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GENESIS OF THE PLANNING STRUCTURE AND CEILINGS OF DUNHUANG SANCTUARIES

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Abstract

The article is devoted to the study of the genesis of the plans and ceilings of the Dunhuang cave sanctuaries. Based on the methods of graphic-and-analytical, defining features and system-structural analysis, the spread of types of plans and ceilings from dynasty to dynasty has been traced. With the help of a group of auxiliary methods of historical analysis, mathematical analysis and comparative analysis, a general picture of the development of the floating structure and constructive schemes of the Dunhuang sanctuaries from the Northern Liang period to the Yuan period was created. By counting the types of plans and ceilings in each period, a group of the most common types of plans was determined: with a combination of larger and smaller rectangles (where the smaller is the altar part of a square or rectangular shape), a plan in the form of a square with a protruding trapezoidal altar, an altar in outline close to a rectangle or trapezoids with rounded corners, a horizontally elongated plan rectangle, based on squares with protrusions. The most common type of ceilings is fu-dow-din with modifications.

Keywords*: China; Dunhuang; cave plan; ceiling; genesis*

Introduction

The Dunhuang cave complex is a monument of world importance. Despite the fact that it is sufficiently widely covered in scientific and popular literature, there is even a "Virtual Dunhuang", but there are aspects that require clarification and deeper study. One such aspect is the study of the genesis of the plans and ceilings of cave sanctuaries, beginning with the Northern Liang period and ending with the Yuan dynasty. The task of the study was to trace the development and outspread of plan and ceiling types over time, from dynasty to dynasty, to identify the most common and less common types of plans, and to determine the place of Dunhuang sanctuaries in the general series of similar complexes in China.

The Tang era was marked not only by the maximum flowering of Dunhuang cave sanctuaries, which was expressed in a variety of plans, structures, and means of artistic expression. This was the heyday of other unique cave sanctuaries, such as the Longmen Caves

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in eastern China, which in 2000 were included in the UNESCO World Register. Just as the cave sanctuaries of Dunhuang are famous for their wall paintings, the 300 Longmen Caves are famous for their sculptures and bas-reliefs carved into the one-kilometre-long rock slope. Unlike the Dunhuang Caves, which are hidden in the thickness of the rock massif, the Longmen Caves are open to the outside, in fact, they are facade three-dimensional images, so instead of wall paintings, sculpture, mostly on a large scale, is used.

A comparison of the Dunhuang and Longmen complexes proves the following:

– the Dunhuang complex was formed from the Northern Liang period to the Yuan period, that is, it is characterized by multi-style and diversity, including in plans, the Longmen complex also began to form in the Northern Wei period, but most of the sanctuaries are dated to the Tang period, therefore, there is no such diversity;

– the number of sanctuaries in Dunhuang is much greater (735), in Longmen there are 300 of them;

– in Dunhuang, all the sanctuaries are closed in the thickness of the rock, in Lunmen they are open, with facades, therefore, they have a different layout and sculpture is used instead of wall paintings (Figs. 1 and 2).

Fig. 1. Facade of the Dunhuang complex. Source: https://en.wikipedia.org/wiki/Mogao_Caves#/media/File:Dunhuang_Mogao_Ku_2013.12.31_12-30-18.jpg

Fig. 2. Longmen Caves. Budda Vairocana, 672–675.

To achieve the objectives of researching the planning structure of the Dunhuang sanctuaries, the following sources were involved:

1) publications that cover the general aspects of monument protection activities and the preservation of the so-called "memory of a place" [3-6];

2) articles, the topic of which is the influence of modern urban processes on the state of preservation of monuments [7];

3) publications in which the aspect of "object – environment" interaction is raised [8];

4) articles of the restoration direction [9, 10];

5) foreign publications devoted to Dunhuang [11-13];

6) Chinese publications dedicated to Dunhuang [1, 2, 14-18].

The purpose of the article, which is part of a larger study of Dunhuang sanctuaries and covers only one aspect, is as follows:

– with the help of only one accepted defining characteristic – the geometry of the form – to systematize the plans of sanctuaries and types of ceilings,

– by applying the method of system-structural analysis, determine the basic types of plans and ceilings and the subtypes formed on their basis;

– to analyse the types of plans and ceilings according to the chronology of the dynasties, proving which periods became the periods of the maximum variety of types of plans and ceilings, which types of plans and ceilings appeared, and which disappeared, and based on this to present a general picture of the genesis of the plans and ceilings of the Dunhuang sanctuaries.

Materials and methods

The set research tasks determined the choice of general scientific research methods. Among them, three are the main ones: this is the graphic-and-analytical method, the method of defining features, and the method of system-structural analysis.

The graphic-and-analytical method is the basic basis of the study, as it involves the analysis of dimensional drawings of sanctuaries.

The second basic method was the method of defining features, when plans and overlaps were analysed according to one and the same criterion – the geometry of the form. In passing, we note that the disadvantage of the existing classifications is that different indicators are analysed in one row, for example, "square cave" and "cave with a sculpture". The presented classification removes this shortcoming.

The third basic method, which logically complements the previous ones, is the system-structural analysis method, because only it makes it possible to maximally summarize and systematize by types and subtypes 309 main out of 735 plans of sanctuaries and their overlaps.

A group of auxiliary methods was also used, including: the method of historical analysis, the method of mathematical analysis, and the method of comparative analysis.

The method of historical analysis made it possible to impose a certain chronology on the graphic-and-analytical part and to argue the specifics of the genesis of the planning structure and types of ceilings from dynasty to dynasty. The method of mathematical analysis made it possible to analyse changes in the geometry of forms within types. The method of comparative analysis made it possible to trace the processes of changes in the types of plans and ceilings and their distribution over time.

All these methods combined allowed to create a well-argued picture of the genesis of the plans and ceilings of the Dunhuang sanctuaries.

Results and discussion

Types of Dunhuang sanctuaries' plans

The analysis of the figurative concept of the interiors of the sanctuaries of the Dunhuang complex includes the systematization of the plans of the grottoes, as this precedes the study of the specifics of the location of the works of art on the planes and in the space of the sanctuaries.

Between the main sanctuary and the so-called vestibule was a special yundao corridor, which was covered with thematic paintings depicting Buddhist historical sites, ornaments, and portraits. In the presented study, the main attention is paid to the layout of the main room itself, the actual sanctuary with the altar since it is here that the main concentration of wall paintings and sculptures is located. A sanctuary is a closed room with one or more entrances, one of which is the main entrance. This room has a ceiling, walls, floor, and sometimes a central column. Often the size of gigantic sculptures (such an example is the so-called "Nirvana Cave" of the Tang era) dictated a radical change in the plan of the cave (Figs. 2-4).

