Research on the Stratification Process and Influencing Factors of Liaocheng Ancient City Based on the Translation of Historical Map

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Abstract: The study of historical maps is the basis for understanding the dynamic changes of cities. In this paper, the historical map of Liaocheng ancient city and other data were translated, and GIS technology was used for visual analysis. Meanwhile, combined with the concept of "stratification" in the urban historical landscape, this paper summarizes the historical evolution of the ancient city from multiple dimensions and explores the factors affecting its development in order to realize the sustainable development of Liaocheng ancient city.

1. Introduction
With the arrival of "building a moderately prosperous society in all respects", Chinese urbanization process has entered a new stage. However, many historical cities gradually lost their direction in the torrent of development, exposing the fragmentation of historical information, "two layers" of protection and development and other problems, which caused a great impact on many historical and cultural cities. Liaocheng ancient city is a historical city of more than a thousand years. However, in the process of urbanization, a series of renovation projects have been carried out, resulting in the destruction of many historical heritages and even the absence of historical fragments. This makes the protection of Liaocheng ancient city, especially the excavation of historical information becomes extremely urgent.

The reason lies in the neglect of historical information in urban planning, which leads to the current situation. It is difficult to connect the complex historical information with urban space, but with the rise of historical map translation technology in recent years, this problem can be easily solved. The concept of "stratification" in historical urban landscape can be put forward from the perspective of "dynamics", and the various stages of urban development can be linked together to analyze the experience of stratification development in previous stages, so as to provide a basis for future urban planning. This paper will take Liaocheng ancient city as the research object, using the above two methods, in order to explore its development process and laws, and provide new ideas for its protection and development in the next step.
2. Construction of the Research Method for the Stratification Process of Liaocheng Ancient City

2.1. historical stratification division of Liaocheng ancient city

Different from the traditional way of thinking, the concept of "historical stratification" emphasizes the temporal continuity and spatial correlation between stratification, on the basis of which the spatial characteristics of cities can be identified. Therefore, this paper attempts to "comprehensively" identify the historical stratigraphic information of Liaocheng ancient city from the perspective of space-time and combining with the translation of historical maps.

According to the urban life cycle theory, a city develops and changes along a certain trajectory and goes through a process of birth, growth, prosperity, recession and regeneration. This coincides with the view of "historical stratification", which reflects the "dynamics" of urban development. As shown in Figure 1, this paper divides Liaocheng ancient City into five stages for analysis from the perspective of time. As for the study of space, this paper divides the historical stratification of Liaocheng ancient city into three types of space, namely architecture, street and function according to the three elements of point, line and plane. Among them, architectural space refers to the city wall and various buildings and structures in the ancient city, which are the direct manifestation of urban stratification [1]. Streets refer to the high streets and back lanes of the ancient city, which are the layered framework of the city. Functional space refers to various functional divisions in the ancient city, which are the perceptive source of urban stratification.

Figure 1 A schematic diagram of historical stratigraphic division method of Liaocheng Ancient City

Source: Author

2.2. Historical Map Translation of Liaocheng Ancient City

The sustainable development of cities is rooted in the history of cities, and the study of historical maps is the basis to understand the dynamic changes of cities. The historical maps described by predecessors often reflect the projection of politics, economy and culture in the space at that time, and the spatial pattern and distribution of elements of ancient cities can be clearly observed, with intuitive and visual characteristics [2]. Combining with the historical map translation technology, this paper integrates all kinds of historical information to translate all kinds of elements in the historical map, and finally uses GIS technology into the current urban space, which is conducive to the next urban planning research.

The main steps of historical information translation in this paper are as follows: ① Collecting the relevant documents and materials of Liaocheng ancient city, mainly the historical books and other materials of each dynasty, so as to obtain important historical information. ② Classifying and processing the complex historical information combined with the above historical stratigraphic space analysis and division method. ③ Loading the classified historical information into modern space for comparative analysis, inferring the coordinate positions of various spatial elements through existing historical relics, and expressing them on modern maps. Since the collected historical maps do not include geographic location information, in order to ensure the accuracy of positioning, GIS software will be used for spatial registration and positioning. After the positioning is completed, the change rules of various historical spatial elements can be clearly understood through the superposition analysis of historical information stratification, and the evolution process and influencing factors can be found [3]. ④ Limited by the technology at that time, there are often large scale error, inaccurate
spatial positioning and other problems of historical maps, the location of some information in the translated historical map is still speculative, which needs to be constantly corrected and improved in the future work. See Figure 2 for the detailed technical route of digital translation of Liaocheng ancient city historical map.

