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THE DEVELOPMENT OF SCIENCE AND CULTURE DURING THE REIGN OF MIRZO ULUGH BEG

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Abstract: This article analyzes the major directions of the development of science and culture in Transoxiana during the reign of Mirzo Ulugh Beg, a prominent representative of the Timurid dynasty and grandson of Amir Timur. Alongside his activities as a statesman, particular attention is paid to Ulugh Beg’s contribution to the development of astronomy, mathematics, education, and architecture. The article examines the establishment of the observatory and madrasas in Samarkand, the formation of a scientific school, and the scholarly activities of such prominent scientists as Qadi Zada al-Rumi, Ghiyath al-Din Jamshid al-Kashi, and Ali Qushji. It also discusses the scientific significance of Zij-i Jadid-i Kuragoni in the history of astronomy and the process through which Samarkand became an international center of scientific scholarship. The study demonstrates that Ulugh Beg’s scientific activities constituted an important component of the intellectual and cultural flourishing of the Timurid period.

Keywords: Mirzo Ulugh Beg, Timurids, Samarkand, astronomy, mathematics, observatory, madrasa, Zij-i Jadid-i Kuragoni, science, culture.

The fourteenth and fifteenth centuries occupy a special place in the history of Central Asia, particularly in relation to the Timurid period. The powerful state established by Amir Timur underwent significant development not only politically and territorially but also in the fields of science, culture, literature, architecture, and education during the reigns of his successors. In particular, during the reign of Mirzo Ulugh Beg, Samarkand developed into one of the major scientific and cultural centers of the medieval Islamic world [1].

Mirzo Ulugh Beg was born in 1394 as the grandson of Amir Timur and the son of Shah Rukh Mirza. From an early age, he demonstrated a strong interest in scientific knowledge and, alongside his political responsibilities, devoted considerable attention to astronomy and mathematics. His scholarly activities represented an important new stage in the development of the scientific traditions of the medieval East [2].

One of the major factors contributing to the development of science during Ulugh Beg’s period was the ruler’s support for scholars and educational institutions. The construction of madrasas in Samarkand, the invitation of distinguished scholars to participate in the intellectual life of the city, and the establishment of a specialized observatory created strong institutional foundations for scientific research [3].

The relevance of this topic is determined by the fact that Mirzo Ulugh Beg’s scientific legacy occupies an important place not only in the history of Central Asian science but also in the history of world astronomy and mathematics. The scientific school established in Samarkand represents

one of the most significant examples of the high level of development achieved by exact sciences in the medieval East.

Mirzo Ulugh Beg's Interest in Science. Mirzo Ulugh Beg's scientific worldview developed within the rich cultural and intellectual environment of the Timurid court. During the reign of Amir Timur, the relocation of scholars, craftsmen, architects, and artists from various regions to Samarkand contributed to the formation of a strong scientific and cultural environment. This environment subsequently provided an important foundation for Ulugh Beg's scholarly activities [4].

Although Ulugh Beg was actively involved in state administration, he regarded scientific inquiry as one of the most important areas of his intellectual life. Astronomy and mathematics occupied a particularly prominent position among his scholarly interests.

In the medieval period, astronomy was not merely a theoretical discipline. It was also closely connected with practical needs such as the calculation of calendars, determination of time, geographical orientation, and the establishment of accurate methods for observing celestial bodies. Therefore, systematic astronomical observations required advanced mathematical knowledge and sophisticated observational instruments.

Ulugh Beg continued these scientific traditions and created the necessary conditions for professional astronomical research in Samarkand.

Samarkand Madrasas and the Scientific Environment. During the reign of Mirzo Ulugh Beg, the development of educational institutions became one of the important factors contributing to the advancement of science. Madrasas associated with Ulugh Beg operated in Samarkand, Bukhara, and Gijduvan. The Ulugh Beg Madrasa in Samarkand, located in the Registan complex, was one of the most significant architectural and educational institutions of the period. Alongside religious subjects, considerable attention was given to mathematics and astronomy [5].