Fig. 3. Buddha Nirvana. Cave 158 with concave side walls, Early Tang period

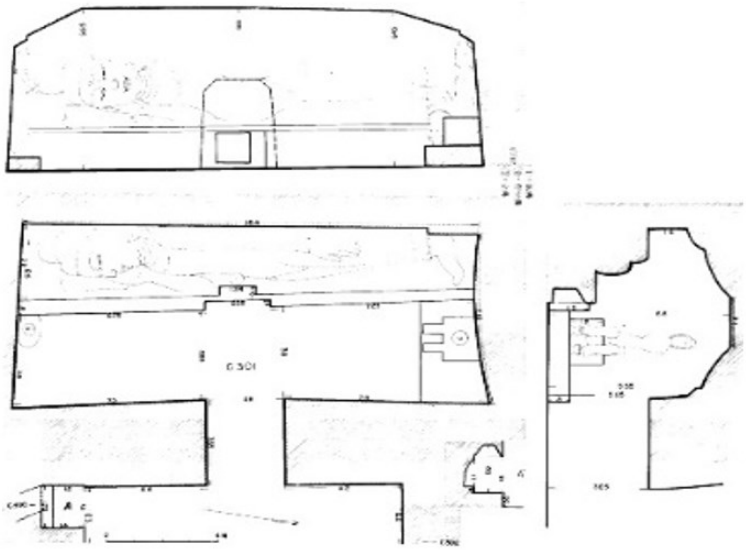

Fig. 4. Cave 158. Plan and sections [1]

The presence of a central column in the layout is characteristic of the Northern Wei period, the Tang period was marked by the presence of a niche in the centre, from the Early Tang to the Late Tang there was a transformation of the central altar itself, which was originally in the centre of the room in the form of a niche, and later was located behind, on the western wall and this tradition passed into the Song period and the Five Dynasties Era.

The thematic location of the murals, the so-called "scenario approach" is directly related to the layout of the premises, where the main role is traditionally assigned to the western wall, opposite the entrance, where the main Buddha statue is located. The script approach involves placing large subjects on the south and north walls, and on the east wall with the main entrance on both sides, less important images are placed (Fig. 5).

Fig. 5. Central Buddha altar, Mogao, Cave 85

The planning of cave sanctuaries from different periods of Dunhuang's existence was analysed. In order to derive a certain regularity regarding the most and least common types of sanctuaries, they were applied according to the system-structural analysis, applying a hierarchical distribution at the level (0,1,2,3... levels). Accordingly, separate subgroups based on a certain subtype of the plan were allocated in each group. Components of level 0 consist of smaller components of level 1, components of level 1 – from components of level 2, etc.

This division of plan types by hierarchical levels opens up the following opportunities for analysis and conclusions:

– considering that there are 735 such grottoes, and each one has its own plan, it is necessary to identify possible types of plans, determining the most and least common ones;

– it is necessary to identify the types of plans that are replicated many times;

– possible variations should be identified within each type of plan;

– in the case of atypical forms of the plan, to argue what caused it.

1. Classification at 0 aggregated level:

A – symmetrical plans;

B – non-symmetrical plans.

The quantitative ratio of symmetric and asymmetric sanctuary plans, as well as existing subtypes and variations within these enlarged two types, proves the multiple predominance of symmetric plan types. Although asymmetric types of plans are found, they are not typical. This fully corresponds to the religious doctrines of both Buddhism and, by the way, Taoism, where orderliness, hierarchy and logical change of phenomena were considered the basis of the universe and world harmony. It can be assumed that the orderly layout of sanctuaries combined with the logical unfolding of canonical plots on the walls also confirmed the harmony and logic of Buddhism.

2. Classification of plans at 1 level:

A1 – plans based on squares and rectangles;

A2 – plans based on a combination of a square and faceted and curved parts;

A3 – plans with sloping side walls.

3. Classification of plans on 2 levels.

The most numerous is the group of plans based on squares and rectangles. This group of plans can be divided into the following subtypes:

A1.1 – based on one square;

A1.2 – based on two rectangles, one or two of which is a square;

A1.3 – based on squares with protrusions;

A1.4 – based on a rectangle;

A1.5 – based on a combination of squares and rectangles.

4. Classification of plans on 3 levels.

Plans of subtype A1.1 based on one square are basically of the same type.

Plans of subtype A1.2 based on two rectangles, of which one or two are square, are more varied, as the altar part can be square or rectangular in plan. There are two smaller subtypes:

A1.2.1 – with a combination of larger and smaller rectangles (where the smaller one is a square or rectangular altar part);

A1.2.2 – with a combination of rectangles close in size, as a rule, a square central part and a rectangular altar.

Subtype A1.2.1 is dominant and quite typified. Subtype A1.2.2 is atypical.

Plans of subtype A1.3 – based on squares with protrusions, where the main space is square in plan, and the altar part is solved by two protrusions, rectangular in plan, is atypical compared to subtypes A1.1 and A1.2. Plan options of subtype A1.3 are of the same type.

Plans of subtype A1.4 are even more atypical – based on a rectangle. This subtype is presented in two variations:

A1.4.1 – an elongated in the depth of the cave rectangle plan;

A1.4.2 – an elongated perpendicularly to the cave entrance axis rectangle plan.

At the same time, elongated in the depth of the cave rectangle plans dominate among this subtype.

The group of plans of subtype A1.5 is also atypical – based on a combination of squares and rectangles, where rectangular side volumes are added to the square of the main space.

A group of plans based on a combination of square and faceted and curvilinear parts of A2 is also divided into the following hierarchical levels of subtypes.

5. Classification of plans on 2 levels:

A2.1 – with a trapezoidal altar;

A2.2 – with a curvilinear altar;

A2.3 – with several niches.

6. Classification of plans on 3 levels.

Level 2 components include level 3 components.

So, plans with a faceted altar are divided into three subtypes:

A2.1.1 – plan in the form of a square with a projecting trapezoidal altar;

A2.1.2 – a plan in the form of a rectangle elongated in depth cave or perpendicular to the axis of the entrance to the cave with a projecting trapezoidal altar;

A2.1.3 – plan in the form of a square with a less protruding trapezoidal altar.

Analysis of the types of plans for the distribution of certain types proved the following:

– in type A2 – the predominance of types of plans with a faceted altar based on a combination of a square and a trapezoidal projecting altar (Subtype A2.1.1).

Type A2.2 – with a curvilinear altar is structured in the same way. Type A2.2 is divided into 2 levels into the following subtypes:

A2.2.1 – based on a square and a projecting curvilinear altar;

A2.2.2 – based on a square and a strongly projecting curvilinear altar;

A2.2.3 – based on combined forms.

7. Classification of plans on 4 levels.

Level 3 components include level 4 components.

Thus, A2.2.1 – on the basis of a square and a projecting curvilinear altar is divided into:

A2.2.1.1 – the outline of the altar is close to a rectangle or a trapezoid with rounded corners;

A2.2.1.2 – egg-shaped altar.

The number of options for caves with altars in outlines close to a rectangle or trapezoid with rounded corners and an egg-shaped shape is approximately the same.

8. Classification of plans on 2 levels.

Plans of type A3 with the slope of the side walls are divided into the following components of level 2:

A3.1 – with the expansion of the space to the altar;

A3.2 – with a narrowing of the space to the altar;

A3.3 – with concave side walls.

Since the adoption of plans with sloping side walls is less common, it has correspondingly fewer varieties at the next hierarchical levels. At the same time, among subtypes A3.1, A3.2 and A3.3, subtype A3.1 is relatively more common. This logically follows from the principles of internal space layout with the effect of expanding the space towards the main element.

Systematization and genesis of the plans of the Dunhuang sanctuaries

An overview of the existing types of sanctuary plans made it possible to formulate the following conclusions.

