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Al-Biruni (The Muslim Scholar and geographer): One of the Greatest Pioneers of Geographical Science

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ABSTRACT

Abu Rayhan al-Biruni (973-1048) was unquestionably one of the greatest polymaths and scientists of the tenth century Islamic Golden Period. He is commonly referred to as al-Biruni. Among his various fields of study, al-Biruni excels in mathematics, physics, astronomy, science, as well as history, chronology, and languages, in which he is well-versed. He also made significant contributions to the advancement of Muslim geographical knowledge, particularly in the subject of mathematical geography. Furthermore, al-Biruni is sometimes referred to as the father of comparative religious studies, as well as the father of Indology, modern geodesy, and the first anthropological. In this paper, I will highlight some of his experimental contributions, as well as his geographical knowledge, which constituted the foundation of current geography knowledge.

KEYWORDS

Al-Biruni, Muslim geographical knowledge, religious studies

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INTRODUCTION

Geography was first studied scientifically in Islam because of what the Greeks did. Not only did the Arabs translate many Greek writings into Arabic, but they also conducted their own independent investigation and critical analysis of the Greek texts they translated. The Abbasid Caliph of Baghdad supported both the study of geography as well as the contributions of his subjects to the study of geography. Early Muslim geographers had a very high regard for the discipline of geography and its study. Geography has always been an important subject for Muslims, and it was even more important during the Middle Ages. In geography, the Muslims made a lot of progress. Their contributions to geographical knowledge were of tremendous importance to the progression of human history. The circumference of the globe was measured by contemporary Muslim geographers, in contrast to the Europeans, who held the belief that the planet was flat..[1]

Due to the formation of the holy pilgrimage, the orientation of mosques towards Mecca, and the requirement to determine the direction of the Kabah during prayer, Muslim geographers gave considerable attention to this topic. This determination was based on knowledge of the latitudes and longitudes of the Muslim settlements. The science of geography is related to astronomy in various ways. The Arabs needed an understanding of the weather and astronomical phenomena such as the positions of the stars and the planets. The knowledge that was gained regarding the positions of the stars was what ultimately led to the calculation of latitude and longitude. These factors inspired them religiously to study geography. The establishment of *Bayt al-Hikmah*[2] at Baghdad in 830 A.D. witnessed the production of a considerable number of geographical works of different nature that were produced.[3]

WHO IS AL-BIRUNI:

He was one of the greatest scholars that the Arab world had produced in the field of sciences as well as humanities. He holds a unique position among the Muslims scholars. He was well versed in Physics, chemistry,

mathematics, astronomy, geography, philosophy, medicine and also Arts. Early in his scholarly career he becomes much interested in acquiring knowledge of geography and its branches.[4] Because he was such a significant advocate for the Arabic language, the vast majority of his writings are written in Arabic. Nonetheless, his first scientific treatise was written in the Persian language, and it dealt with the various subfields of mathematics at the time.[5] In the second half of the 10th century, Abu al-Rayhan Muhammad Ibn Ahmad better known as al-Biruni[6], become prominent for his geographical works.

He was an Arab scholar of Persian origin and was born on 4th September 973 A.D.in the suburbs of the city of Kath[7], the former capital of the Khwarezm region, which today is known as Karakalpakstan and borders the Aral Sea. Kath was the centre of the Afrighid Dynasty. Kath and Jurjaniyya were the two important cities in this region. Al-Biruni was born close to Kath, and the town where he was born is now known as Biruni in honour of the esteemed intellectual. He grew up in both Kath and Jurjaniyya, and we know that he started his studies under the renowned astronomer and mathematician Abu Nasr Mansur at a very young age. Al-Biruni was certainly involved in serious scientific study by the age of seventeen, as it was in 990 that he calculated the latitude of Kath by watching the greatest altitude of the sun..[8]

Al-Biruni lived during the Islamic Golden Era, a time when scientific inquiry and learning were greatly supported by the caliphs of the Abbasid dynasty. This period is known as the heyday in the sciences within the Islamic world.[9] He enjoyed the royal patronage of Of Iraq's royal family. Al-Biruni was forced to flee his homeland with the collapse of the Ale-Iraqi family. He travelled to Ray and joined Shams al-Maali, a ruler of Jurjan and Tabristan.[10]

Sultan Mahmud conquered Khwarizm at the beginning of the 11th century and claimed the title of Shah-e Khwarizm for himself. On his return, he was joined by eminent Khwarizm intellectuals and courtiers.[11] So he requested that some of the scholars from his court be sent by Mamun, the then-Abbasid Caliph. Mamun, after the approval of Al-Biruni, sent him to the court of Mahmud while ibn Sina refused to go with him.[12]

After his arrival in the court of Mahmud at Ghazna and later when he accompanied him to India in his campaign with sultan, the scholarly career of Al-Biruni underwent significant changes.[13]In India he came into contact with many Indian scholars, learnt Sanskrit and acquired the knowledge of Indian sciences.[14] Having acquired the knowledge of the Sanskrit, al-Biruni translated many works into Arabic. He also translated a number of treatises into Arabic which were already translated into Sanskrit from other languages. According to Al-Faraj in his Arab History, al-Biruni stayed for a number of years in India and that neither in his life neither time nor after wards was there seen a man more learned in astronomy than al-Biruni.[15]

Al-Biruni is known for his remarkable works, that he made astronomical observations in the cities of Kabul, Lamghan, Multan and Peshawar. He penetrated deep along with the Mahmud's army and was also witnessed to the conquest of Nakarkot, famous for idolatry, and situated at the foot of the Himalayas. Al-Biruni died in Ghazna in the year 1039A.D.[16]

