



## GREAT DISCOVERIES OF THE MIDDLE AGES - SCIENTIFIC RESEARCH OF ENCYCLOPEDIA SCIENTISTS IN THE FIELD OF EXACT SCIENCES

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### Annotation.

The article reveals the great discoveries of the encyclopedic scientists of Central Asia in the field of exact sciences. Especially such sciences as astronomy, mathematics, medicine, chemistry, history, philosophy, linguistics, literary studies, and crafts - sculpture, weaving, pottery, glass making, etc.

### Keywords:

Astronomy, mathematics, medicine, chemistry, history, philosophy, world science.

Uzbekistan is a state on the territory of which the development of science and culture began since ancient times. In particular, such sciences as astronomy, mathematics, medicine, chemistry, history, philosophy, linguistics, literary studies, and crafts - sculptural art, weaving, pottery, glass-making and others - were widely developed. At present, scientists of Uzbekistan are actively studying the scientific heritage left by scientists of antiquity, enriching science with their new discoveries, making a significant contribution to the development of world science. In the 11th century, Urgench, the capital of Khorezm, was a well-maintained city with a high culture. Khorezmshah Abul Abbas ibn Mamun, being a ruler with a keen interest in culture and science, strongly supported scientists, poets, musicians, calligraphers, architects and artists [5, p.75]. At the Palace of Khorezmshahs in Urgench there were such great thinkers of the East as encyclopedists: physician Ibn Sina (Avicenna) and representative of exact sciences Abu Raikhan Beruni, historian Ibn Miskawayh, mathematician Abu Nasr ibn Iraq, philosopher Abu Sahl Masihi, healer Ibn and others. In Urgench, the "House of Experts" was organized - a kind of "Academy", in which research was carried out in the field of astronomy, philosophy, mathematics and medicine. However, such an atmosphere in Urgench did not last long - until 1017, the conquest of Khorezm by Mahmud Ghaznavi [9, pp.147].

Thus, in the East, in particular in Central Asia, the organization of scientific activity in the form of an academy became a tradition, and thus institutions like the academy in Urgench were created in the following centuries. In Samarkand, the academy was organized by Mirzo Muhammad Taragay Ulugbek in the 15th century. The academy had an observatory, the richest library of that time and a higher educational institution - a madrasah. In madrasah, along with religious sciences, mathematics, geometry, astronomy, medicine, geography and other secular sciences were also taught. Famous scientists - Kazizada Rumi,

Giyasiddin Jamshid al-Kashi and Ali Kushchi - worked at the Ulugbek Academy, and, accordingly, the scope of research was very differentiated. Ulugbek's Academy in Samarqand made a significant contribution to the development of such sciences as mathematics, astronomy and geography.

In the 9th-15th centuries, the exact and natural sciences (mathematics, astronomy, geodesy, mineralogy, medicine, pharmacology and others) began to develop at a rapid pace. The works of Plato, Aristotle, Hippocrates, Galen, Khorezmi, Ahmad al-Fergani, Abu Nasr Farabi, Abu Raikhan Beruni, Mahmud Kashgari, Abu Ali ibn Sina (Avicenna), Nasriddin Tusi, Kazi-zade Ali Kashi, Jamshid Kashi, Mirzughu other scientists of the East was in some areas much higher than the results of work carried out in later times by thinkers of other countries. Abu Raikhan Beruni wrote works on history, chronology, pharmacognosy, mineralogy, astronomy, mathematics, theoretically substantiated and calculated the presence of a new continent on Earth and solved a number of other problems that have received worldwide recognition [3, p.56]. Many researchers associate the beginning of the formation of the Mamun Academy in Kunya-Urgench (now Khiva) with the arrival of Abu Raikhan Beruni to this city, who worked there for a long period.

At the same time, another great Central Asian scientist Abu Ali ibn Sina worked here. Ibn Sina is truly an encyclopedic natural scientist, philosopher, physician, astronomer, mathematician, musicologist, writer and poet. He was known as Avicenna [1, 2]. And the phrase characterizing the activities of Ibn Sina - "Madadi Sino" - in an adapted form has been transferred into European languages as a whole direction in science - "Medicine" [8]. The famous eighteenth century natural scientist Karl Linnaeus praised Ibn Sina's achievements in botany and gave his name to one of the rare evergreens. Ibn Sina wrote over 400 works, 240 of them have survived to this day. The Institute of Oriental Studies named after Abu Raikhan Beruni of the Academy of Sciences of Uzbekistan contains more than 50 works of the scientist and a number of comments to them [6, p.8]. Among these works - the five-volume "Al-Qanun fi-t-tibb" ("Canon of Medicine"), which is the crown of his work. This work in its era raised the level of medical science incredibly high, and a hundred years after the death of Ibn Sina it was widely recognized in the countries of Western Europe. In the 12th century, the Canon of Medicine was translated into Latin and distributed in the form of manuscripts. This work was published in Venice in 1493 in a Latin translation, and in one century it was reprinted 16 times. In all authoritative educational institutions in Asia and Europe, medical science was taught on the basis of this work for 500 years. This invaluable canon of medicine has not lost its scientific significance even now.