Predominant are sanctuaries symmetrical in plan. Plans in the form of one square predominate quantitatively, with a combination of larger and smaller rectangles (where the smaller is the altar part of a square or rectangular shape), based on a square with a projecting trapezoidal altar, based on a square and a strongly projecting curvilinear altar, a common method of expanding the room in the direction to the altar by a slight slope of the side walls. Plans based on a rectangle, with concave side walls, with a large number of side extensions to the main square of the plan, with a narrowing of the space towards the altar by sloping walls are atypical.

In type A2, there are plans based on a combination of a square and faceted and curved parts – a predominance of types of plans with a faceted altar based on a combination of a square and a trapezoidal projecting altar (Subtype A2.1.1).

A separate question for future research is the question of what caused the atypical shape of cave sanctuaries, for example, with side walls curved inward, with a large number of side extensions to the square of the central room, etc.

Certain judgments can be obtained by determining the number of caves of each type and subtype in each period.

A total of 19 caves are marked on the basis of one square. Of these, there are none in the Northern Liang and Northern Wei periods, one cave (No. 435) in the Western Wei period, two

caves (No. 442, 461) in the Northern Zhou period, Sui period two caves (No. 244, 281), Early Tang four caves (No. 75, 76, 211, 333), Golden Tang two caves (No. 319, 460), in the Late Tang period, three caves (No. 161, 196, 237), in the Five Dynasties, two caves (No. 61, 261), in the Northern Song period, three caves (No. 55，233，234), in the Xi Xia and Yuan periods, this type of plan of cave sanctuaries was not noted.

Thus, the one-square-based type of cave plan originated in the Western Wei Dynasty, became most widespread in the Tang Dynasty, and ended in the Song Period.

The type of plan with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape) – a total of 87 caves were recorded (Fig. 6).

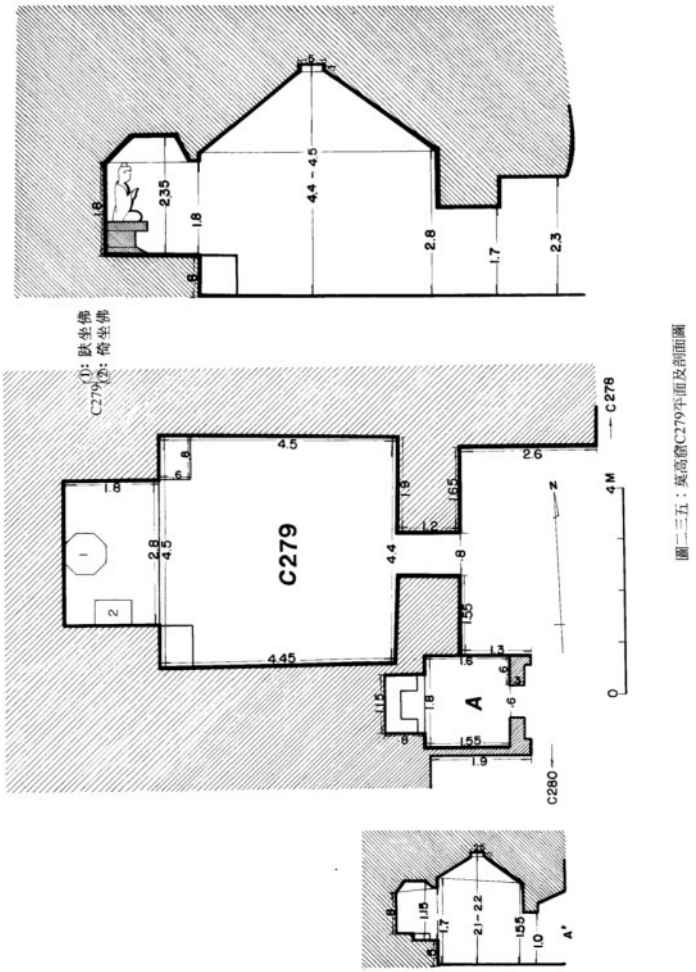

Fig. 6. A type of plan with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape). Cave 199, Golden Tang period [1]

There are two of them in the Northern Liang periods (No. 268, 272), in the Northern Wei, Western Wei, and Northern Zhou periods there are none, in the Sui period there are thirteen (Nos. 59，235，266，289, 376, 378, 379, 400, 418, 419, 423, 424, 425), in the period of Early Tang there are seventeen of them (No. 112, 155, 162, 164, 169, 170, 207, 231, 238, 240, 358，359，360，363，367，368，369), in the Golden Tang period there are eight of them (No. 79，

91，113，124，171，188，194，199), in the Late Tang period there are thirty-six (No. 12, 18, 19, 20, 23, 29, 35, 70, 81, 92, 93, 97, 111, 121, 126, 127, 128, 132, 133, 136, 141, 142, 143, 144, 145, 147, 150, 151, 156, 159, 192, 230, 232, 237, 258, 459), in the period of Tang Dynasty 1 (No. 344) (the exact time cannot be given), in the Five Dynasties era there are four of them (No. 5，72，99，100) in the Northern Song period there are two (No. 25，356), in the Xi Xia period there are two (No. 87，327), in the Yuan period there are two (No. 1, 3).

This type of plan originally appeared in the Northern Liang period, and was absent in the Northern Wei, Western Wei, and Northern Zhou periods. The peak of the development of the type of plan with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape) falls on the period of the Tang Dynasty, and then it is used less and less. This is one of the most common types of Mogao Dunhuang grotto plans.

A plan with a combination of rectangles close in size, as a rule, a square central part and a rectangular altar is found in 2 caves of the Late Tang periods – one (No. 229) and Xi Xia– one (No. 326).

Plan based on squares with ledges have 26 cave sanctuaries. In the Northern Liang, Northern Wei, Western Wei, and Northern Zhou periods, this type of plan is not found. In the Sui period - seventeen caves (No. 282, 310, 314, 315, 380, 389, 392, 397, 402, 404, 407, 409, 411, 412, 413, 414, 415), in the Early period Tang four caves (No. 204，322，361，390), in the Golden Tang period this type of plan is not found, in the Late Tang two caves (No. 7，15) in the era of Five Dynasties are not found, in the Northern Song period there are two caves (No. 449, 452), in the Xi Xia and Yuan periods they are not found, in the Qing period – one cave (No. 228).

So, the type of plan based on squares with protrusions is quite common, it arose and developed during the Sui dynasty, and appeared in small quantities during the Tang and Northern Song dynasties. One cave was rebuilt during the Qing Dynasty.

5. The elongated into the depth of the cave rectangle of the plan – 27 caves. In the Northern Liang period, it is absent, in the Northern Wei period – seven caves (No. 248, 251, 254, 257, 260, 263, 265), in the Western Wei period – two caves (No. 288, 432), in the Northern Zhou period – one cave (No. 428), in the Sui period – four caves (Nos. 292, 303, 313, 427), in the Early Tang and Golden Tang there are none, in the Late Tang there are six caves (No. 9, 16, 76, 85, 94, 138), in the Five Dynasties Era there are four caves (No. 4, 98, 108, 146), in the Northern Song period – one cave (No. 256), in the Xi Xia period there are none, in the Yuan period – two caves (No. 2, 95).

The type of elongated into the depth of the cave rectangle plan appeared and developed during the Northern Wei dynasty and was then found in all dynasties except Xi Xia.

