

PHYSICAL GEOGRAPHICAL BACKGROUND OF THE CULTURE OF TRADITIONAL CHINESE RESIDENTIAL ARCHITECTURE

Sha Run(沙润) Shi Gaojun(石高俊) Chu Shaoying(储少莹)

Geographical Science College, Nanjing Normal University, Nanjing 210097, P. R. China

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ABSTRACT: Produced in China's physical environment, traditional Chinese residential architecture is restrained by social factors and adapts itself to the natural economy. Physical geographical environment does not solely shape architectural styles. However, in the self-sufficient economy era, it deeply influenced the culture of traditional Chinese residential architecture. This thesis discusses regional influence of climate on the spatial patterns and styles of residential architecture; it also analyzes the influence of landforms and water systems on architectural landscapes and local housing selections. Geology and botany play another important role in forming local features and improving microenvironment around buildings. With the comprehensive effects of all elements that take climate as the key one, architectural styles differ evidently in various regions. On the above basis, analysis is made to find the view of nature of traditional residential architecture culture with the connotative views of utility, aesthetic perception and ecology. By analyzing the effects of physical geographical factors on China's residential architecture and exploring the natural view in its cultural and spiritual aspects, some enlightenment may be gained to protect ecological environment and realize harmony among man, architecture and environment, thus developing the culture of modern residential architecture with local flavor and characteristics.

KEY WORDS: traditional residential architecture, physical geographical background, natural view

The thesis is to explain the basic factors referring to the traditional Chinese residential architecture basically finalized in the Ming and Qing dynasties in the country's specific physical environment. Restrained by social factors, it adapts itself to the self-sufficient natural economy. It is flexibly designed, reasonably functioned, economically constructed and featured by remarkable local characteristics.

1 INFLUENCE OF CLIMATE ON TRADITIONAL RESIDENTIAL ARCHITECTURE

Ninety percent of China's population inhabits the eastern area within the demarcation joining

Heihe, Heilongjiang Province to Ruili, Yunnan Province, which is dominated by the world's most prominent monsoon climate(Luo *et al.*, 1992). In winter, dry and cold wind blows from the continents at middle and high latitudes, while in summer, wind brings hot and wet climate from the tropical oceans. Such drastically changing climate produces a notable effect on the traditional residential architecture as to its pattern and style. In order to meet the basic needs of ventilation, natural lighting, preventing burning heat and keeping out the cold, people had to build houses at the mercy of local climate due to the limited wealth and technological means in the self-sufficient economic conditions.

1.1 Influence on Spatial Patterns of the Residential Architecture

The eastern part of China extends very long from south to north where the weather strides across tropical, subtropical, temperate and frigid zones. The moderate altitude of the eastern regions enables temperatures to change accordingly. The climatic difference results in corresponding reflection on the patterns of traditional residential architecture. The quadrangle patterns, formed on the basis of Confucianism and patriarchal concepts, can be found almost all over the country (Peng, 1994). In the course of hundreds of years of development since the Ming and Qing dynasties, Beijing quadrangle has become a representative of traditional residential architecture. It is characteristic of a rectangular structure with the northern and southern sides extending rather longer and the front lines of its wing-rooms on both sides not exceeding the sidelines of the principal room (Wang *et al.*, 1994). Apart from the social factors, people tended to adapt this kind of pattern to the latitude of Beijing, thus making full use of the solar light and heat. Beijing, located in North China, has quite a low temperature in winter when the average temperature in January is at least 9°C lower than that of the same latitude areas on the west coast. Winter here lasts over five months, being the longest season of the year, so one of the problems that Beijing people consider first is how to keep out the cold. In Northeast China, due to a smaller incident angle of the sunlight, it is more important to keep out the cold in winter, which lasts more than half a year. Houses have to be built scatteredly in order to maintain a larger space to avoid being shadowed by each other and to receive more solar radiation. Therefore, quadrangle in Northeast China is called "spacious Northeast China Courtyard". The areas of Central and South China lie in the tropical and subtropical regions under the control of the subtropical high pressure in summer so that the high humidity in air may prevent the heat from diffusing. According to an experiment report, people will feel awfully hot when the relative humidity exceeds 70%

with a high temperature over 31°C.

