al-Baytar wrote a number of works, but his most famous work is his massive *Compendium on Simple Medicaments and Foods* (الجامع لمفردات الأدوية والأغذية), a pharmacopoeia that describes over 1400 different plants, animals and minerals and discusses their uses as foods or medicines. The information provided is based on Ibn al-Baytar’s own observations as well as the writings of

approximately 150 other sources, both ancient and contemporary. This work influenced the writers of later pharmacopoeias and remained a standard reference work until the modern era.

The other scholar known to have spent time in the Sultanate of Rum is one of the most unique figures in medieval Islamic science and literature, 'Abd al-Rahim al-Jawbari (fl. first half of the 13th c). Little is known about al-Jawbari outside of the information he provides in his writings. He was a Syrian from the town of Jawbar (today a suburb of Damascus), and appears to have been self-taught, primarily in the sciences. al-Jawbari claims to have traveled widely, and his travels took him to Anatolia where he spent time in both the Sultanate of Rum, and in territories ruled by the Hasankeyf branch of the Artuqid dynasty who ruled from Diyarbakır during al-Jawbari's time. At the urging of the Artuqid ruler Rukn al-Din Mawdud (r. 1222-1232), al-Jawbari wrote his one surviving work, *Book of the Selected Disclosure of Secrets* (*Kitab al-Mukhtar fi kashf al-asrar* / كتاب المختار في كشف الأسرار). The book is an exposé of the tricks and methods used by the *Banu Sasan* (بنو ساسان), the name given to the medieval Islamic underworld of swindlers, false religious leaders, fake Sufis, beggars, storytellers, thieves, jugglers, fraudsters and con men. The approach that al-Jawbari takes to these groups and their tricks is one of skepticism – he refuses to believe that the tricks he sees are as they seem, and that they can be explained rationally through science. However, al-Jawbari's style is anything but cold and scientific. It varies from condemnation of some forms of deception, to near admiration for the cleverness of some of the tricks he describes. His detailed knowledge of fraud and deception has raised questions about the source of his knowledge, and it is still unclear to what degree he may have been personally involved in some of these shady activities. The style of language that al-Jawbari used varies from the standard literary language to Middle Arabic, the spoken form of medieval Arabic, and includes numerous slang expressions and jargon used by the groups he examines. The result is an entertaining mix of stories, exposé and a window on segments of medieval Islamic society that are generally ignored by contemporary chroniclers.

Readings

al-Hassan, A.Y. et al (eds.). *The Different Aspects of Islamic Culture, Vol. 4, Science and Technology in Islam, Parts I & II*. Beirut, 2001.

al-Khalili, Jim. *Pathfinders: The Golden Age of Arabic Science*. London, 2010.

Discussion Questions

1. Why did the Sultanate of Rum produce no scientists of its own, yet a number of prominent scientists came from the lands of the Great Seljuq Empire?