The elongated perpendicularly to the axis of the cave entrance rectangle of the plan is fixed in 4 caves. This type does not exist in the Northern Liang, Northern Wei, Western Wei, Northern Zhou, Sui periods. In the period of Early Tang – two caves (No. 365, 371), there are none in the periods of Golden Tang, Late Tang, Five Dynasties, Northern Song, Xi Xia. In the Yuan period – one cave (No. 463).

Therefore, two caves with a plan in the form of an elongated perpendicularly to the axis of the cave entrance rectangle were in the early Tang Dynasty, one cave in the Yuan Dynasty, and one cave (No. 149) is unattributed by time.

4 caves have a plan type based on a combination of squares and rectangles. In the Northern Liang period, there is one cave (No. 275), in the Northern Wei, Western Wei, Northern Zhou periods this type is not found. In the Sui period – three caves (No. 381, 401, 420), all subsequent periods of the Early Tang, Golden Tang, Late Tang, Five Dynasties, Northern Song, Xi Xia and Yuan is not found.

This type of plan, based on a combination of squares and rectangles, appeared in the Northern Liang Dynasty, and was found in the Sui period.

The plan in the form of a square with a projecting trapezoidal altar is very common and noted in 35 caves. This plan is not found in the Northern Liang, Northern Wei, Western Wei, Northern Zhou periods. In the Sui period – two caves (No. 206, 388), in the Early Tang period – seven caves (No. 202, 212, 220, 338, 339, 342, 445), the Golden Tang – twenty-three caves (No. 26, 65, 74, 83, 84, 109, 115, 116, 120, 122, 125, 165, 166, 172, 176, 182, 185, 201, 208, 217, 218, 328, 347), Late Tang – three caves (No. 30，107，444), in the Five Dynasties, Northern Song, Xi Xia and Yuan periods this type does not occur.

The plan type in the form of a square with a projecting trapezoidal altar is the second most common type, which originated in the Sui dynasty, developed in the Tang dynasty, and did not appear in subsequent eras.

5 caves have a plan in the form of a vertically or horizontally elongated rectangle with a protruding trapezoidal altar. This type is not found in the Northern Liang, Northern Wei, Western Wei, Northern Zhou periods. In the Sui period – one cave (No. 243), in the Early Tang period – two caves (No. 186, 446), in the Golden Tang period – one cave (No. 88), in the Late Tang period is not found, in the Five Dynasties era – one cave (No. 68), in the following Northern Song, Xi Xia and Yuan eras it is not found.

The type of plan in the form of a rectangle elongated in depth of the cave or perpendicular to the axis of the entrance to the cave with a projecting trapezoidal altar appeared in the Sui, Tang, and Five Dynasties, but did not appear in subsequent eras.

A plan with several niches is noted in 11 caves (Fig. 7). This type of plan is not found in the Northern Liang period, in the Northern Wei period – one cave (No. 259), in the Western Wei period – one cave (No. 285), in the Northern Zhou period this type does not exist, in the Sui period – two caves (No. 302, 305), in the Early Tang period, the type is not found, in the Golden Tang period – seven caves (No. 39, 148，223，225，353，384，450), in the following periods – Late Tang, Five Dynasties, Northern Song, Xi Xia and Yuan – the type is not meets

The multi-niche plan type appeared in the Northern Wei Dynasty, developed in the Tang Dynasty, and did not appear in subsequent eras.

The type of plan with the altar, which in outline is close to a rectangle or trapezoid with rounded corners, has 30 caves. This type of plan is not found in the Northern Liang and Northern Wei periods. In the Western Wei period – one cave (No. 249), in the Northern Zhou period – seven caves (Nos. 294, 296, 297, 299, 301, 438, 440), in the Sui period – five caves (No. 283, 291, 309, 318, 383), in the Early Tang period – seven caves (No. 71, 78, 131, 242, 321, 372, 373), in the Golden Tang period – eight caves (No. 38, 41, 89, 119, 123, 216, 264, 458), in the Late Tang period – one cave (No. 103), in the Five Dynasties era – one cave (No. 69), this type is not found in the Northern Song, Xi Xia and Yuan periods.

The type of plan where the altar is close to a rectangle or trapezoid with rounded corners appeared in the Western Wei Dynasty, developed in the Tang Dynasty, and did not appear again after the Northern Song Dynasty. This type occurred in all eras except the Northern Liang and Northern Wei, Northern Song, Xi Xia and Yuanperiods.

The egg-shaped altar has 4 caves. Not found in Northern Liang, Northern Wei, Western Wei, Northern Zhou, Sui periods. In the period of the Early Tang – one cave (No. 335), in the period of the Golden Tang – three caves (Nos. 27, 45, 49), in the following periods of the Late Tang, the era of Five dynasties, Northern Song, Xi Xia, Yuan are not found.

There are only four caves with an egg-shaped altar and they all date from the Tang Dynasty.

A plan type based on a square and a strongly projecting curvilinear altar is recorded in 19 caves. This type is not found in the Northern Liang, Northern Wei, Western Wei, Northern Zhou, Sui periods. In the Early Tang period – nine caves (No. 329, 331, 334, 340, 341, 374, 375, 386, 387), in the Golden Tang period – nine caves (No. 31, 32，33，34，46，66，180，323,

345), in the Late Tang, Five Dynasties and Northern Song periods this type does not exist, in the Xi Xia period – one cave (No. 351), in the Yuan period there is no such type.