In the river valleys, plains and basins where paddy fields spread, the humidity amounts to 70% – 80% with low wind speed, which contributes to the average temperature over 32°C in the hottest month (Yao *et al.*, 1986). To resist heat and humidness becomes a very first task on construction. As for the patterns, the smaller spaces among buildings produce more shadows, which may shelter the houses from sunlight. As a result, the courtyards of the quadrangle pattern in the subtropical areas are smaller than those in Beijing. Further southward in the tropical areas, there is very long summer instead of winter. Accordingly, quadrangle develops into tiny courtyard (Fig. 1).

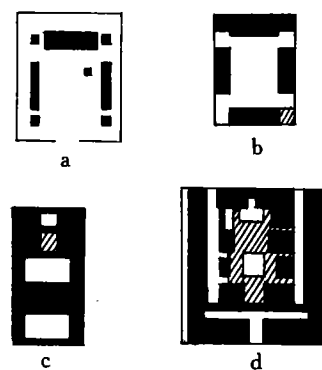


Fig. 1 Layout of quadrangles in Northeast China(a), North China(b), Central China(c) and South China(d)

1.2 Influence on the Styles of Residential Architecture

From the east to the west in China, continental climate appears evident with less rainfall. Therefore, the styles of residential architecture vary to suit such climate. Suppose we can draw a line from the southeastern part of Northeast China to the Yili Valley of Xinjiang to see the difference. In the Changbai Mountain areas, the annual precipitation is 700 – 800 mm. In order to keep out humidness, to drain rainwater, and to lighten snow pressure, houses are designed to stand with double-sloped pointing roofs. Travelling west to the Liaoh Valley and the Liaoxi

Corridor, with an annual precipitation of less than 600mm, we can find that houses are quite low and the slightly curved roofs can be used to dry grain. Further westward to the Hetao areas in Inner Mongolia and Ningxia, there is only an annual precipitation of 200 mm. The roof, covered with mud or plaster, is a slightly slanting flat, and most of the walls are also built of mud. The scarce precipitation in Turpan, Xinjiang leads to flat-roofed houses built with sun-dried mud bricks. To the west end of the Yili Valley, influenced by the westerly air current and landforms, precipitation gradually increases to over 400mm, and there appear once again houses with double-sloped pointing roofs(Jin *et al.*, 1993).

Atmospheric temperature also affects the style of architecture. To meet the needs of driving out cold and keeping warm, the northern dwellers build their windows facing courtyards, and the southern windows are especially wide in order to receive more sunlight. The houses are narrow and low with fairly limited inner space and seem to seal well. The room is furnished with heating walls and warm brick beds. Windows are made of double-layered glass, which makes the layout appear thick and heavy. For the sake of lowering temperatures and preventing humidity and considering the factors such as ventilation, keeping out rain and preventing heat radiation, the southern residential buildings are generally higher with rather sticking eaves and larger gabled slopes. The residential structures look open, outward and elegant and graceful on the whole.

2 INFLUENCE OF LANDFORMS AND WATER SYSTEMS ON RESIDENTIAL ARCHITECTURE

Though regional climate affects the patterns and styles of traditional architecture in relevant areas, certain factors of landforms and hydrology cannot be neglected.

China has immense mountainous areas. Even on plateaus and in basins, rolling hills and mounds stretch far and wide. Eighty-four percent of the country's territory exceeds 500m above the sea level,

and real plains only account for 11%, most of which are alluvial plains(Ren, 1985). There the climate directly makes effects on the residential buildings. However, in the regions of plateaus, mountains, hills and basins, the influence of landforms and river systems can be seen clearly. The landforms and hydrology mainly affect local selections and processing of the ground, especially in hilly and river, stream or drainage net areas.