Distinguished scholars of the period taught at Ulugh Beg's madrasas. The activities of Qadi Zada al-Rumi, Ghiyath al-Din Jamshid al-Kashi, and later Ali Qushji significantly strengthened the intellectual potential of the Samarkand scientific environment [6].

Qadi Zada al-Rumi was a prominent scholar of mathematics and astronomy who had a considerable influence on Ulugh Beg's scientific activities. Ghiyath al-Din Jamshid al-Kashi became one of the leading mathematicians of the Samarkand school and conducted important research in mathematical calculations and astronomical problems. Ali Qushji later played a major role in transmitting the achievements of the Samarkand scientific school to subsequent generations [7].

Thus, the scientific environment of Samarkand was not based solely on the personal interests of the ruler. It developed as a broader intellectual system founded upon scholarly cooperation, educational institutions, and systematic scientific research.

Establishment of the Samarkand Observatory. One of Mirzo Ulugh Beg's greatest contributions to the history of science was the establishment of an observatory in Samarkand. Constructed during the first half of the fifteenth century, the observatory was considered one of the largest and most sophisticated scientific institutions of its time [8].

Large astronomical instruments were installed in the observatory for observing the movements of celestial bodies. One of the most famous instruments was a gigantic sextant with a radius of approximately 40 meters. This instrument made it possible to determine the positions of stars and measure the altitude of celestial bodies with remarkable accuracy for the period [9].

The importance of the observatory was not limited to its impressive physical dimensions. More importantly, systematic astronomical observations were conducted there over an extended period.

As a result, a large body of scientific data was collected, which subsequently served as the basis for the preparation of accurate astronomical tables.

The Samarkand Observatory provided an opportunity to conduct scientific research within a specially organized institutional framework. In this respect, it became one of the most important scientific centers in the history of Central Asian science.

Zij-i Jadid-i Kuragoni and the Development of Astronomy. The most famous work associated with Mirzo Ulugh Beg's scientific legacy is Zij-i Jadid-i Kuragoni. This work represents a major astronomical study that systematized the results of astronomical observations and included information concerning the coordinates of stars, astronomical calculations, and trigonometric data [10].

The creation of the work involved not only Ulugh Beg but also other scholars belonging to the Samarkand scientific school. Through long-term observations, scholars obtained highly important data concerning the positions of stars and other celestial bodies.

Ulugh Beg's astronomical tables were studied by scholars in both the East and the West during subsequent centuries. His star catalogue became one of the most significant achievements in the history of medieval astronomy [11].

The scientific importance of the Zij lies in the combination of systematic observation and mathematical calculation. This approach demonstrates the advanced methodological level of the Samarkand scientific school and its contribution to the development of exact sciences.

Development of Mathematics. During the reign of Ulugh Beg, mathematics developed alongside astronomy. The observation of celestial bodies, calculation of stellar coordinates, and solution of complex astronomical problems required advanced mathematical knowledge.

Ghiyath al-Din Jamshid al-Kashi was one of the most prominent representatives of mathematics within the Samarkand scientific school. His work on calculation methods, decimal fractions, and mathematical constants occupies an important place in the history of medieval mathematics [12].

Qadi Zada al-Rumi also made a significant contribution to the development of mathematics and astronomy. His scholarly activities played an important role in the formation and consolidation of the scientific school of Samarkand.

The simultaneous development of astronomy and mathematics was one of the distinctive characteristics of the scientific school established under Ulugh Beg. The close relationship between these disciplines enabled scholars in Samarkand to conduct complex astronomical calculations with a high degree of accuracy.

Architecture and Culture during the Reign of Mirzo Ulugh Beg. The cultural development of Ulugh Beg's period was not limited to the exact sciences. Architecture, calligraphy, manuscript culture, literature, and the arts also flourished during the Timurid period. The construction of monumental architectural structures transformed the cultural appearance of Samarkand [13].