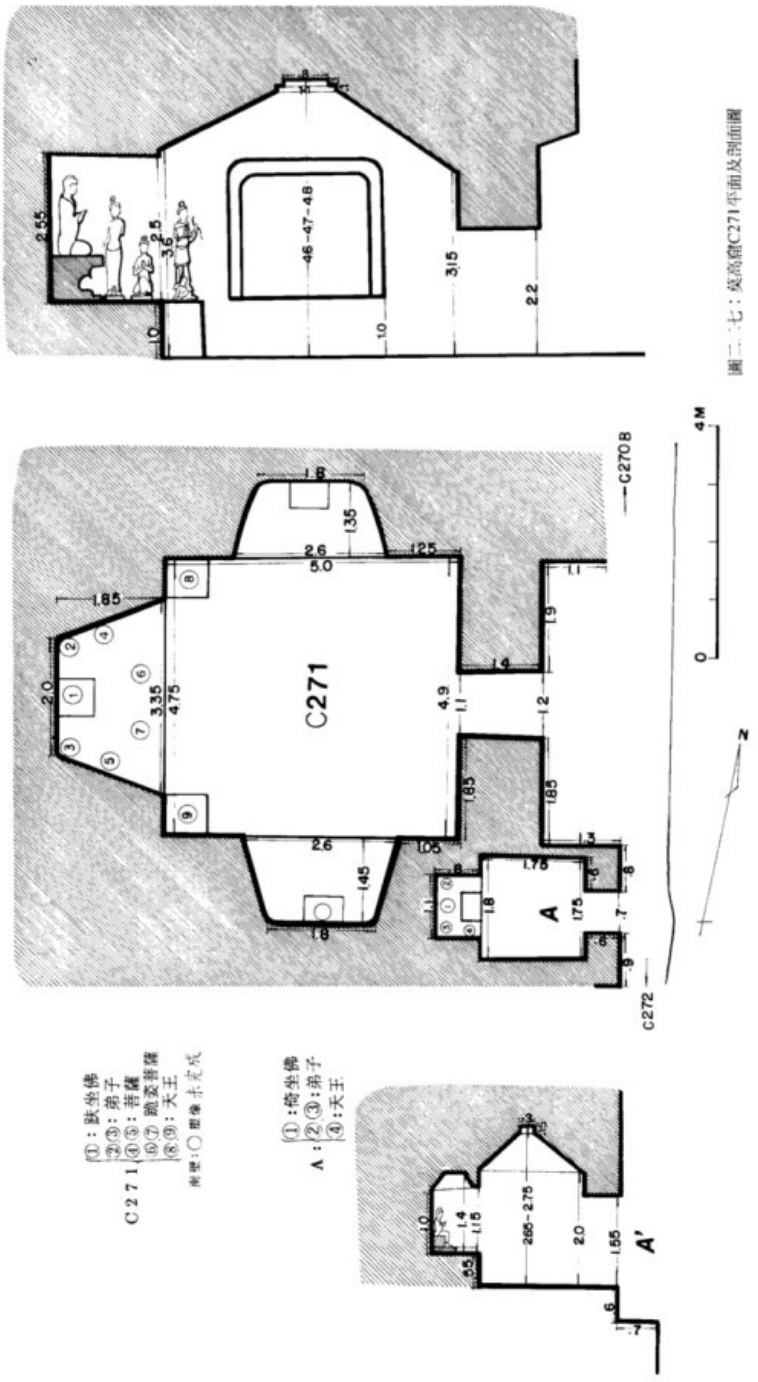

Fig. 7. A type of plan with several niches. Cave 223, Golden Tang period [1]

Therefore, the type of cave plan based on the square and strongly projecting curvilinear altar originated and developed during the Tang Dynasty, and the main plans of this type are dated to this period. Apart from the Tang period, this plan is found in one example in the Xi Xia period.

A plan based on combined forms is not common and is noted in 8 caves. In the Northern Liang, Northern Wei, Western Wei, and Northern Zhou periods, this type does not exist. In the period of Sui – five caves (56, 311, 394, 396, 398), Early Tang – three caves (No. 57, 96, 203), in periods of the Golden Tang, Late Tang, Five Dynasties, Northern Song, Xi Xia and Yuan this type of plan is not noted.

Therefore, a type of plan based on combined forms appeared only in the Sui and Early Tang dynasties.

17 caves have the type of plan with the extension of the space to the altar. In the Northern Liang period, this type does not exist, in the Northern Wei period – two caves (No. 246, 431), in the Western Wei period this type does not exist, in the Northern Zhou period – one cave (No. 290), in the Sui period – one cave (No. 307), in the Early Tang period – two caves (No. 197，448), in the Golden Tang period – two caves (No. 200, 215), in the Late Tang period – five caves (No. 14, 140, 152, 175, 205), in the Five Dynasties era, two caves (No. 6, 22), in the Northern Song period, there is no such type, in the Xi Xia period – one cave (No. 464), in the Yuan – one cave (No. 465).

Thus, the type of plan with the expansion of the space to the altar originated in the period of the Northern Wei Dynasty and took place in other eras besides the Western Wei Dynasty and the Northern Song Dynasty.

The plan with the narrowing of the space to the altar is noted in 5 caves. In the Northern Liang and Northern Wei periods, there is no such type, in the Western Wei period – one cave (No. 437), in the Northern Zhou and Sui periods, this type is absent, in the period of the Early Tang– one cave (No. 366), in the period of the Golden Tang – two caves (Nos. 117, 118), in the periods of the Late Tang and the era of the Five Dynasties this type does not exist, in the Northern Song period – one cave (No. 454), in the Xi Xia and Yuan periods this type does not exist.

So, the type of plan with the narrowing of the space to the altar arose in the period of the Western Wei dynasty, took place in the period of the Tang and Northern Song dynasties.

The plan type with concave side walls has 6 caves. In the Northern Liang, Northern Wei, Western Wei, Northern Zhou, and Sui periods, this type is absent. In the Early Tang period – two caves (No. 158, 332), in the Golden Tang period – three caves (No. 44, 130, 320), in the Late Tang period – one cave (No. 236), in the following periods the era of the Five Dynasties, Northern Song , Xi Xia and Yuan this type does not exist.

Therefore, the type of plan with concave side walls is exclusively of the Tang Dynasty period.

Types of ceilings

The study analysed the presence of certain types of cave ceilings by period. In particular, a chronology of the following types has been established:

1) cave with a ceiling of fu-dou-ding type – this type arose in the early period in the Northern Liang period, developed maximally into a dominant type in the middle period, and remained dominant until the end of the Yuan dynasty. Several of its subtypes are distinguished:

– with a fu-dou-ding ceiling without any additional elements (Fig. 8);
– with a fu-dou-ding ceiling, with a column;
– with a fu-dou-ding ceiling and niches;
– with a fu-dou-din ceiling with a flat part at the top at the back.

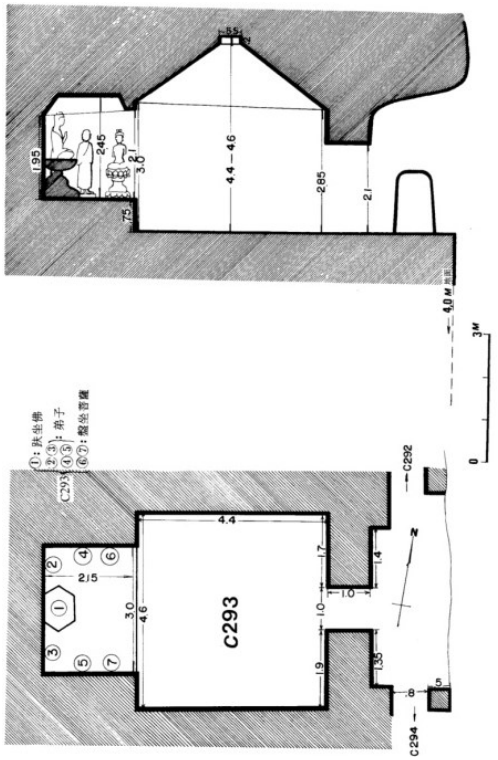

Fig. 8. A cave with a fu-dou-ding ceiling. Palace Cave 171, Golden Tang period [1]

2) a cave with a flat part at the top:

– with a flat part at the top without additional elements (appears in the Middle Tang period, Yuan period) (Fig. 9);

– with a flat part at the top and with niches (appears in Northern Liang, atypical, later disappears),

– with a flat part at the top and with a central column;

3) a cave with a wedge-shaped ceiling:

– a cave with a wedge-shaped ceiling (appears in the Northern Zhou period, disappears after the Early Tang period);

– a cave with a wedge-shaped ceiling and a central column (appears in the Northern Wei era, exists in the Western Wei, Northern Zhou, Sui era, disappears after the Early Tang era) (Fig. 10);

– a cave with a wedge-shaped ceiling, with a central column and niches (appears in the Northern Wei era, disappears after the Middle Tang era);

4) a combination of the first two types of caves:

– a cave with a wedge-shaped ceiling and a flat part at the top (appears during the Northern Zhou, Sui periods);

