ABSTRACT

This article touches on the development of observatories for astronomical activities in Muslim history. The period covered by this article is throughout the ‘Abbasid and Fatimid periods. It is to give a general picture of the historical sequence in the development of observatories in line with the progress of astronomy during the Islamic caliphate. This study finds that the ‘Abbasid caliphate preceded the other governments in the building of observatories for the purpose of education and research in astronomy. However, it cannot be denied that other Muslim governments also contributed to astronomy. It depended on the interest and political will of the ruling caliph. Generally, the rulers’ concern and commitment, the dedication of intellectuals and political stability form the most important foundation in creating a conducive atmosphere for the development of observatories.

Key words: Observatory, Islamic history, Muslim scholars.

Introduction

Observatories are usually associated with observational studies and theories concerning celestial objects, spaces in-between these objects and the universe as a whole. The technology for building observatories had existed ever since the 8th Century AD. At that time, the Muslim civilization pioneered in building observatories and the technology then evolved from time to time (Arny and Schneider, 2010). An observatory may be defined as a structure complete with certain equipment which enable scientists to make observations and predictions on phenomena such as of weather, bearing or position of stars and so on (Marni and Haron, 2008). Even today, observatories are being built all over the world. As a product of scientists’ ingenious inventions to meet the needs of science, the building of observatories has improved to become more modern and sophisticated. As a result there are today new types of observatories such as robotic, airborne and space observatories (Ibrahim et al., 2012).

The building of observatories in the early historical years of the Muslim civilization was only for observation activity. With the facilities and equipment provided in the observatory, scientists became more comfortable and observation could be more thorough and effective. Later, the observatory became a place of research where scientists gathered to conduct group research. Here, they would discuss and exchange opinions in the process of completing their research. Later on, the observatory evolved into an effective scientific educational institution. This happened when many scientists worked in the observatory and at the same time taught to spread their scientific knowledge (Nasr, 1987; Mujani et al., 2012).

The History and Development of Observatories during ‘Abbasid Rule:

As is known, the development of astronomy in the Islamic civilization flourished during the time of Caliph al-Ma’mun of the ‘Abbasid Dynasty. The history of building observatories also began at this time (Sidik and Mujani, 2012). Among the observatories built were:

Shammasiyah Observatory:

The first observatory to be built in the history of Islamic civilization was Shammasiyah Observatory in Baghdad. It was built at the command of Caliph al-Ma’mun and began operations in the year 828 AD (Ibn Sa’id, 1912). Caliph al-Ma’mun had appointed Sanad bin ‘Ali as one of the scientists to maintain Shammasiyah Observatory. He was originally a Jew but had embraced Islam. Before conversion, he was responsible for building worship houses in the vicinity of Baghdad (Shami, 1997). He was an important scientist for the
observatory and was given the task by Caliph al-Ma’mun of inventing and building astronomical devices for the observatory (Sayili, 1960).

Among other scientists appointed by Caliph al-Ma’mun to work in the observatory were Yahya bin Abi Mansur and al-‘Abbas bin Sa’id al-Jawhari. Yahya bin Abi Mansur was among the most outstanding among the scientists of Caliph al-Ma’mun. He was considered by Caliph al-Ma’mun as a highly valuable astrologist (Sayili, 1960). He had also formulated a table of planetary movements and compiled it with other observation tables in his book known as Zij al-Mumtahan (Tested Tables). This table became very famous and was one of the earliest tables produced by a scientist in astronomy then (Quraishi, 1983). And Sa’id al-Jawhari or his al-‘Abbas bin Sa’id al-Jawhari, was also one of the earliest scientists to work for Caliph al-Ma’mun (Shami, 1997). He was renowned for his expertise in geometry, planetary movement and positions, and astronomical calculations. Both these scientists were among the individuals who conducted astronomical observations in Baghdad in the years 829 to 830 AD and in Damascus from the years 823 to 833 AD (Kahhalah, 1972).

