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GIYASIDDIN KOSHI IS A GREAT MATHEMATICIAN, ASTRONOMER, ARCHITECT, DESIGN ENGINEER

Abstract: Giasiddin Cauchy has made many innovations in the field of mathematics. The ratio of circumference to diameter found a 17-digit value of the number a among European scientists in this field almost two hundred years ago. Cauchy was the first in the world to apply the decimal fraction to scientific work. Similarly, the great mathematician and astronomer wrote a book on the theory of architecture as a mature architect and engineer of his time. It turns out that none of the other scientists had previously written about some parts of this field, as he himself notes. Considering that Giyasiddin Koshi was glorified by his contemporaries as the "sultan of engineers", it is natural to wonder whether the famous scientist was directly involved in the construction of the madrasah, Khanak and observatory in Samarkand, built under Ulugbek.

Keywords: mathematics, sterometry, Astronomy, Architecture, design, rationing

Introduction

One of the bright stars of science that shone over Samarkand in the first half of the XV century, Ulugbek's closest associate in his scientific research was Said Jamshid ibn Masud ibn Mahmud Giasiddin Koshi, head of the Samarkand Observatory. The note at the end of one of the famous Arabic manuscripts "Ziji Kuragani" is especially noteworthy. Sultan Ulugbek, after making observations

in Samarkand, wrote a treatise on it, which was translated into Arabic and edited by Giyasiddin Jamshid [1].

Abdul Ali ibn Mahmud ibn Husayn al-Birjani, one of the scientists of the Ulugbek school of astronomy, the author of a number of scientific reviews, spoke highly of his mentor Giyasiddin Jamshid Koshi as the "Sultan of the Engineers", There is no doubt that this definition expressed the unanimous opinion of scientific specialists of that time. Thus, Giyasiddin Koshi is embodied not only in the field of mathematics and astronomy, but also as the "sultan of engineers", who was directly involved in the theoretical foundations of architectural creativity and gained authority and fame among scientists, architects and engineers. Birjani would not have raised his mentor so high if he had been an engineer older than Koshi in the time of Ulugbek[3].

Materials and methods

This includes empirical methods such as modeling, fact-finding, experimentation, description and observation, as well as logical and historical methods, theoretical methods such as abstraction, deduction, induction, synthesis and analysis, as well as methods of heuristic strategies. Research materials: scientific facts, results of previous observations, surveys, experiments and tests; means of idealization and rationalization of the scientific approach.

Very little information has been preserved about Giyasiddin Koshi. The Koshi (Koshani) anachronism indicates that the scientist was born in the Persian city of Koshi. It is assumed that the name of the ceramic tile used to decorate binoculars was also assigned to the name of this city. But the fact that the scientist is called Cauchy can also be understood in the sense that he was a skilled Cauchy master, considered one of the most exquisite and complex decorations in architecture. Initially, Giyasiddin was in the service of the Timurids in Persia and Khorasan, and around 1414-1416 he was invited to

Samarkand, where he became a permanent resident. According to some sources, Giesiddin Koshi died in 1436-1429 in Samarkand.

Results and discussions:

Ghiyasiddin Koshi's book "Miftah Al-Husab Fil-arithmetic" is mainly devoted to arithmetic, and its special chapter, consisting of three sections on the measurements of buildings and structures, is entirely devoted to the theory of architecture.

