

## The blossom of «brick style» in Central Asia

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**Abstract.** The article presents the «brick» style that determined the aesthetic features of the perception of the architecture of Central Asia. The flourishing of the «brick» style falls on the period of the reign of the Samanid and Karakhanid dynasties – IX-XII centuries. The aim of the study is to determine the genesis and evolution of the methods of forming the «brick» style of the Samanids and Karakhanids. Based on this goal, the following range of tasks is determined: first, a cursory analysis of the use of burnt bricks in Central Asia in the pre-Islamic period; second, the analysis of the integration of constructive and ornamental structure in the architecture of the Samanids; third, the definition of techniques and methods of ornamental brickwork at the time in question; fourthly, the methods of using figured masonry made of burnt bricks during the Karakhanid period. Attention is focused on the syncretic nature of the constructive, architectural and decorative sides of burnt brick in the architecture of Central Asia in the 9th-12th centuries. The role of burnt bricks in the construction of minarets, monumental tower structures of Islamic architecture, is described. The questions of preservation of unique architectural monuments of the Middle Ages of Central Asia, made with ornamental patterned masonry of burnt bricks, are raised. The problem of destruction of building materials, in particular, burnt bricks, due to the deterioration of the ecological situation in the Central Asian region is emphasized.

**Keywords:** burnt brick, brick style, ornamental decor, types of masonry, mausoleum, girikh-geometric ornament, ganch.

### 1. Introduction

Along with adobe bricks, burnt bricks have been used since ancient times in the construction of buildings and structures. In Central Asia, fired brick was used, for example, in the buildings of the Parthian Nisa (III-II centuries BC), where besides traditional square bricks, bricks of a special curved shape were used in the construction of massive round columns. In the Kushan period (I-III centuries AD), in the Buddhist sanctuary of Ayrtam (Uzbekistan), cells amazed by the varied and unusual use of burnt bricks. «In addition to square bricks 35x36 cm of which the walls were folded, trapezoidal bricks were used for laying the vaults, stairs, as well as niches were covered with fired bricks of complex curved shapes» [1].

In the pre-Islamic period of the early Middle Ages V-VIII centuries. In Central Asia, as before, load-bearing structures were erected from baked bricks, floors and roofs were lined, foundations were laid, and representative buildings were faced (the palace in Varakhsha). Judging by the images that have come down (for example, a drawing of a castle on a silver «Anikovskiy» dish), the facades of palaces and castles of that time were decorated frie with stepped battlements, zes made of obliquely lying bricks, as well as ornamental belts of figured burnt bricks in the form of discs, crosses, corners, etc. NS. Such decorative details have been found in various, remote from each other corners of Central Asia. The bottom of the facades and the inner walls of the premises (the palace in Varakhsha, Afrasiab, Penjikent, etc.) were faced with burnt bricks. As renowned architect and archaeologist S.G.

Khmelnitsky notes, «it is possible that burnt brick in the monumental architecture of the 5th-8th centuries. was used more widely than can be assumed from the surviving buildings of that time» [2]. Arab geographer Abu Ishaq al-Istahri, describing the House of Government, built in Merv in the middle of the 8th century. governor Abu Muslim, spoke of a huge building erected of baked bricks, into which four entrances led, crowned with a large dome, and «... from the inside, the way of building a roof was visible» [3]. Undoubtedly, the creators of such a building must have had significant experience in the construction of baked brick, calculated by more than one generation of craftsmen.

«Still, in the remains of the most monumental buildings of the pre-Islamic time, there are not even signs of those figured, constructive-decorative and purely decorative brickwork, which in the 10th century will become a specific feature of the new, Islamic architecture of Central Asia» [2]. However, there is no doubt that the technique of using fired bricks had a long tradition in Central Asia, and only thanks to this in the Samanid era (IX-X centuries) outstanding works of art were able to appear, demonstrating the unique technique of the ornamental «brick style».

### 2. Materials and methods

The article used methods of historical and comparative analysis to identify the commonality of ongoing processes in the Central Asian region and their impact on the development of architecture. For this purpose, natural materials were collected in the form of drawings and graphic and photo-

graphic recordings of architectural monuments of the 11th-12th centuries. The source base was formed on the basis of the study of archival materials, materials from historical museums, archaeological reports of expeditions, historical and architectural, written, and visual sources.