2.1 Influence on Architectural Landscapes

Land is the most precious material and fortune in the self-sufficient economy era. In order to leave flat and fertile lands to cultivate, people in mountainous areas built their houses in places relatively suitable for cultivation. At that time, single household had no ability to change landforms extensively, so they tried hard to make full use of the natural micro-landforms of mountains and hills and built houses along with them, thus developing individual architectural structures into various flexible styles. There were several methods to deal with hillside field. They might build storied houses or build houses on the grounds of different heights with the roofs at the same level, so as to form two stories in the front and one story behind; or stretch the buildings and corridors outside and support them with pillars, in which people live on the upper floor while storing material below; or make use of slopes to lay stones and build platforms, thus building houses at different heights and joining them together. In the southern hilly regions of China, the various styles of residential architecture, integrated with local landforms, enrich architectural landscape to a large extent and lead to diverse style effects when viewed elevatedly and vertically.

To meet the needs of production and living, traditional villages and towns usually had their houses facing rivers and lakes. The great seasonal changes of precipitation brought by the typical monsoon climate cause the wide different margins of water level between flood and dry seasons. In order to avoid the disasters caused by floods, people in China's eastern

river valleys chose to build houses on low terraces, mounds and dykes. Floods between the Changjiang (Yangtze) River and the Huaihe River frequently attacked the low basin in North Jiangsu Province, which might be responsible for low economic development and the unsafe feelings among people. The houses crowded on highlands were built temporarily with mud and dry grass in this area. Up to the end of the Qing Dynasty, grass and mud-made huts still accounted for 4/5 of the residential buildings in Yancheng County, the so-called "wealthy town east of the Huaihe River" (Jin *et al.*, 1990). Residential buildings in the river and lake regions south of the Changjiang River are traditionally built on the sides of rivers and with the front facing the streets. Bridges of different sizes and styles and the domestic multi-functional stone docks constitute the distinctive view in the river or lake regions.

2.2 View of Geomancy

Provided that in traditional societies, the first circle in which people live is an artificial one including residential architecture and its interior environment, and a larger scope in which people extend their living behaviors may be considered a second environment circle, i. e., a compound environment of nature and humanity, in which middle-scaled landforms and hydrographic nets consist of the structure of residential communities and their exterior environment. At the times of the self-sufficient economy, people who individually built houses were evidently unable to remake the environment on a large scale to satisfy themselves, so they had to choose a suitable place in the second circle to build their houses. As a result, view of geomancy that emerged to meet the needs of practising geomancy was required in the society. Because at that time, people's understanding of the nature remained uncivilized and was at a phase of worshipping it. They deified geomancy and related the foundations of buildings with people's fortune and their descendents' property. Viewed from an active aspect instead of the absurd dross of witchcraft, geo-

mancy shows great respect to natural environment which are composed of mountains and rivers, and it finds the way to achieve harmony among human, architecture and nature. According to geomancy, auspicious land should face rivers with hills lying behind, and the main hill should surround spacious and flat ground on three sides. In the front of the ground, there should be rivers flowing with a faraway hill as a screen. People usually choose to build their towns and villages where a narrow watercourse (water mouth) traverses into a basin or valley from outside (He, 1990). Buildings in towns and villages situated with back to the north while facing the south can receive more sunlight and avoid fierce wind. Built in this way, they can not only satisfy their need of utility, but also enjoy the value of beauty perception.

3 INFLUENCE OF GEOLOGY AND BOTANY ON RESIDENTIAL ARCHITECTURE

The geological factors dealt with in this thesis mainly refer to the local building materials such as stone materials and loose accumulation in the Quaternary period provided by certain geological environment. Botany can reflect the natural landscape typically. The botany factors mainly refer to the construction-use timber, bamboo, grass, etc., provided by the nature. These local building materials closely related to geology and botany are only simply processed on the construction spot. Together with the plants grown for a better living environment, they contribute much to forming the distinctive local characteristics.