Figure 2 Technical route of digital translation of Liaocheng ancient City historical map
Source: Author

3. Analysis on The Historical Stratification Process of Liaocheng Ancient City

3.1. Architectural Space Elements
Through digital translation, the architectural space changes of Liaocheng ancient city in different periods are shown in Figure 3. It can be seen that the most buildings can be examined in the Qing Dynasty, followed by the post-founding of China period, the Republic of China (1912-1949) and the Ming Dynasty. Due to the scarcity of retained materials and frequent wars in the Song and Yuan dynasties, most of the architectural elements recorded were inferred from the records of other times. Since the founding of the city in the Song Dynasty, Liaocheng had been serving as the prefecture and county offices in the region, with a large number of offices, temples, altars and mansions in the city. When the empire fell, the system of "rites" that maintained the feudal dynasty collapsed, and a large number of buildings were regarded as feudal remnants and destroyed. After the founding of the People's Republic of China, the ancient city was in ruins, but there were still many idle buildings destroyed and demolished to serve as building materials for new buildings. With the disappearance of old buildings and the birth of new ones, a large number of industrial and public buildings have been built in succession, which made the overall functional structure of the ancient city begin to change.

Figure 3 Architectural spatial stratigraphic analysis diagram of Liaocheng ancient city
Source: Author
Nowadays, with the implementation of the Ancient City Reconstruction plan in 2009, although the quality of life of residents in the ancient city has been improved, and significant historical buildings such as Wan Shouguan and Wei Cang have been restored, a large number of modern buildings have been demolished. So far, there are only 7 cultural relics protection units and 13 modern architectural heritages (Figure 4).

3.2. Street Space Elements
Through the interpretation of the street space (Figure 5), it can be seen that Liaocheng ancient city also follows the city landscape of ancient China. It is mainly square, with one door in east, west, north and south, and four main roads turning inward. The rest of the roads are graded on this basis, with three vertical and three horizontal, showing a layout of well field system, which has been continued until now. In addition to these nine roads, with the development of the city in the late Ming and early Qing dynasties, the number of buildings in the ancient city increased and many new roads were built. Most of these roads were named after the buildings and homes nearby [4]. These streets and lanes interlaced with each other and together formed the historical blood of the old Liaocheng. After the founding of the People's Republic of China, urban construction was put on the agenda. During this period, the function and spatial pattern of many streets and alleys also changed and gradually faded out of people's sight.
According to the field survey, although some streets and alleys in Liaocheng ancient city have disappeared due to "constructive destruction" at present, most of them have been preserved, and the overall pattern of three vertical and three horizontal streets and alleys is still in place (Figure 6). But many have been subdivided into residential areas, with changes in scale and texture. After a period of rectification, the municipal government sets up signs to display and reproduce the historical names, trends, allusions and other contents of the retained historical streets and alleys, so that these historical memories can be handed down.

3.3. Functional Space Element
Compared with physical space such as buildings and streets, the functional space of Liaocheng ancient city has undergone great changes in the past thousand years, as shown in Figure 7. During the imperial
period, the city's primary task was to maintain the rule of feudal dynasties. The sites of political, military, and cultural domination dominated the ancient city. Thanks to the prosperity of the canal transport, the business district also accounted for part of the economic prosperity. After the Republic of China, the ancient city was still the political and economic center of Liaocheng, but compared with the previous dynasties, the space proportion of a large number of symbols of power declined sharply. At the same time, under the influence of western culture, new social functional space began to appear in this period. In the early days of the founding of the People's Republic of China, a large number of administrative functions continued after the restructuring. At the same time, the Miaotan District completely disappeared under the call of breaking the feudal superstition, and the living functions of the city residents were replaced by industrial and leisure areas. At this point, the secondary rights space of the ancient city has been all disintegrated. Since the 1960s, the ancient city has been unable to meet the needs of urban development, and the gradual move out of the political center has made the ancient city lose the power of development, and the ancient city has become an "old city" with residential functions as its main function. Today, though experiencing a new round of reconstruction, the weak development function makes the ancient city gradually exist in name only.