– a cave with a wedge-shaped ceiling, a flat part at the top and niches (appears during the Northern Wei period);

5) a cave with a vault (appears in the Early Tang period);

6) a cave with an inclined ceiling (appears in the Middle Tang period and later disappears);

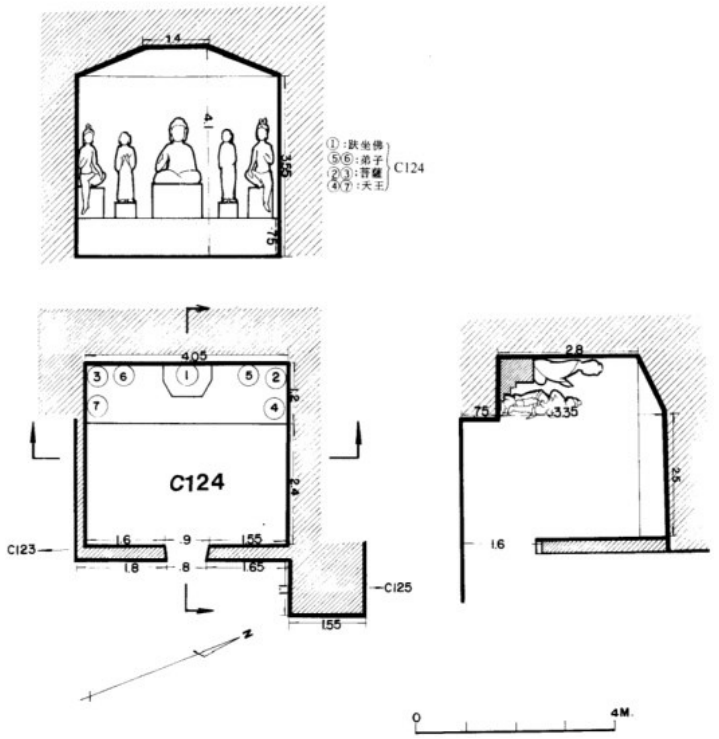

Fig. 9. Cave with a flat part at the top. Cave 319, Golden Tang period [1].

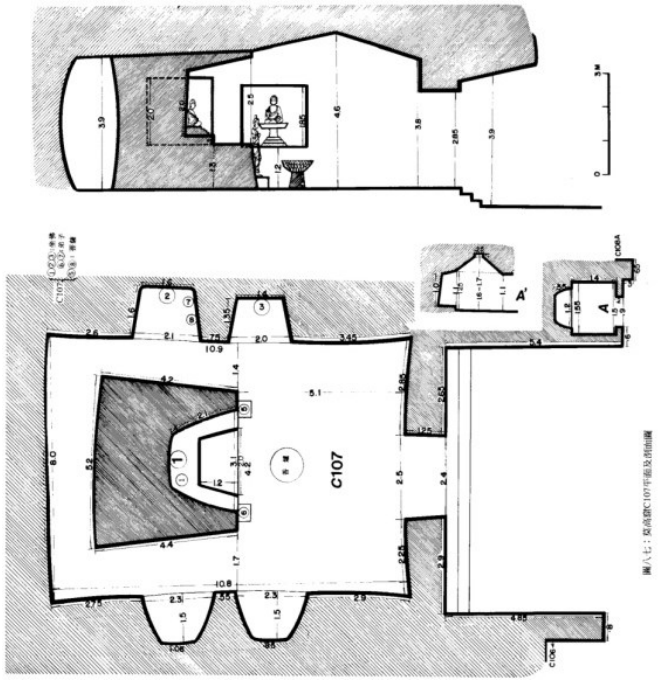

Fig. 10. A cave with a wedge-shaped ceiling and a central column. Cave 44, Golden Tang period [1]

7) a cave with a convex ceiling:

– a cave with a convex ceiling without additional elements (appears in the Early Tang, atypical, later disappears),

– a cave with a convex ceiling and niches (North Liang, atypical, later disappears);

– a cave with a flat part at the top (appears in Late Tang, atypical, later disappears).

The distribution of ceiling types by periods of dynasties is as follows.

Early period Northern Liang – 3 caves:

1 cave with a fu-dou-ding ceiling (in the form of a bucket);

1 cave with a flat top and niches (not found later);

1 cave with a convex top and niches (not found later).

Northern Wei – 10 caves:

(new type) 1 cave with a flat top and a central column;

(new type) 7 caves with a wedge-shaped ceiling and a central column;

(new type) 1 cave with a wedge-shaped ceiling and with a central column and niches;

(new type) 1 cave with a wedge-shaped ceiling and flat top and niches (not found later).

Western Wei – 6 caves:

1 cave with a fu-dou-ding ceiling;

4 caves with a wedge-shaped ceiling and a central column;

(new type) 1 Cave with Fu Dou Ding ceiling and niches.

Northern Zhou – 9 caves:

6 caves with a fu-dou-ding roof;

2 caves with a wedge-shaped ceiling and a central column;

(new type) 1 cave with a wedge-shaped ceiling and a flat part at the top;

(new type) 1 cave with a wedge-shaped ceiling.

Therefore, the early types of overlaps from the Northern Liang Dynasty to the end of the Northern Zhou Dynasty are as follows:

– a cave with a fu-dou-ding ceiling (in the form of a bucket);

– a cave with a flat top and niches;

– a cave with a convex top and niches;

– a cave with a flat top and a central column;

– a cave with a wedge-shaped ceiling and a central column;

– a cave with a wedge-shaped ceiling and a central column and niches;

– a cave with a wedge-shaped ceiling and a flat top and niches;

– a cave with a wedge-shaped ceiling and a flat part at the top;

– a cave with a fu-dou-ding ceiling and niches.

Middle period (flourishing period)

Sui– 52 caves

31 caves with fu-dou-ding ceiling;

4 caves with a wedge-shaped ceiling and a central column;

6 caves with a wedge-shaped ceiling and a flat top (not found later);

3 caves with a wedge-shaped ceiling;

(new type) 2 caves with fu-dou-din ceiling and niches;

Early Tang – 63 caves:

57 caves with a fu-dou-ding ceiling;

1 with a wedge-shaped ceiling and a central column (not found later);

2 caves with a wedge-shaped ceiling (not found later);

1 cave with a flat top and a central column;

(new type) 1 cave with a vault;

(new type) 1 cave with an inclined ceiling (not found later);

(new type) 1 cave with convex ceiling (not found later).

Golden (Middle) Tang – 71 caves:

61 caves with a fu-dou-ding ceiling;

6 caves with a fu-dou-ding ceiling, with niches;

(new type) 1 cave with a flat part at the top;

2 caves with a wedge-shaped ceiling, with a central column and with niches (not found later);

1 cave with a vault (not found later);

Late Tang – 54 caves:

50 caves with overlapping fu-dou-ding;

(new type) 3 caves with a fu-dou-ding ceiling, with a column;

(new type) 1 sloped roof cave (not found later).