3.1 Influence on the Local Features of Residential Architecture

Admittedly, the prominent local characteristics of traditional residential architecture are created by various factors including social factor. However, local building materials related to geology and botany play key roles in forming the features. Making use of local materials and constructing houses by suiting measures

to the local conditions has become a principle that people should follow. Stones become the major building materials where they can be easily exploited; bricks and dried mud bricks are produced where mud is sticky; earth is rammed into walls where mud is a little sandy; bamboo and timber are used as major building materials where they are abundant. Due to their own physical qualities, the local building materials directly or indirectly affect the interior spatial division and exterior styles of residential architecture. They also embody colors and qualities of the buildings, thus bringing keen native features to traditional residential architecture.

In Northeast China, people employ post and lintel system universally by taking advantage of abundant timber. The joint of the wooden pieces is the combination of mortise and tenon, which couples hardness with softness. Even the harmful energy of a slight earthquake can be consumed because of the slight shift of the joint, thus achieving a remarkable effect that walls collapse while house keeps standing. Wooden structure makes it convenient to build walls by filling them with mud. People also use mud widely and ingeniously to keep warm, guard against water, daub it on walls, make mud bricks or dig grass rafts on the spot. Mud can be used to build not only walls and houses but also heatable brick beds and kitchen sinks. Residential architecture in Northeast China is the one made of wood and mud in reality as well as in name(Wang *et al.*, 1994).

The Loess Plateau, 630 000 km² in area, is short of timber after generations of felling. Accordingly, the residential buildings mostly take the one-sided-slope form. But the area is covered with thick layer of loess without any stones, which is mainly made up of fine sands. Because of the dry climate and low level of ground water, the loess has powerful strength. Cave dwelling with arched roofs dug in the loess represents traditional residential architecture in the Loess Plateau. It goes with the nature by making full use of the land, hence saving cultivated land and being easy and cheap in the construction. The local residents often dig caves on undulating cliffs, and on

flat grounds, they dig rectangular earth pits, on the walls of which caves are dug. Some other residents make an ingenious combination of the caves and ground structures. Therefore, people there can enjoy warm winters and cool summers.

Most of the hilly regions in the south of the Changjiang (Yangtze) River are considered to be the areas which composed of 80% hills, 10% waters and 10% farming fields. There they are rich in bamboo, timber, stones, bricks, tiles and other building materials. In the areas rich in stones, the components of the whole architectural structures ranging from foundation, walls, roofs to floors are all made of stone. In hilly regions, timber is generally used as wooden blocks to make partitive walls, railing doors, windows and floors, etc. Since the wooden structured houses have thin and hollowed walls, they weakly guard against fires as the thick earthen houses do in the North. The factor of high density of buildings added, guarding against fires is of crucial importance. In order to prevent fires, traditional residential buildings in the South usually have walls for banking up fires, also called horse-head walls. The various styles increase beauty to traditional residential buildings in the South.

3.2 Improving Micro-environment Around Buildings

People always take advantages of natural elements such as hills, rivers, lakes, flowers and trees to improve the micro-environment around their houses. They also purposely grow plants to beautify the landscapes and improve the microclimate as well.

In the tropical and subtropical areas of the south of China, special green plants are chosen to grow in front of houses and under windows so as to help better ventilation inside. These are small-sized trees and can be trimmed frequently, which makes good material for green fences. People cultivate vertical adhesive green plants in the south of their houses. Such plants can prevent walls from fierce solar radiation.

When growing plants about residential build-

ings, people should take into account the comprehensive functions of ecology, aesthetics, practice, etc. For example, plum tree, a kind of small and exquisite plant, is appropriate to be planted north of the house where there is relatively less rain and the land is higher. Elm tree is a plant with exuberant foliage and it grows fast. People plant it around houses since it can absorb dust and smoke, thus protecting the environment(He, 1990). Bamboo tree is of shade resistance and grows fast. It is widely used to make tools. People praise it as a lofty style and plant it at the back of the houses.

4 THE IMPACT OF COMPREHENSIVE GEOGRAPHICAL FACTORS ON THE FORMATION OF RESIDENTIAL ARCHITECTURAL STYLES

Of all the geographical elements which are integrated to have joint impact on the formation of architectural functions and styles, climate is undoubtedly the key element. In the comprehensive effects of various elements, the architectural styles differ evidently in different regions.