### 3. Results and discussion

#### 3.1. «Brick style» of the Samanids

It was the Samanid era (875-999) that enriched the world with a unique constructive and decorative technique made of baked bricks in the construction of buildings for various purposes - caravanserais, mosques, minarets, mausoleums, which spread from Central Asia further throughout the Islamic world. As the researcher of architectural ornament, the famous art critic BP Denike wrote, «Monuments with brick ornamentation were not concentrated in any one place, but are found throughout Central Asia» [4]. Initially, judging by the preserved architectural monuments of the 9th century, buildings made of adobe bricks were faced with burnt bricks. For example, the Kyrk-Kyz palace in ancient Termez, built of adobe bricks, has preserved traces of the figured facing of the outer walls and towers with burnt bricks.

The ornamental «brick style» of the Samanids, taking on exquisite outlines in the central and peripheral buildings, combined geometric and floral ornaments. S.G. Khmelnskiy, analyzing the architectural decor of the monumental architecture of the Samanids, notes that «brick decor was a product of building techniques and structures, representing their aesthetic interpretation and did not hide the material and construction basis of buildings, but revealed it by artistic means» [5]. Thus, the «brick style» of the Samanid buildings demonstrates the duality of the whole, expressed in the integration of architectural and ornamental structures – the fusion and smooth flow of the constructive system into the decorative one, creating an inseparable architectural and ornamental integrity. The syncretic nature of the brick ornamental decor and architectural structure is demonstrated by the monuments of Maverannahr – the Samanid mausoleum and the Magoki Attori mosque in Bukhara (X-XI centuries), mausoleum-madrasah of Khoja Mashad in Sayod (IX-XI centuries), the mausoleum of Mir-Said-Bahram (X-XI centuries). Traces of this approach can be seen in the architecture of Samarra (Iraq), the palace complex in Lashkar Gah, the portal arch of the mosque in Bust (Afghanistan), the Ibn Tulun mosque in Cairo (Egypt), etc. Brick decor completely covered the surface of the walls, both inside and outside the building ... «It differed from the internal masonry of the walls in a more complex structure and was, in essence, a cladding layer, inextricably and constructively connected (in contrast to the cladding of a later time) with the main building mass of the walls» [5]. The massive use of fired bricks predetermined a new approach to architectural decor, expressing both the constructive and artistic and figurative content of architecture. The dual integrity of the architectural decor becomes a fundamental distinctive feature of the Samanid era.

Decorative brickwork was distinguished by a variety of methods used: bricks were laid out with a ladder, a herringbone, a curb; were located flat on an edge or corner; patterns were made from figured bricks forming circles and other geometric shapes; alternating masonry of protruding and sinking bricks was used, etc. S.G. Khmelnskiy drew atten-