The types of ceilings of the middle period (the flourishing period) from the Sui dynasty to the end of the Late Tang dynasty are as follows:

– a cave with a fu-dou-ding ceiling (in the form of a bucket) – the dominant;
– a cave with a fu-dou-din ceiling and niches;
– a cave with a wedge-shaped ceiling;
– a cave with a wedge-shaped ceiling and a central column;
– a cave with a wedge-shaped ceiling and a flat top;
– a cave with a wedge-shaped ceiling, with a central column and with niches;
– a cave with a flat top and a central column;
– a cave with a vault;
– a cave with a convex ceiling;
– a cave with a flat part at the top;
– a cave with an inclined ceiling.

Late period

The era of the Five Dynasties – 15 caves:

12 caves with a fu-dou-ding ceiling;

1 cave with a fu-dou-ding ceiling, with a column (not found later);

2 caves are damaged;

Northern Song – 9 caves:

9 caves with a fu-dou-ding ceiling.

Xi Xia – 6 caves:

5 caves with a fu-dou-ding ceiling;

(new type) 1 cave with a fu-dou-ding ceiling with a flat part at the top at the back (not found later);

Yuan – 6 caves:

4 caves with a fu-dou-ding ceiling;

1 cave with a flat part at the top;

1 cave with a flat part at the top and a central column.

The late period (from the Five Dynasties to the end of the Yuan Dynasty) types of ceilings are as follows:

– a cave with a fu-dou-ding ceiling (remains the dominant type);
– a cave with a fu-dou-ding ceiling, with a column;
– a cave with a fu-dou-ding ceiling, with a flat part at the top at the back;
– a cave with a flat part at the top;
– a cave with a flat part at the top and a central column.

Conclusions

The plans of 309 main caves were analysed in order to structure the types of caves plans according to their distribution. In particular, the types of plans were grouped into three groups:

1) the most common types of plans (from 87 to 26 examples):

– with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape) (87)(Fig. 11);

– plan in the form of a square with a projecting trapezoidal altar (35) (Fig. 12);

– the outline of the altar is close to a rectangle or a trapezoid with rounded corners (30);

– an extended deep into the cave rectangle plan (27) (Fig. 13);

– based on squares with protrusions (26) (Fig. 14);

2) moderately common types of plans (from 19 to 11 examples):

– based on one square (19);

– based on a square and a strongly projecting curvilinear altar (19);

– with the expansion of the space to the altar (17);

– with several niches (11);

3) atypical, less common types of plans (from 8 to 2 examples):

– based on combined forms (8);

– with concave side walls (6);

– with the narrowing of the space to the altar (5);

– a rectangle of plan extended into the depth of the cave or perpendicular to the axis of the entrance to the cave with a projecting trapezoidal altar (5);

– vertically elongated rectangle plan (4);

– based on the combination of squares and rectangles (4);

– egg-shaped altar (4);

– with a combination of rectangles close in size, as a rule, a square central part and a rectangular altar (2).

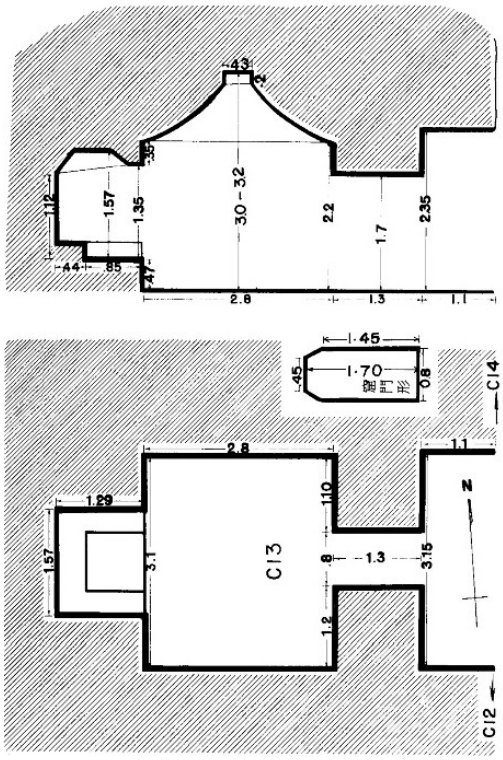

Fig. 11. The most common type of plan with a combination of larger and smaller rectangles, a section of the sanctuary. Cave 147, Late Tang period [1]

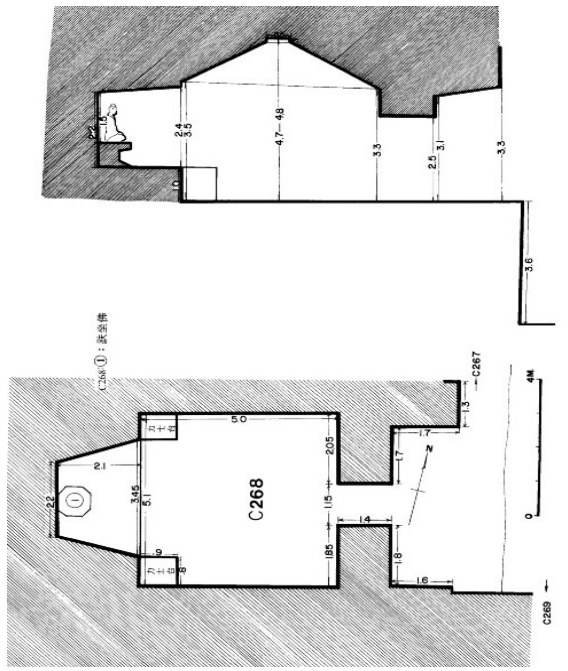

Fig. 12. The type of plan in the form of a square with a projecting trapezoidal altar and section of the sanctuary. Cave 217, Golden Tang period [1]

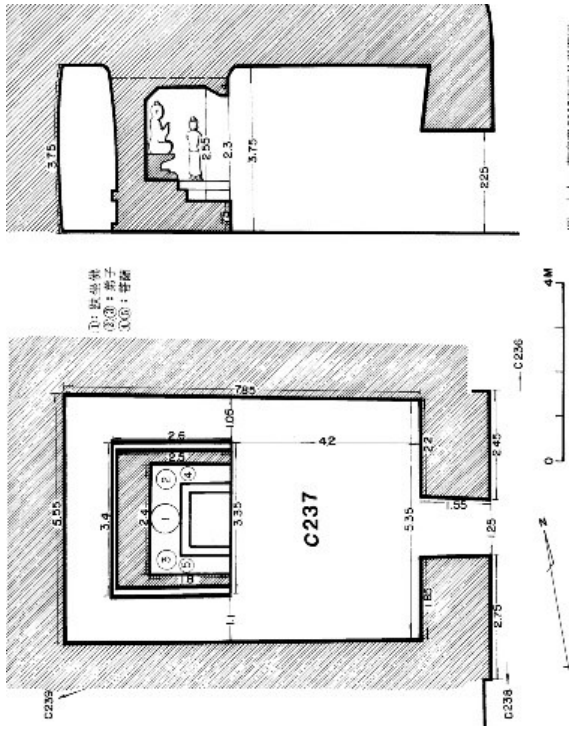

Fig. 13. The type of plan in the form of an elongated into the depth of the cave rectangle and a section of the sanctuary. Cave 265, Northern Wei period [1]