In the temperate zone of Northeast China, Inner Mongolia, Northwest China and North China, there are immense plains, plateaus and basins. Residential buildings here are mainly single flats with one-sloped or flat mud roofs and built to meet the needs of keeping out the cold, preserving heat, thus strengthening northern style. In the great North China Plain located in the warm temperate zone, wealthy households build single flats to form typical quadrangles. In the hilly mountainous areas of the subtropical Central China and the tropical South China, residential houses are light-colored buildings hidden in green with sealed courtyards and narrow lanes. They are densely built along landforms by rivers and among hills. Built in this way, residential buildings possess the functions of sheltering the sunlight, ventilation, and preventing heat, thus achieving harmony with the green basin environment. In the tropical southwest mountainous areas where there are abundant building materials, people consider primarily how to adapt their houses to

the mountainous environment and to satisfy the needs of preventing moisture, ventilation and security. The hanging-styled wooden and bamboo buildings, sitting in valleys, display strong ethnic characteristics. In the frigid Xizang (Tibet) area, the unique thick and heavy flat-roofed blockhouses stand under snow-covered mountains. Other residential houses full of strong ethnic characteristics such as Mongolian tents, cave dwellings in the northwest, etc., also have intense relations with the local geographical environment.

5 NATURAL VIEW OF THE CULTURE OF TRADITIONAL CHINESE RESIDENTIAL ARCHITECTURE

As one of the material aspects of traditional Chinese culture at the times of self-sufficient economy, traditional residential architecture is mixed with the physical geographical environment by adapting to it negatively. Compared with the stereotyped modern buildings made of reinforced concrete, traditional residential architecture has much more direct and close connection with the natural environment. The natural view here mainly refers to the understanding and the attitude toward the physical geographical environment.

5.1 View of Utility

Following the nature's law, people try hard to build houses by making full use of the natural conditions and materials purposely so as to solve the housing problem, seek their existence and make further development afterwards. This is mainly manifested in two aspects, i. e., suiting measures to local conditions and utilizing local materials. The former shows adaptation to the regional environment composed of the climate, hydrology and landforms. In this way, favorable living surroundings are developed to satisfy the basic needs of ventilation, natural lighting, preventing burning heat, and keeping out the cold. The latter means that by utilizing the local raw building

materials, large amount of manpower and material sources may be effectively saved.

5.2 View of Beauty Perception

The beauty perception of the Chinese traditional culture is harmony, an ideal state people of traditional society pursued in aesthetics. Traditional residential architecture and its community couple well with their natural environment in perfect harmony with no lack of varieties. For example, the residential communities in the south of Anhui Province are mostly designed to face rivers with hills lying behind. The architecture, merged in green hills and rivers, looks plain and elegant with gray walls and fine-grained wooden frames as if it grew out naturally instead of being artistically constructed. Raw materials such as mud, stone, timber, bamboo, etc. that residential architecture usually use can easily reach harmony with the nature in both colors and quality sense.

5.3 View of Ecology

Mankind gradually deepens its understanding, transforming and utilizing of the surrounding environment for its own existence. Originally, people's understanding of the nature remained uncivilized so that they couldn't explain natural phenomena scientifically. They had to worship natural matters that they valued affectionately and made them godlike. The natural matters that were closely connected with daily life and production were then regarded as gods, i. e. , gods of land, mountains, dragons, fire, thunder and rivers who dominated human's destiny. People built

their traditional residential houses by obeying the principle that it "drew materials from the earth while obtaining law from the heaven so as to show respect to the nature". The limited wealth, energy and technology restrained the natural environment from being transformed in a large scale. Instead, they had to worship the natural environment, which showed in architecture their passive adaptation to natural surroundings while seeking little from them. The destruction made to the ecological environment didn't surpass the self-adjusting capacity of the natural environment and was tolerated by it, thus receiving less revenge from it. It is beneficial to maintain the nature's ecological balance, leaving us a harmonious ecological environment.

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