One of the leaders of the XIII century, Mahmud ibn Muhammad ibn Umar al-Chagmini, who lived in the XII-XIII centuries, is the successor of the scientific works of Ahmad Fargoni and Abu Rayhon Beruniy. A native of Khorezm, encyclopedist, philosopher, astronomer, mathematician, geographer. Although the scientific works of al-Chagmini are very famous in the East, his life and work have not yet been studied. He received his primary education in Khorezm and to improve his knowledge went to Samarkand, where he mastered many sciences at the highest level. In his works, the teacher Beruniy - Abu Nasr ibn Irak is mentioned several times. Mahmud al-Chagmini at one time worked on many areas of scientific activity, such as astronomy, mathematics, medicine, geography and others. His contribution to these sciences was so significant that he became the largest scientist in Khorezm after Abu Raykhon Beruniy [4, pp. 5-6]. Mahmoud al-Chagmini's main study, A Brief Exposition of Astronomy, was very popular in Central Asia and Iran. The treatise consisted of an introduction on the elements and the ether, and two books - "On the celestial spheres" and "On the Earth"; in the first of these books, following al-Fargani, al-Khazin and Ibn al-Khaisam, the doctrine of the orbits of the planets was set forth. In the same treatise,

for the first time, the coordinate system is considered in detail, the basis of which is the horizontal plane of observation.

He, the largest scientist of the scientific school of Khorezm after Beruni, created an encyclopedia that includes the achievements of all sciences of the XII-XIII centuries. He continued the scientific traditions of Ahmad Fergani and Beruni and, above all, he earned universal recognition in astronomy. His merit consists of a complete study of the works of ancient Greek scientists and scientists of the East, in particular Central Asia on astronomy and offered new scientific conclusions in this field of science. Chagmini, paying much attention to geodesy and geography, and on the basis of the study of scientific problems of many branches of science, brought up topical philosophical problems for discussion and expressed his point of view on them [9, pp. 76-78].

The mathematician and astronomer Kazizade Rumi (1360-1437) was Mirzo Ulugbek's mentor. One cannot underestimate the significant contribution he made to the creation of Ulugbek's school. For achievements in science, Rumi was nicknamed "Aflotuni Zamon" (Plato of his time). The outstanding mathematician and astronomer al-Kashi (Giyasiddin Jamshid Kashi) was the first to introduce decimal numbers into mathematics on a positional basis and theoretically proved this, accurately calculating the values of  $\sin 1^\circ$  and the number  $\pi$  up to 17 decimal places. He also dedicated a number of his outstanding works to astronomy. Together with Kazi zade Rumi al-Kashi, he supervised the construction of Ulugbek's observatory.

Muhammad Taragay Ulugbek (1394-1449) left behind a huge scientific and cultural heritage, "Zizhi zhadidi Guragoniy" ("New Guragan astronomical tables") - the world famous work of the great scientist "Zij Ulugbek". Ulugbek built an observatory and a madrasah in Samarkand, organized his own Academy. Together with his students, he studied and compiled a list of more than a thousand stars - "a map of the starry sky." At the Ulugbek Academy, scientists conducted research not only in astronomy, but also in mathematics, philosophy, history and other sciences. The famous astronomer Ali Kushchi (Mavlano Alauddin Ali bin Mohammed Kushchi, 1403-1474), who worked at the Ulugbek Academy, left behind world famous scientific works in mathematics and astronomy. He considered the change in the seasons to be the result of the approach of the Earth to the Sun and the corresponding effect of the sun's rays on the temperature of the Earth's surface, from a scientific point of view, he correctly determined the process of the eclipse of the Sun. The works of Ali Kushchi significantly influenced the development of astronomical and mathematical science in the Middle and Near East in the 16th-17th centuries.

Mirzo Ulugbek, al-Kashi, Ali Kushchi made a significant contribution to the development of number theory and raised the existing knowledge of observational astronomy to a higher level. In 1428-29. he built a unique astronomical observatory with an unsurpassed main instrument - a quadrant with a radius of 40 meters. The unique catalog of 1018 stars compiled in Samarkand on the basis of 30-year observations has remained the best in the world for many years. The achievements of the astronomical school of Ulugbek had a great influence on the development of science in the West and the East [6, pp.69-109.]. His scientific works have been translated into many languages of the world, widely disseminated in Europe and the USA. The name of Mirzo Ulugbek is in the history of world science on a par with the names of Tycho Brahe, Johannes Kepler, Nicolaus Copernicus and Galileo Galilei. In the Great Hall of the Moscow State University. MV Lomonosov in the memorable historical gallery of the great scientists of all times, the portrait of the outstanding medieval scientist Mirzo Ulugbek rightfully occupies a worthy place. Monuments to Mirzo Ulugbek have been installed in a number of cities in Uzbekistan and in Belgium, the ancient Samarkand Observatory, a number of universities, including the National University of Uzbekistan, as

well as schools, urban areas and the village of nuclear physicists in Uzbekistan are named after him.

The first scientific institution in Uzbekistan in the 19th century. - The Tashkent Physics and Astronomical Observatory (today the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan) was organized in 1873. Initially, the observatory was engaged in organizing expeditions, as a result of which the exact coordinates of over a thousand locations in the region were determined, and only by the 30s of the XX century the observatory began to solve research tasks of fundamental astronomical science.

## In conclusion

We can say that the study of the invaluable creative heritage of the thinkers of the ancient and medieval East has not taken due attention of researchers to this day. At the same time, the disclosure of the stages of the origin, formation and subsequent development of chemical science and technology, as well as related areas of natural science, based on the analysis of the existing fund of ancient manuscripts or comments on them by scientists of the next generation, certainly has scientific and practical importance. Carrying out research in this direction is relevant because it allows one to assess the significant contribution made by the thinkers of Central Asia, Iran, India, the Arab East to the progress of world civilization. This allows you to reveal the principle of continuity in science, which was passed from East to West and vice versa, which ultimately led to the progress of common human civilization.

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