Furthermore, Caliph al-Ma’mun also ordered his scientists to determine the direction of Qiblat. The purpose was to determine the true direction of Qiblat for Baghdad. Caliph al-Ma’mun had succeeded in determining the latitude and longitude of Mecca through observation of a lunar eclipse which was conducted continuously in Baghdad and Mecca. In addition, the distance between the two cities was measured to obtain data for use in research (Sayili, 1960; Virk, 2010).

Qasiyun Observatory:

Caliph al-Ma’mun also ordered scientists to build Qasiyun Observatory. It is believed that this observatory was built either in late 830 AD or early 831 AD on a mountain known as Qasiyun Mountain in Damascus (Kahhalah, 1972). The scientist responsible for supervising it was Khalid bin ‘Abd al-Malik al-Mawrudhi. He was handpicked by Caliph al-Ma’mun and ordered to prepare better astronomical equipment to replace the previous. And he was also ordered to conduct observation of celestial objects for a year at Dayr Murran, from which he gained more accurate data on the movements and positions of the sun and moon (Sayili, 1960). After operating for nearly four years, the Shammasiyyah and Qasiyun Observatories experienced a drastic decline following the sudden death of Caliph al-Ma’mun in the year 833 AD. His death caused observation activity under his patronage to be discontinued (Sayili, 1960).

Banu Musa Observatory:

However, even after the death of Caliph al-Ma’mun, Banu Musa carried on observation activity such as at Samarra’. They observed the lunar eclipse and the autumn equinox (‘Abd al-‘Aziz, 1973). They also conducted observation activity at Baghdad on the stars, the minimum and maximum altitudes of the sun, determination of latitudes and preparation of Zij. Among their achievements was observation of the star Ursa Major about the year 863 AD. Their residence near the River Tigris was their place for astronomical observation and was known by many in the vicinity of Baghdad as the Banu Musa Observatory (Sayili, 1960).

Al-Battani Observatory:

Al-Battani or Abu ‘Abd Allah Muhammad bin Jabir bin Sinan al-Battani (919-997 AD) came from Battan in Iraq (Al-Sayyid ‘Aud and Mahmud, 2000). He owned an observatory in Raqqa, Syria and conducted observation activities for a period of about 40 years at this observatory (Farrukh, 1970). Al-Battani compiled a Zij known as Zij al-Sabi, also known as The Sabian Tables. It was one of the works which is the basis of modern Islamic astronomy and had influenced the progress of science in Europe. Originally in Arabic, it was translated by Western scientists into Latin for their use as reference over several centuries (Glick, Livesey and Illis, 2005).

Ibn al-‘Amid Observatory:

The Ibn al-‘Amid Observatory was owned by Ibn al-‘Amid or Abu al-Fadl Muhammad bin al-Husayn bin Muhammad. He was also known by the title al-Ustadh al-Ra’is (Ibn Miskawayh, 1914). Among his achievements was measurement of the tilt line in the sun’s path done jointly with al-Khazini or Abu Mansur (or Abu al-Fath al-Mansur, or Abu Ja’far) ‘Abd al-Rahman al-Khazini (Sayili, 1960).

History and Development of Observatories during Fatimid Rule:

Throughout Fatimid rule in Egypt, there were three caliphs who were the main patrons of intellectual activity. They were Caliphs al-Mu’izz bin al-Mansur, al-‘Aziz billah, and al-Hakim bi Amrillah (Von
Grunebaum, 1970). The glory of the Fatimid government was very much influenced by the inclination of its caliphs towards science and philosophy. Thus, core knowledge such as al-Quran and al-Hadith were enhanced and established with the development of science and philosophy in educational institutions such as at al-Azhar, (Shuib, 1995). In line with the development of science then, several more observatories were built to meet the research needs of scientists. Among these observatories were the following:

**Al-Hakim Observatory:**

Al-Hakim Observatory was founded by Caliph al-Hakim bi Amrillah during his rule (996-1020 AD). It was originally his place of residence and was later converted by him to become an observatory. It was located on a mountain known as Muqattam Mountain and was believed to be part of Dar al-‘Ilm (Al-Rifa‘i, 1982).