tion to the meaning of light and shadow in brick ornamentation «the seams on the surface of the walls were usually not filled with mortar, they remained empty, - the shadows in the seams form a clear geometric pattern, emphasizing the decorative qualities of the masonry and turning it into a kind of brick mosaic, each whose element – a narrow plate of brick – is surrounded by a dark frame» [5]. The most widespread ornamental technique of the brick style is the «ladder» masonry. The fir-tree masonry also has undoubted ornamental properties that coincide with the plasticity of the spatial elements of vaulted structures. The famous art critic Sh. M. Shukurov emphasizes that the ideal «architectural ornament can be called exactly what was born in the architectural body of the «brick style» of the Samanid time» [6]. It was during this period that the syncretism of ornament and architecture manifested itself most fully. The mausoleum of Ismail Samanid in Bukhara is a masterpiece of «brick style» art. Many articles and monographic studies of such scientists as L. I. Rempel, B. P. Denike, G. A. Pugachenkova, L. N. Voronin, V. A. Shishkin, S. G. Khmelnskiy and others are devoted to the Mausoleum. and the first drawings were made by TS Stramtsova, B.N. Zasytkin and K.S. Kryukov. It was on them that M.S. Bulatov relied when performing analytical studies of the harmony of the proportional structure of the mausoleum. The usual masonry in the mausoleum was completely replaced by figured ornamental masonry of two types - smooth and embossed. A variety of spectacular ornamental surface textures were created using the simplest techniques. Basically, these are motives of the rhythmic alternation of blocks of several (from 2 to 5) bricks, located vertically, horizontally, with setting on a prong, at an angle, with a poke and a spoon. The art critic G.A. Pugachenkova describes the patterned brick decor of the Samanid mausoleum in the following way: «in the masonry of the walls, a brick is laid by alternating three rows of horizontally and diagonally placed bricks, then by arranging five horizontal rows and a brick placed flat diagonally. In the tympana of the arches there are brick squares or bricks protruding in relief at an angle, or «herringbone» masonry. In the layout of the sails, we see paired bricks with wide vertical seams. Brick is used in curbs and horizontal rods, while it is either laid diagonally, then curvilinearly hewn, followed by a chain of discs, rings or four-blade rosettes. Patterned gratings filling the arches were taken out of the figuratively hewn bricks» [7]. Due to the deep embossed masonry, the cubic volume of the mausoleum loses its massiveness, creating a feeling of delicacy and lightness. «The play of light and shadow on the surface evokes the impression of expediency and beauty, sawn and polished bars give the architectural details a patterned variety» [8]. To make curly details, a brick was used with the addition of gypsum, thus rings, four-petal rosettes, leaves, rectangles, twisted columns, etc. were obtained.

Architectural brick decor made of burnt bricks, just like in the mausoleum of Ismail Samanid, organically merged with its constructive and artistic solution, we can see in the mausoleum of Arab-Ata of the 10th century, located in the village of Tim, Samarkand region. The study of the mausoleum was carried out by N. Leonov, G.A. Pugachenkova, S.G. Khmelnskiy, S.F. Starr and others. The cubic volume of the mausoleum is crowned with a lancet dome, the corners of the building are flanked by three-quarter octagonal columns. The Arab-Ata mausoleum, built at the end of the 10th century, has, in contrast to the Samanid mausoleum, a pronounced

main facade, highlighted by a portal with a combined brick-ganch decorative design richer than the other facades. The lancet arched niche of the portal, resting on columns, is decorated with carved figured bricks on the inside and on the top. The portal is crowned with a three-arch arcature and framed by a U-shaped strip of Kufic inscription. «The laying of the walls was carried out by bandaging – in pairs of bricks, with wide dividing vertical seams. This practically simple and expedient technique is an important element of the decorative design of the building, highlighting the textured character of the brickwork. In the process of removing the curly masonry, the brick was divided in half, fourfold, cut into the size of a square or into a semicircle. The lower edge of pairs of bricks is sometimes hewn obliquely, in order to expand and highlight horizontal joints filled with ganch» [7]. In the city of Mary (Turkmenistan), there is a domed Talkhatan Baba mosque of the 10th century, which is distinguished by its graceful harmony and variety of brick decor. V. A. Zhukovsky, S. A. Sudakov, B. P. Denike, G. A. Pugachenkova and others studied this object. The unique ornamental laying of the mosque is a reference to the techniques that form the patterned texture of the Ismail Samanid mausoleum. «In the brick ornamentation of the Talkhatan Baba mosque», writes BP Denike, «motifs of masonry are used with paired bricks in an empty seam, sometimes with S-shaped figures carved from brick, a pattern of repeating rhombuses, a herringbone pattern, rosettes and triangles carved from bricks» [4].