During his stay in Ghazna he wrote a book *Tahqiq ma fil-Hind* (Kitab al-Hind) properly known as Al-Biruni's India in which he has given a description of his study and travels. This works was published after the death of Sultan Mahmud in 1030 A.D.[17]

After the death of Sultan Mahmud Ghazni, during Sultan Masud's reign, he wrote his monumental work named *Al-Qanun al-Masudi* in Ghazna. This monumental work was dedicated to Sultan Masud. In this book he wrote about the general mathematical geography. [18] For the first time in this treatise he had raised the question that the earth rotates on its axis and he also discussed about the heavenly bodies which set and rise due to the rotation of the earth.[19] His book, *Al-Qanun al-Masudi,* was the greatest of all his works and has always been recognized as the standard book of references in the East.[20] In this book he also discussed about the circumference of the Earth. He refused to accept the notion of the Earth's origin. [21]

During the reign of Sultan Mahmud[22] two notable works were composed by him—*Kitab al-Tafhim* and *Kitab al Jamahir fil Maarifat al-Jawahir*. The later work was on geography in which he discussed mineralogy, metallurgy, precious stones and pearls.[23] His *Kitab al-Tafhim* is a short book on geometry, arithmetic, astrology and astronomical geography. It is divided into five chapters. The first chapter deals with geometry, while the second is devoted to the discussion of numbers, computation and algebra. The longest third chapter deals with geography, cosmology, and astronomy. The next chapter describes the astrolabes, its theory and application, while the concluding chapter contains detailed account of astrological matters.[24]

In order to describe the location of the sea, Al- Biruni created a circular map of the globe for his book *Kitab al-Tafhim*. In this map he also discussed about the map of the Sky and Earth.[25] In his work *Athar al-Baqiyah*, he invented a method of projection of a map of the sky and earth, as well as several maps of other countries..[26]

On the mathematics and astronomical side of the geography, al-Biruni discussed the antipode and also his belief in the sphericity of the Earth and gave the ideas of longitudes[27] and latitudes[28] of various places and movement of the Earth.[29] He also wrote about the tidal phenomenon and the effect of moon on the tides of the sea on different days of lunar month. The position of moon is setting and rising the water of the sea, rise in flood, while the position of the moon is on the meridian at noon, the water recedes in the ebb.[30]

Throughout his time period, there were European scholars who did not think human life was feasible on the antipodes.[31] He was completely aware of the phenomena that the Polar Regions experience nonstop night during the winter and 24 hours of daylight during the summer. He fully understood the ecliptic's obliquity.[32]

Before al-Biruni, Mohammad Ibn Musa al-Khwarizmi proved that the Earth is spherical. This theory was presented by Khwarizmi at the time when the European geographers believed that the Earth is flat. Al-Biruni examined the theory of Mohammad bin Musa al-Khwarizmi and concluded that it was very necessary to sphericity of the Earth. If the Earth is not spherical the Earth will to the North Sea and the water to the south sea. Al-Biruni has presented many scientific theories to prove that Earth is spherical. He says that the sphericity of the Earth can be observed by the eyes.[33] Further he wrote that the Earth rotates on its own imaginary axis which was not perpendicular (it makes an angle of 23 and ½ degree.)[34] Al-Biruni has also given the idea of gravitational force. He writes that every things in the world which has some mars is attracted this gravitational force towards its centre.[35]

An idea of the scientific method of his reasoning and research may be had from the following passage quoted form this book, in which he propounded his theory of rotation of the earth on it axis, about 600 years ahead of Galileo.

> "When a thing falls from a height, it does not coincide with the perpendicular line of its descent, but inclines a little and falls making different angles. When a piece of earth separates from it and falls, it has two kinds of motions: one is the circular motion which it receives from the rotation of the earth, and the other is straight which it acquire in falling directly to the centre of the earth. If it had only the straight motion, it would have fallen to the west of the perpendicular motion. But since both of them exist at one and the same time, it falls neither to the west nor in the perpendicular direction, but a little to the east."[36]

Similar, al-Biruni's book *Tahdid Nihayat al-Amakin* is the first of its kind on mathematical geography, in which he has discussed the scientific method of measuring the radius of the earth and the areas of cities. It is remarkable to note that he calculated the circumference of the earth as 24779 miles, only 78miles shorter than the actual one. He also given accurate geographical tables of latitudes and longitudes of a number of places. As such he became the founder of the geodesy on modern lines.[37]

CONCLUSION

The above descriptions clearly show that Al-Biruni, as a geographer, has possessed a wonderful critical power of observation and spirit of scientific enquiry. He not only preserved and assimilated the Greek, Persian and Indian legacy, but also sufficiently enriched and modernized almost all branches of geography including scientific, mathematical and astronomical aspects of the discipline.

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[27] . The distance of a point E or W of the Greenwich meridian, which is longitude 0 degree, measured as an angle from the centre of the Earth. Longitude is measured in degrees E or W of the Greenwich up to 180 degrees. Lines of longitude are known as meridians.

[28]. The distance of point N or S of the equator, measured as an angle from the centre of the Earth,. The equator is latitude 0 degree and the poles are latitudes 90 degree N and 90 degree S. Lines joining poles with the same latitude are called parallels.

[29] . Ahmad Nafis, *Muslim Contribution to Geography*, p. 33

[30] . *Ibid*., p. 32

[31] . It is a Point on the surface of the Earth directly opposite to each other if a straight line were drawn through the centre of the Earth. Australia and Newzealand , which lie roughly on the opposite side of the earth to the British Isles, are often referred to as the antipodes

[32] . Mohammad Israruddin, “Al-Biruni’s Contribution to Geography’, Al-Biruni Commemorative Volume, p. 206

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