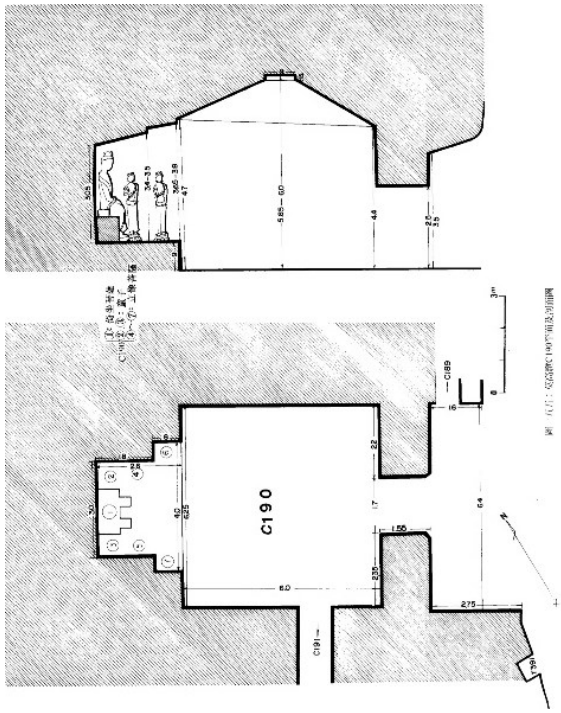

Fig. 14. A type of plan based on raised squares and section of the sanctuary.
Cave 390, Early Tang period [1]

The undoubted dominance of the plan type with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape) has been proven, which is almost three times greater than the following even fairly common types of plans.

Now it is possible to determine the distribution of certain types of caves by period:

1) Northern Liang – (2) with a combination of larger and smaller rectangles (where the smaller one is a square or rectangular altar part, based on a combination of squares and rectangles;

2) Northern Wei – (3) an extended deep into the cave rectangle of plan, with several niches, with an extension of the space to the altar;

3) Western Wei – (5) on the basis of one square, a rectangle of plan extended into the depth of the cave, with several niches, the altar in outline is close to a rectangle or trapezoid with rounded corners, with a narrowing of the space to the altar;

4) Northern Zhou – (4) on the basis of one square, a rectangle of plan extended into the depth of the cave, the altar in outline is close to a rectangle or trapezoid with rounded corners, with the expansion of the space to the altar;

5) Sui – (10) on the basis of one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), on the basis of squares with protrusions, a rectangle of plan extended into the depth of the cave, on the basis of a combination squares and rectangles, a plan in the form of a square with a protruding trapezoidal altar, a rectangle of plan extended into the depth of the cave or perpendicular to the axis of the entrance to the cave with a protruding trapezoidal altar, with several niches, the altar in outline is close to a rectangle or a trapezoid with rounded corners, based on combined forms, with the expansion of the space to the altar;

6) Early Tang – (13) on the basis of one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), on the basis of squares with protrusions, a rectangle of plan extended perpendicular to the axis of the entrance, plan in the form of a square with a protruding trapezoidal altar, the plan in the form of a rectangle extended into the depth of the cave or perpendicular to the axis of the entrance to the cave with a protruding trapezoidal altar, the outline of the altar is close to a rectangle or a trapezoid with rounded corners, an egg-shaped altar, based on a square and a strongly protruding curvilinear altar, based on combined forms, with an expansion of the space to the altar, with a narrowing of the space to the altar, with concave side walls;

7) Golden Tang – (11) on the basis of one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), a plan in the form of a square with a projecting trapezoidal altar, a plan in the form of a rectangle elongated in depth cave or perpendicular to the axis of the entrance to the cave, a rectangle with a protruding trapezoidal altar, with several niches, the altar in outline is close to a rectangle or a trapezoid with rounded corners, an egg-shaped altar, based on a square and a strongly protruding curvilinear altar, with an expansion of the space to the altar, with a narrowing space to the altar, with concave side walls;

8) Late Tang – (9) based on one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), with a combination of rectangles close in size, as a rule, a square central part and a rectangular of the altar, based on squares with protrusions, a rectangle of plan elongated into the depth of the cave, a plan in the form of a square with a projecting trapezoidal altar, the outline of the altar is close to a rectangle or a trapezoid with rounded corners, with an expansion of the space to the altar, with concave side walls;

9) The era of the Five Dynasties – (6) on the basis of one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), a rectangle of plan elongated into the depth of the cave, a plan in the form of an elongated into depth of the cave or perpendicular to the axis of the entrance to the cave rectangle, a rectangle with a protruding trapezoidal altar, the outline of the altar is close to a rectangle or a trapezoid with rounded corners, with an expansion of the space to the altar;

10) Northern Song – (5) on the basis of one square, with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), on the basis of squares with protrusions, a rectangular plan elongated into the depth of the cave, with a narrowing of the space to the altar;

11) Xi Xia – (4) with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), with a combination of rectangles close in size, as a rule, a square central part and a rectangular altar, based on a square and strongly projecting curvilinear altar, with the expansion of the space to the altar;

12) Yuan – (4) with a combination of larger and smaller rectangles (where the smaller one is the altar part of a square or rectangular shape), a rectangular plan elongated into the depth of the cave, a rectangular plan elongated perpendicular to the axis of the entrance to the cave, with an expansion of the space to the altar;

13) Qing – (1) based on squares with protrusions.

The greatest variety of types of plans in the periods of Sui – (10), Early Tang – (13), Golden Tang – (11), Late Tang – (9). The least diversity is in the periods Northern Liang – (2), Northern Wei – (3) in the initial periods and Xi Xia – (4), Yuan – (4) and Qing – (1) in the final periods.

This proves the commonality of the processes of improvement and diversification of layouts and improvement and diversification of wall painting styles. Early periods are characterized by greater primitivism, as are periods of decline. At the same time, wall painting

techniques in the Xi Xia and Yuan periods improved slightly after the decline, and the types of plans did not diversify.

The genesis of the types of cave ceilings of three consolidated periods was also traced: early, middle, and late.

In the early period (from the Northern Liang Dynasty to the end of the Northern Zhou Dynasty), there are 9 types of ceilings: cave with fu-dou-ding ceiling (in the form of a bucket), cave with a flat top and niches, a cave with a convex ceiling and niches, a cave with a flat top and a central column, a cave with a wedge-shaped ceiling and a central column, a cave with a wedge-shaped ceiling and a central column and niches, a cave with a wedge-shaped ceiling and a flat top and niches, a cave with a wedge-shaped ceiling and the flat part at the top, a cave with a fu-dou-ding ceiling and niches.

In the middle (flourishing) period (from the Sui dynasty to the end of the Late Tang dynasty), 11 types of ceilings are found: cave with a fu-dou-ding ceiling (in the form of a bucket) is the dominant type, cave with a fu-dou-ding ceiling and alcoves, a wedge-shaped ceiling cave, a wedge-shaped ceiling cave with central column, a wedge-shaped ceiling cave with flat top, a cave with a wedge-shaped ceiling, with a central column and niches, a cave with a flat top and a central column, a cave with a vault, a cave with a convex ceiling, a cave with a flat part at the top, a cave with an inclined ceiling.

In the late period (decline period) (from the Five Dynasties to the end of the Yuan Dynasty), 5 types of ceilings are noted: a fu-dou-ding ceiling cave (remains the dominant type), a fu-dou-ding ceiling cave with a column, a fu-dou-ding ceiling cave with a flat part at the top behind, a cave with a flat part at the top, a cave with a flat part at the top and a central column.

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