The same techniques of the brick style were used in the ornamental calculations of the Mir-Said-Bahram mausoleum of the 10th century, located in the center of the city of Karman (Uzbekistan). The historical complex, including the mausoleum with the adjoining mosque, framed by an L-shaped aivan on carved wooden columns, was investigated by A.K. Pisarchik, V.S. similarity with the Samanid mausoleum, in a peculiar way achieving proportional relations, as well as methods and techniques of the figured laying of the prototype. A small quadrangle of the mausoleum (8x8 m) with a domed end, visually increases due to the main facade protruding along its sides and along its height. Such «decorative and curtain side of the peshtak», writes S. G. Khmel'nitsky, «its role as an illusory architectural mask, hiding real architecture, becomes especially evident here» [5]. Geometric ornament-girih frames the portal of the mausoleum with a U-shaped ribbon. Corner octahedral columns are laid out by alternating relief blocks of four bricks. An example of a developed brick style is demonstrated by the architectural complex Khoja Mashad of the 9th-12th centuries, located far from the capital cities. in Sayod (Tajikistan). As Sh. M. Shukurov notes, «although the remoteness of the architectural monument from Bukhara and Samarkand is noticeable, the level of skill of the architects remains the same, which allows us to make two assumptions: either the architect of the complex was a master of the capital, or, more likely, the skill of the capital and peripheral architecture in the Samanid time remained essentially at the same level» [6]. The ensemble of the Khoja Mashhad madrasah consists of two domed buildings – a mausoleum and a mosque, built of burnt bricks and connected by a vaulted passage that led to a courtyard framed along the perimeter with cells-hujras. The mausoleum, built in the IX-X centuries. It is composed of ornamental masonry using alternating rows of horizontally placed bricks, which are «broken» by inserts of vertical bricks. The building of the mosque, erected a hundred years later, practically does not differ in external shapes and sizes from the mausoleum, only the brick decor is more

diverse, based on many variations of herringbone patterned masonry.

The considered architectural monuments of the brick style of the Samanid era allow us to conclude that initially all the facades of the structure were evenly covered with figured patterned ornamentation; later on, priority is given to the front one, which stands out with a pestak portal and concentrates all the wealth and variety of brick decor.

### 3.2. Analysis of brick ornamentation of the Karakhanids and Seljukids

The «brick style» remained relevant and popular both under the Karakhanids (942-1212) and the Seljukids (XI-XIV centuries). The Turkic state of the Karakhanids extended over most of the territories of Central Asia (modern southern Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and the western lands of the Xinjiang Uygur region of China). The Turkic Seljuk dynasty ruled in most of the countries of the Middle East and Iran. Since the XI century, as the researchers of the medieval architecture of Central Asia and the Middle East point out: V.L. Voronina, A. N. Bernshtam, N. S. Gorazhankina, S. G. Khmel'nitsky, D. D. Imankulov and others. the main material in the construction of monumental architecture. Mass production and quality improvement created the preconditions for an increase in construction equipment and contributed to the development of architectural decoration, and, in particular, to the improvement of brick ornamentation. «The development of figured brickwork in the XI-XIII centuries. led to the fact that the dressing of the seams – its original purpose – passed into brick mosaic, which was applied to the wall mainly for decoration. Sawed, polished, hewn bricks are used in amazing combinations» [8]. Brick decorative ornamentation, steadily improving by the XIth-XIIth centuries, thanks to its technical simplicity and impeccable expressiveness, becomes widespread and creates a distinctive style of Islamic architecture of the Karakhanids and Seljukids. The lines of the figured masonry pattern are deepened or protruding, forming a geometric carpet pattern. Curly masonry decorates the panel, tromps and the space between them in the interior, and also covers the facades; «in the masonry of minarets, it covers their trunk with belts of various ornaments» [9].

There are a number of techniques for using baked brick curly masonry. First, in the architecture of the Middle East and Central Asia, patterned relief masonry, designed for the play of chiaroscuro, continued to improve (the Middle Mausoleum in Uzgen, the mausoleums and minaret of Buran, the Kalyan minaret, the minaret in Mosul, etc.). Secondly, at this time, the construction of buildings made of adobe bricks with figured cladding of burnt bricks (the steppe palaces of Rabat-i-Malik in Uzbekistan, Robate Sharaf in Iran, the palace complex of the Lashkorgah country palace in Afghanistan, etc.) was still relevant. Thirdly, the method of combining ornamental brickwork with ornamental motifs from carved ganch (the Southern mausoleum and minaret in Uzgen, the portal of the Magoki-Attari mosque in Bukhara, the Great Mosque in Isfahan, etc.) has become widespread.

Burani settlement is the ruins of the medieval city of Balasagun – the capital of the Karakhanids, where one of the first minarets built of burnt bricks with ornamental masonry belts (Burana tower), as well as the foundations of three portal mausoleums with patterned relief decor, have survived. The minaret, according to a number of scientists (L. I.