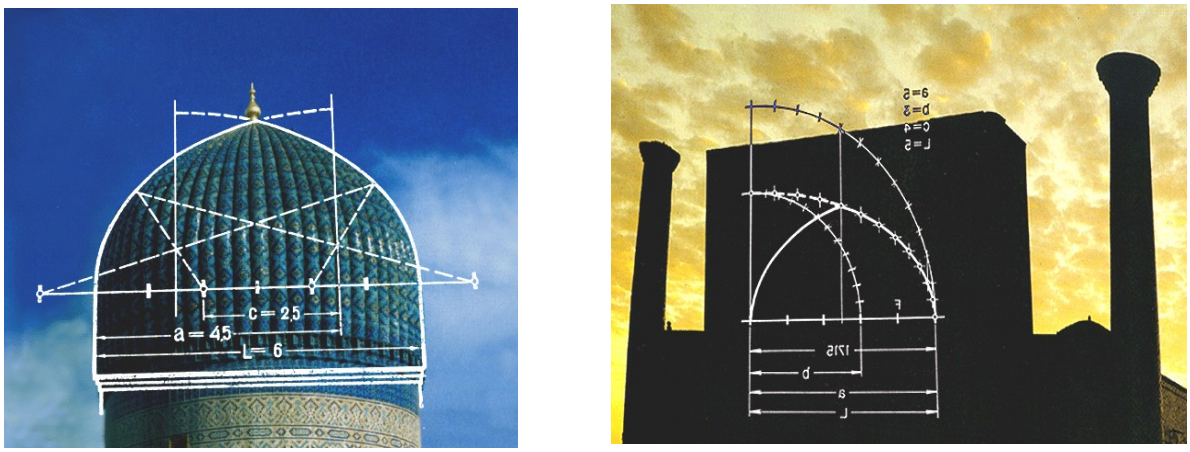
The author says that those who know the "science of architecture" have never thought about writing a paper about the need to measure structures and buildings before. With this in mind, I have included the science of building measurements among the necessary knowledge," he notes.

The first section is devoted to the measurement of odd and arched ones. The scientist explains a number of architectural terms, describing three types of dominant cylindrical walled volume – falaka, hulk and tambourine. Then it shows the difference between odd and arc-shaped shapes. "The difference between an arch and a vault is as follows: the height of the arch (rad) is less than the width, and the height of the vault is greater than the width. The thickness of the vine – the length of the arc-is called tulle." Cauchy cites five different geometric methods for making a dome of varying complexity. Studies of architectural monuments that have survived in our country so far show that during their construction, the architectural proportions outlined by Giesiddin Koshi were also observed (Fig.1). These forms themselves indicate how scientifically sound the art of drawing was in the architecture of that time [4].

Giyasiddin Koshi also provided a table for determining the volume, multiplying the outer perimeter of the arches and vaults by their thickness, explaining the order and rules of calculation. He even showed a way to find dimensions related to the length of curved arcs using trigonometric functions (sine, cosine).

The second section, the dome, is devoted to the shape and order of measurement of domes. Cauchy describes four different types of domes, showing ways to calculate their surface and volume.

The third section is devoted to measuring the surface of the mukarnassus. The ornament on the inside of the Mukarnassus vaults and arches is an overlapping ornamental pattern consisting of a system of tosak bowls. It is based on a very complex drawing project. Cauchy cites the constituent elements of mukarnassus, their descriptive features and names. Cauchy calls the bowl of mukarnassus a byte, each of the overlapping rows a plate, and the largest and most important module of the bowl a scale.