Throughout the changes of the functional space of Liaocheng in the past thousand years, the power space represented by administrative districts gradually disintegrated, the commercial districts fluctuated periodically, the cultural and educational districts gradually shrunk and the industrial districts were ephemeral. The main function of the city has gradually evolved from the political, economic and cultural center to a component of the broader urban landscape.

Figure 7 Functional spatial stratigraphic analysis diagram of Liaocheng ancient city  
Source: Author

4. Analysis of Influencing Factors in The Evolution of Liaocheng Ancient City
By superimposing the historical stratification of each space in Liaocheng ancient city (Figure 8), it can be found that the stratification evolution of the entire ancient city is mainly affected by external factors represented by politics and economy and internal factors represented by culture. External factors, as the main force and constraint force, determine the path and direction of urban development, while internal factors, as the expression force, reflect the soul of urban evolution and the significance of the times.
In the construction of cities in successive dynasties, the state power was often the dominant factor in this process, which determined the shape and structure of cities. From the original historical map of Liaocheng, we can see that the ancient city was in square shape and the streets were in grid layout, which all reflected the traditional idea of "orbicular sky and rectangular earth". The increase of temples, shrines and other buildings reflected the penetration and domination of the imperial power to the public ideology, which was the strengthening of the imperial power and marks the existence of the government. The urban planning of the People’s Republic was also carried out under the guidance of the national development strategy. After the founding of the People's Republic of China, the replacement of buildings and the reconstruction of space, the transfer of urban centers in the 1960s and the transformation of the functions of ancient cities today have further revealed the advantages of the new national ideology and system. In general, just as Lucic believed in his study of ancient Chinese cities, "it is the power that 'makes' the city and the system that' arranges' the spatial structure of the city" [5].

As a city developed because of canal, the influence of economic factors were more obvious, which can be roughly divided into three stages. The first stage was before the Ming Dynasty. During this period, the canal transport was still underdeveloped, and Liaocheng developed very slowly. There were few landmark buildings in Liaocheng. The second stage was the Ming and Qing Dynasties. With the smooth flow of the canal and the development of grain transport, commerce gradually became the mainstream of urban development. Ganjiang Huiguan, Caishen Temple and other buildings were built in the city, and shops along the street can be found everywhere from Loudong Street along Dongguan to the canal. The third stage was from the end of the Qing Dynasty to the present. Due to the river troubles, the canal and waterway were gradually blocked, and the government changed to sea transportation. In addition, the opening of railway provided a more convenient way for the north-south trade. Therefore, Liaocheng's economy began to decline, and the development of the ancient city fell into a stage of stagnation. Under this circumstance, it finally embarked on the road of realizing the development of the ancient city through land economy.

As a product of long-term human creation, culture also influences the development of cities, urban patterns, street places and landmark landscapes. In the early Ming Dynasty, when the ancient city of Liaocheng was replanned, the government offices and other government buildings were arranged in the northwest of the city, facing south. This included traditional feng shui ideas. The northwest represents the qian position, which represents the day, is a symbol of honor, power and geomantic treasure. The second was the temple architecture influenced by folk beliefs. According to the textual research, Liaocheng area was a city with Confucianism as the main religion and many religions coexisted. Temples and monasteries in the ancient city could be up to more than 30. As the spiritual
pillar of people in feudal times, folk belief architecture changed with the rise and fall of religion and dynasty, which promoted the development of Liaocheng ancient city to a certain extent.

5. Conclusion

In recent years, more and more attention has been paid to the method of historic urban landscape. As a witness carrier of the evolution process of historical cities, stratification contains the genetic information of cities just like DNA. As a small city in the north, Liaocheng ancient city has witnessed the rise and fall of the canal and the change of the regime over the past thousand years, and has presented a unique historical urban landscape under their influences. Based on the digital analysis of the historical maps of Liaocheng ancient city in different periods, this paper divides it into three stratigraphic space, namely architecture, streets and functions, explores the evolution rules and influencing factors, and makes the urban characteristics of the ancient city more prominent and distinct. It is hoped that it can provide more ideas for the study of historical stratification and also provide references for more relevant studies of small and medium-sized cities.

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