Rempel, B. N. Zasytkin, V. L. Goryacheva, D. D. Imankulov, etc.) destroyed by an earthquake, survived half of its height – 24 m and consists of two parts – octahedral base and round minaret shaft. Each face of the socle is decorated with a lancet niche and «a relief brick ornament built on a diagonal square grid of squares that form cross-shaped figures» [10]. The trunk of the minaret is an alternation of smooth masonry and belts of relief geometric ornament. Ornamental belts, built on a square grid, with offsets of centers and axes, receiving dynamic, rotating patterns of swastikas, crosses, meanders and squares. From the general construction scheme, a narrow belt is knocked out of zigzag pairs of bricks. Not far from the minaret there were three portal mausoleums - one octahedral, possibly with a hipped roof, and two rounds, topped with a dome. As noted by Professor D. D. Imankulov, who carried out the graphic reconstruction of the mausoleums, «in terms of their architectural, artistic and building qualities, they are undoubtedly higher in comparison with the minaret. In the ornamentation of these mausoleums, in addition to curved bricks, figured bricks, carved ganch were already widely used, which have not yet found their application in the Buran minaret due to its earlier origin – at the end of the 10th century» [10].

Uzgen is one of the capitals of the Kara-khan dynasty, whose reign coincided with the flourishing of the city. A unique patterned and relief masonry made of baked bricks has been preserved in the Middle Mausoleum of the 11th century. – the oldest of the linear ensemble, adjoining three mausoleums of the Uzgen complex. The researchers of the mausoleum B. P. Denike, L. I. Rempel, D. D. Imankulov, B. N. Zasytkin indicate the use of three types of ornamental techniques for laying brick decor: 1) a pattern repeat of a repetitive motif of two bricks laid flat and one on the edge; 2) figured relief masonry on a corner column with bridges of three bricks; 3) relief masonry, forming eight-pointed stars and cruciform figures, the inner space of which was filled with carved ornamental knocking. A wide variety of ornamental motifs of patterned relief masonry is presented on the XIth century minaret, which is part of the architectural complex. The surface of the minaret's trunk is decorated with decorative masonry, in which wide ornamental stripes alternate with narrow ones. Considering the peculiarities of human perception, in order to preserve the illusion of uniform division, the size of the ornamental stripes increases, the higher from the ground, the wider the stripes. In patterned masonry, most often there are motifs of a rhombus with a cross, a circle, a rosette and a meander. «The ornament of the lower strip with lines breaking at right angles (meander) is similar to the ornamental motives of the three wide friezes of the Burana tower» [4].

The pinnacle of the building art of the Karakhanids is the Kalyan minaret in Bukhara, the beginning of the 12th century. Fully preserved to its full height – 46.5 m, it consists of a round minaret trunk, three rows of stalactite masonry, on which a lantern with arched openings rests, ending with a cornice of four rows of stalactites. The trunk of the minaret is lined with ornamental stripes of different sizes with non-repeating geometric patterns in relief masonry. Her techniques represent a wide palette of ornamental motifs – weaving with eight-pointed stars (known from the portal of the Middle Mausoleum in Uzgen); rapport from in-depth crosses; a belt of rhombuses with crosses inside (similar to the minaret in Uzgen); circles located on a diagonal grid; alternation of paired bricks and bows, etc.

Despite the disintegration of a single state – the Arab Caliphate – constructive innovations and artistic and aesthetic ideas spread very quickly in a single space of the Islamic world. The al-Hadba minaret, built in 1148 at the al-Jami al-Kabir Mosque (better known as the al-Nuri Mosque) in the Seljuk city of Mosul, is decorated with relief ornamental masonry made of burnt bricks. The slender minaret, 45 m high, bent over time due to the erosion of the foundation, receiving its nickname «Khatba» (humpbacked). The cube base of the minaret, decorated with a relief pattern in the form of squares located on a diagonal grid and framed by a strip of a cruciform pattern along the perimeter, stood on a high pedestal of simple trapezoidal brickwork, their total height is 15.5 m. The trunk of the minaret with seven ornamental frieze belts was completed by a domed lantern. In the frieze patterns, various variations of the diagonal lattice were used. In 2017, the unique historical monument al-Hadba of the original construction, which existed for almost nine centuries, was destroyed by militants, as well as the al-Nuri Mosque.