The madrasas associated with Ulugh Beg were not merely educational institutions but also outstanding examples of architectural art. Their decoration combined geometric patterns, calligraphic inscriptions, tilework, and sophisticated engineering solutions.

The scientific and cultural environment of Samarkand also contributed to the development of literature. During the Timurid period, scholars and poets wrote in Persian and Turkic languages. This cultural environment subsequently provided an important foundation for the intellectual and literary achievements of such figures as Alisher Navoi [14].

Manuscript production and calligraphy also developed significantly. The copying and dissemination of scientific works made it possible to preserve and transmit scholarly knowledge

from one generation to another. This process became an important component of the cultural life of the Timurid period.

Samarkand as an International Scientific Center. As a result of Mirzo Ulugh Beg's activities, Samarkand became one of the major scientific centers of Central Asia. The arrival of scholars from different regions and the intensification of intellectual exchange contributed significantly to the development of the local scientific school.

One of the distinctive characteristics of the Samarkand scientific school was its synthesis of different intellectual traditions. Greek, Arabic, Persian, and Central Asian astronomical and mathematical knowledge interacted with one another and contributed to the production of new scientific results [15].

Ulugh Beg's scientific legacy was subsequently transmitted to the Ottoman territories through Ali Qushji. His scholarly activities in Istanbul played an important role in disseminating the achievements of the Samarkand astronomical school to other scientific centers [16].

This process demonstrates that the Samarkand scientific school was not merely a local phenomenon. It became part of a wider network of intellectual exchange that connected the major scientific centers of the medieval East.

Historical Significance of Mirzo Ulugh Beg's Scientific Legacy. The historical significance of Mirzo Ulugh Beg's scientific activities can primarily be seen in the precision of his observations and the systematic organization of their results. During his period, astronomy and mathematics entered a new stage of development.

One of Ulugh Beg's greatest achievements was his ability to use his position as a ruler to create favorable conditions for scientific research. The establishment of an observatory, madrasas, and a community of scholars created an interconnected scientific infrastructure in Samarkand.

His scientific legacy was studied by scholars in both the East and West during subsequent centuries. In particular, his star catalogue and astronomical tables became important sources in the history of astronomy [17].

In this respect, Mirzo Ulugh Beg's activities provide a historical example of the relationship between state policy, education, and scientific development during the Timurid period. His experience demonstrates the importance of supporting scholars, developing educational institutions, and establishing institutional conditions for scientific research.

The period of Mirzo Ulugh Beg represents one of the most important stages in the development of science and culture in the history of Central Asia. As a result of his activities, Samarkand developed not only as a political and economic center but also as a major scientific and cultural center.

Ulugh Beg's commitment to science was reflected in the establishment of madrasas and the observatory in Samarkand, the invitation of prominent scholars to participate in scientific research, and the systematic implementation of astronomical observations. The Samarkand scientific school, formed through cooperation among scholars such as Qadi Zada al-Rumi, Ghiyath al-Din Jamshid al-Kashi, and Ali Qushji, became one of the leading scientific centers of its time.

The Zij-i Jadid-i Kuragoni represents the most important achievement of Ulugh Beg's scientific legacy and holds a significant place in the history of astronomy. Its astronomical tables and star catalogue contained highly accurate scientific data for their period.

At the same time, architecture, manuscript production, calligraphy, literature, and other cultural fields also flourished during the reign of Ulugh Beg. This demonstrates that the cultural flourishing of the Timurid period was comprehensive and involved various areas of intellectual and artistic activity.

In general, Mirzo Ulugh Beg's historical legacy represents a remarkable example of the interaction between science and state administration, education and culture. The scientific environment he established in Samarkand made a significant contribution to the development of scientific thought in Central Asia and secured a distinguished place for the region in the history of world astronomy.

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