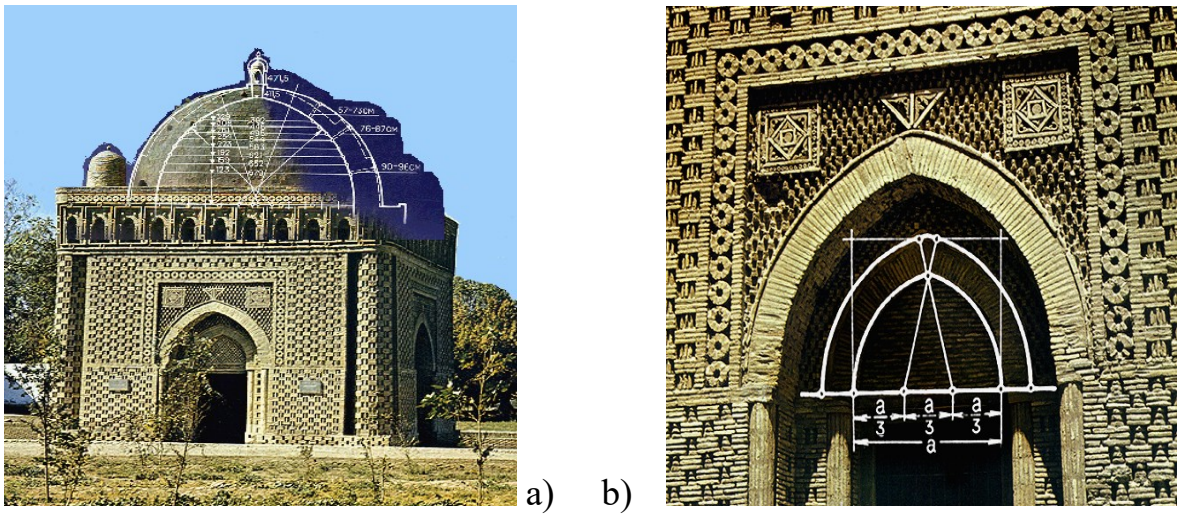


a) b)

Figure 1. Engineering techniques embedded in the architecture of Central Asia in the Middle Ages: a) the project of forming vaults and arches; B) designing the shape of domes and vaults

Provides information about four different types of mukarnas. Cauchy also shows the order of manufacture of the repeating elements of the bowl of mukarnasa. "Know," the scientist writes, "that master builders take the base of a straight quadrangle equal to the Mukarnass scale (modulus) and determine the height two fractions longer than it."

Cauchy's knowledge of the use of a large–scale modular block in the manufacture of a moukarnass is especially interesting and important for the history of architecture. In his work, he outlines the proportions that operated in architectural monuments, analyzes the laws and measurement methods used in practice in Central Asian architecture to create traditional geometric shapes and brings them to a unified scientific justification (Fig.2).



a) b)

Figure 2. Engineering laws observed in the design of the mausoleum of Ismail Samani (IX century): a) the design of the dome section; b) the method used in the manufacture of shapes of arches and vaults

As you know, modern achievements in the field of architecture and construction technologies dictate how necessary a modular system, rationing, standardization, typing, unification of sizes of goods and components are, in light of the requirements of widespread implementation of the principles of interchangeability and economic efficiency. Scientific research is underway on their widespread use today. Even more important is the fact that back in the XV century, Samarkand scientists and architectural engineers carried out practical and theoretical work on the modular scale, seismic resistance, durability of monuments, wrote manuals and scientific books [4].

Conclusion:

Giyasiddin Koshi has made many innovations in the field of mathematics. The ratio of the circumference to the diameter found the 17-digit value of the number a among European scientists in this field almost two hundred years ago. Cauchy was the first in the world to apply the decimal fraction to scientific work. Similarly, the great mathematician and astronomer wrote a book on the theory of architecture as a mature architect and engineer of his time. It turns out that none of the other scientists had previously written about some parts of this field, as he himself notes. Considering that Giyasiddin Koshi was glorified by his contemporaries as the "Sultan of Engineers", it is natural to wonder whether the famous scientist was directly involved in the construction of the madrasah, khanak (mosque temple with shelter for Muslim monks) and the observatory in Samarkand, built under Ulugbek. It remains for gifted historians and Orientalists to clarify this in order not to interpret the contents of centuries-old primary source manuscripts purely literarily, namely, and technically.

If we recall that Giyasiddin Koshi arrived in Samarkand in 1414-1416 and settled permanently, where world-famous monuments of the Ulugbek era were erected during his lifetime, then there is no doubt that the great scientist, awarded the honorary title "Sultan of Engineers", performed exceptionally responsible and important creative tasks in the process of unprecedented creativity [5].

The research of scientists such as Ahmad al-Ferghani, Mirzo Ulugbek, Giyasiddin Koshi in the field of ultra-precise metrological, astronomical and architectural measurements has served to improve measuring instruments and methods in other fields. The rich scientific heritage left by our great compatriots in determining the annual motion of the planets, the period of rotation, has not lost its scientific significance in our time.

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