We see the architectonicity of the constructive and artistic-decorative principle, which determines the brick style in Islamic architecture, in the ornamental calculations of the Alambar dar mausoleum of the 11th century, in the mausoleums from the Sultan-Saadat complex in Termez in the 11th century, the minaret in Vabkent of the XIIth century, the minaret in Jarkurgan of the XIIth century. c., minaret Saraban in Isfahan XII century, minaret in Barsian near Isfahan XI century etc.

If in the structures considered, the ornamental masonry and the constructive system of burnt bricks constituted a single and inseparable structure, then at the same time, construction from adobe bricks (especially in the architecture of residential buildings) was still popular, in which the figured facing appeared exclusively in decorative quality. The steppe palace of the Karakhanids Rabat-i-Malik, built in the 12th century, from which only a richly decorated portal has survived, was located at the intersection of busy trade roads. Tsar Rabat – a powerful fortification with sides of 85 m, was flanked by round corner towers. Its walls were made of adobe bricks with fired facing. The architectural concept of a comfortable fortress-residence was supported by the luxurious decoration of the premises, courtyards, facades, and above all the entrance portal. The plane of the portal, cut by a pointed arch, is framed by a strip of ornamentation of eight-pointed stars (a similar motif on the Middle Mausoleum in Uzgen), made of bricks with a «bonded» masonry. Along the perimeter, the ornamental strip is bordered by two rows of bricks, at equal intervals, intercepted by intertwining knots. In the niches located on both sides of the portal, the meander motif is used under the pointed arches. Figured bricks are also used in perspective arches, completing half-columns-corrugations and in the stalactite cornice of the facade.

Another Seljukid steppe palace – Robate Sharaf, located between Mashhad and Serakhs, is of unique artistic value, built in 1114 by the architect Mohammed Karim. The fortress-residence is rectangular in shape, measuring 110x75 m, with six round towers, built of adobe bricks, the height of the walls is 6 m. The four-hawn composition of the courtyards along the axes is fixed by portals with pointed arches. The premises were located along the perimeter of the courtyards, to the left of the entrance in each courtyard there was a mosque. The walls, domes and vaults were decorated with figured baked brickwork with jointing and bridges in the form of «bows». Portals of entrances and ayvans were deco-

rated with lacy geometric patterns and epigraphy. Geometric ornamental facing of raw walls with burnt bricks was also used in the Daya-Khatyn caravanserai of the 11th century, the country palace complex Lashkargakh of the 12th century, and the Khulbuk palace of the 12th century. and etc.

Figured masonry made of fired bricks in combination with ganch carving was cultivated in Central Asia and Iran. The northern mausoleum in Uzgen, adjacent to the Middle, was built 35 years later. In it, along with patterned-relief masonry, new decorative elements are widely used, which over time will replace brick ornamentation, such as carving on ganch and facing with carved terracotta. Inscriptions in naskh script are carved from carved terracotta on a background of floral ornamentation. The main ornamental patterns are made in the ganch carving. «The motif of alternating stars and cruciform figures, often found in the architectural scenery of the Middle East, writes B.P. Denike, is interpreted here in a very peculiar way. The stars are formed by wide, clearly protruding frames and intertwined with narrow ribbons, and eight-petal rosettes are placed in the centers of the stars, and the gaps between the frames and ribbons are completely filled with stylized floral ornaments, most often with spiral shoots» [4].

The cathedral mosque in Isfahan, 9th century, was extensively expanded during the reign of the Seljukids. The original type of mosque-kiosk was replaced by a yard composition with four aivans. The most perfect small domed pavilion of Gombede-Khaki, XI century, located not far from the entrance to the mosque, was richly decorated with patterned masonry (tympanum of large arches, belt of tromps) with inserts of carved terracotta (tympanum and soffits of small arches).