**Ibn Yunus Observatory:**

Ibn Yunus or Abu al-Hasan ‘Ali bin ‘Abd al-Rahman bin Ahmad bin Yunus al-Sadafi al-Misri was a scholar of astronomy who was under the patronage of Caliph al-Hakim of the Fatimid Dynasty in Egypt. He was the earliest person to introduce the use of a minaret as an observatory (Al-Zirikli, 1995). Known for his observation activity, his observations were more accurate than previous observations, thus showing his outstanding skills as a scholar of astronomy then. His seriousness and his diligence in observations proved the possible existence of the Ibn Yunus Observatory.

**Al-Afdal al-Bataihi Observatory:**

Al-Afdal al-Bataihi Observatory was situated in Cairo. Its construction began in the year 1120 AD and was finally completed in the year 1125 AD. Two persons were appointed as Nazir responsible for completing the construction of the observatories al-Afdal Shahanshah and al-Afdal al-Ma‘mun al-Bataihi. At the onset, it was suggested that the observatory be built at Masjid al-Tannur situated at Muqattam Mountain. However, transportation of construction materials would be difficult as the location was distant from Cairo. Thus, the new location selected was at Masjid Fila in Jarf, situated north of Birka al-Habash (Sayili, 1960). Not long afterwards, the observation facilities constructed at Masjid Fila were shifted to Masjid Juyushi, also known as Masjid al-Rasd. This was done because it was said that the location of Masjid Fila could not give satisfactory observation results. Later, the facilities at Masjid Juyushi were transferred to a new location at Bab al-Nasr situated in Cairo. This main observatory was finally known as al-Afdal al-Bataihi Observatory. Among the main functions of this observatory was to prepare an astronomical table and to study differences between its calendar and that of Syria. Furthermore, observation activity relating to the orbits of the sun and planets, and the solar and lunar eclipses were also conducted (Sayili, 1960).

**Al-Dinawari Observatory:**

There was an observatory believed to be located in Dinawar which was owned by a Muslim scientist at that time. This private observatory was owned by al-Dinawari. al-Dinawari or Abu Hanifa Ahmad bin Dawud bin Wanand al-Dinawari, born in the year 815 AD, was a physicist and a scholar of astronomy (Shami, 1997). He authored a book called Kitab al-Rasad which contained recorded data of observation conducted from 849 to 850 AD and a Zij.

Al-Dinawari was renowned for his observation activity which covered several years. His private ownership of the observatory led him to be known by many as ‘Sahib Rasad’ which means owner of observatory. However, the equipment he used for observation could not be determined (Sayili, 1960).

**Sharaf al-Dawlah Observatory:**

Sharaf al-Dawlah Observatory was built by a ruler from Bani Buwayh by the name of Sharaf al-Dawlah (Ibn al-Jawzi, 1992). It was built in a garden of the ruler’s residence situated in Baghdad. For this reason, this observatory was also known as Bayt al-Rasd. Sharaf al-Dawlah attached great importance to knowledge and supported all efforts in the hope that the observatory would facilitate further observation activity (Virk, 2010). This observatory was renowned for two unique aspects:

i) It was a royal observatory which had a fine system of organization and administration in addition to being headed by a director known as Sahib, who was al-Qahi.

ii) The observation activities conducted were more accurate, including observation of all the seven planets done since many years ago (Sayili, 1960).
Among the observations conducted at this observatory was the position of the sun on the appearance of the Cancer zodiac constellation. This was conducted in June 988 AD. The second observation was done three months later of the sun’s position on the appearance of the Libra zodiac constellation. These observation activities were attended by many famous scientists such as Abu Ishaq al-Sabi’, Abu Sa’d al-Fadl, and Abu al-Wafa al-Buzjani. Furthermore, observation related to the sun, solstice and equinox was also conducted at this observatory (Sayili, 1960).

Conclusion:

Based on the discussion above, it is clear that Muslim scholars had played an important role in building observatories since the 8th Century AD. Their ideas and works had greatly contributed to the development of astronomy in Europe.

References