### 3.3. Natural threats to the preservation of architectural monuments

Climate and deteriorating ecological conditions of the environment, such as sudden changes in temperature, wind speed, absolute and relative humidity, insolation destroy unique historical and architectural monuments. The durability of the same material in different environmental and geographic conditions is different. The intensity of the destructive process of materials is increased by various pollutants that are constantly found in the environment: nitrogen dioxide, hydrogen sulphide, sulfur dioxide, etc. The increase in pollution due to the gas contamination of the surrounding atmosphere, industrial waters, frequent acid rains lead to the emergence and rapid multiplication of microorganisms that can survive in extreme conditions and have the deepest destructive effect on the structure of building materials. The active acidity (pH) of the medium is of great importance for the development of fungi. These facts entail an increase in the danger of mass microbial damage to architectural monuments. Micromycetes – microscopic fungi play a role in damage to cultural monuments. The study of the destructive action of microdestructors purposefully began to be dealt with only in the 60s of the XX century. At present, in many cases it has been proven that stains, the origin of which was previously attributed to the action of moisture, are a product of the vital activity of microorganisms. The spread of mushrooms on cultural monuments is determined by their biological characteristics, the most important of which are: mycelium structure, rapid growth, high metabolic activity depending on environmental factors, genetic variability, the ability

to stay in a state of suspended animation for a long time. Metabolic products are represented by organic acids, enzymes, ammonia, hydrogen sulfide, etc. Thus, acids destroy soils, reacting with chalk or gypsum filler, forming water-soluble calcium salts.

Many microorganisms get on the substrate: fungi, yeast, bacteria, algae, etc. They can spread with air currents saturated with dust particles and other pollutants, on the surface of which spores easily settle. Most fungi that cause damage to materials have a high reproductive energy. Spores can penetrate into cracks and pores that permeate the substrate; they can be carried away by water seeping into the depths of materials, especially porous ones. In the initial stages, they can use the components of dust particles as a power source, and later they begin to grow due to the components of the environment. These are binders for soil and paints, plant residues and other additives of organic substances in the soil. In addition, pollution due to capillary suction of moisture from places contaminated with organic matter can serve as a source of nutrition for mushrooms.

Destruction by microorganisms usually occurs under the influence of not one any group, but a complex that includes both bacteria and fungi. One group of organisms by their activity prepares a substrate for another and interconnected associations are constantly formed. At the same time, environmental conditions play an important role in their formation. Therefore, when developing measures to combat microbiological damage, this factor should always be considered. Violation of the temperature and humidity regime and the rise of groundwater, changes in the aerodynamic conditions of the environment and a number of other factors led to an increase in humidity and the creation of favorable conditions for the development of these microorganisms, which pose a serious danger of corrosion destruction in historical and architectural monuments (Uzgen memorial complex, Burana tower and etc.).

### 4. Conclusions

Since ancient times, burnt brick has been used in Central Asia as a facing material for the external and internal surfaces of buildings. In this case, the wall structure was three-layer - the outer and inner layers were laid out of baked bricks, and the middle one was made of raw bricks. Later, burnt bricks began to be used in the construction of vaulted and domed roofs, facilitating their structural structure and increasing the space of the overlapped premises. Burnt brick became widespread as a building material for enclosing structures only in the X-XII centuries. The brick was usually flat and square in order to increase the horizontal bond. The square shape was convenient for the construction of domes and vaults without circles, using the method of vertical segments. Over time, the size of the bricks increased. Small «Samanid» brick with sides of 20x22x2.5 cm is gradually giving way to a larger one – up to 30x30x6 cm. The thickness of the brick was generally one-fifth of the side of a square or the long side of a rectangular brick. The durability of baked bricks is in direct proportion to the degree of firing. Unburned brick - strongly collapses under the influence of frost, salt, dampness and wind. Brick of normal degree of firing - better resists the action of salts, but being in the zone of capillary suction of moisture, in the absence of insulation, collapses. Burnt brick – well preserved everywhere. Brickwork, as well as individual bricks, is destroyed

under the influence of moisture freezing in the pores, rain and snow thrown by the wind (for example, destruction on the western side of the cone-shaped trunk of the Burana tower).

Mass production and improvement of brick production technology contributed to the development of its decorative and artistic capabilities in the development of the plane of the walls and architectural details. A historical review of the «brick style» of Samanid and Karakhanid architecture shows the desire of medieval masters to an inextricable unity of the constructive, artistic and aesthetic qualities of brickwork. he considered architectural monuments, which simultaneously arose in different parts of the Central Asian region, the Samanid period (*the Samanid mausoleum, the Arab-Ata mausoleum, the Mir-Said-Bahram mausoleum, the Talkhatan Baba mosque, the Khoja Mashhad madrasah*) and the Karakhanid period (*Burana tower, Kalyan minaret, Minaret al-Hadba, the Middle Mausoleum in Uzen, etc.*) testify to the virtuoso use of a simple material – burnt brick - to create an impressive patterned, ornamental-relief surface of the facades.

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## Орталық Азиядағы «кірпіш стилінің» өркендеуі

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**Аңдатпа.** Мақалада Орта Азия архитектурасын қабылдаудың эстетикалық ерекшеліктерін анықтайтын «кірпіш» стилі ұсынылған. «Кірпіш» стилінің өркендеуі IX-XII ғасырлардағы Саманидтер мен Қараханидтер әулеттерінің тұсына келеді. Зерттеудің мақсаты-Саманидтер мен Қараханидтердің «кірпіш» стилін қалыптастыру әдістерінің генезисі мен эволюциясын анықтау. Осы мақсатқа сүйене отырып, келесі міндеттер шеңбері анықталады: біріншіден, исламға дейінгі кезеңде Орта Азияда күйдірілген кірпішті қолдануды еркін талдау; екіншіден, Саманидтер архитектура-сындағы құрылымдық және сәндік құрылымның интеграциясын талдау; үшіншіден, сол кездегі сәндік кірпіш қалаудың тәсілдері мен тәсілдерін анықтау; төртіншіден, Қараханид кезеңінде күйдірілген кірпіштен қалауды пайдалану тәсілдері. IX-XII ғасырлардағы Орта Азия сәулетінде күйдірілген кірпіштің конструктивті, сәулеттік және сәндік жақтарының синкреттік сипатына назар аударылады. Күйдірілген кірпіштен өрнектелген өрнектелген қалаумен орындалған Орта Азияның ортағасырлық бірегей сәулет ескерткіштерін сақтау мәселелері көтеріледі. Орталық Азия өңіріндегі экологиялық жағдайдың нашарлауына байланысты құрылыс материалдарын, атап айтқанда күйдірілген кірпішті бұзу проблемасы атап өтілді.

**Негізгі сөздер:** күйдірілген кірпіш, кірпіш стилі, сәндік декор, қалау түрлері, кесене, портал-пейштак.

## Расцвет «кирпичного стиля» в Центральной Азии

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**Аннотация.** В статье представлен «кирпичный» стиль, определивший эстетические особенности восприятия архитектуры Средней Азии. Расцвет «кирпичного» стиля приходится на период правления династий Саманидов и Караха-



нидов – IX-XII вв. Цель исследования - определить генезис и эволюцию приемов формирования «кирпичного» стиля Саманидов и Караханидов. Исходя из этой цели, определяется следующий круг задач: во-первых, беглый анализ использования жженого кирпича в Средней Азии в доисламский период; во-вторых, анализ интеграции конструктивной и орнаментальной структуры в архитектуре Саманидов; в-третьих, определение приемов и приемов декоративной кирпичной кладки того времени; в-четвертых, приемы использования фигурной кладки из жженого кирпича в караханидский период. Акцентируется внимание на синкретическом характере конструктивной, архитектурной и декоративной сторон жженого кирпича в зодчестве Средней Азии IX-XII вв. Описана роль жженого кирпича в строительстве минаретов, монументальных башенных сооружений исламской архитектуры. Поднимаются вопросы сохранения уникальных архитектурных памятников Средневековья Средней Азии, выполненных орнаментальной узорчатой кладкой из жженого кирпича. Подчеркнута проблема разрушения строительных материалов, в частности жженого кирпича, из-за ухудшения экологической ситуации в Центрально-Азиатском регионе.

**Ключевые слова:** *жженный кирпич, кирпичный стиль, орнаментальный декор, виды кладок, мавзолеей, портал-пейштак.*

Received: 20 April 2024

Accepted: 15 September 2024

Available online: 30 September 2024