ISSN : 0974 - 7435 Volume 10 Issue 9

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(9), 2014 [4070-4079]

Ecological research configuration of cave architecture in Wang Yu village of Shanxi Province

Weicheng Han, Tieying Li

The Architecture Department of Taiyuan University of Technology Shanxi Province, (CHINA)

ABSTRACT

Cave building houses the world's largest extant living a traditional form, along with the social and economic development, the continuation and development of cave architecture has been relatively large impact. Cave is difficult to meet the housing needs of the construction of contemporary society residents, especially prominent in the town's performance. Cave buildings are being degraded and disappear, development cave building facing great difficulties, cave dwellings and folk culture has also elapsed. Articles selected for the study area in Shanxi Jinzhong cave building, research and analysis of various aspects of the problem areas in Shanxi Jinzhong cave buildings in the town existence, cave architecture proposed adaptive significance and necessity of updating and development of contemporary society, the study cave construction update and strategy development. There Jinzhong cave in the village common areas restrain kiln, as well as by Cliff kilns, brick kilns and other forms, called Grand cave. Cave has some regenerative capacity building, so the temperature is relatively stable, fit for human habitation. This paper carried out the construction of ecological cave topography study Wang Yu village, provide new ideas and guidance for the future protection of Wang Yu village cave architecture.

KEYWORDS

Cave architecture; Ecological research configuration; Computational fluid dynamics.

INTRODUCTION

Energy is the basic driving force of global development and world economic growth, provide material resources for human survival and development. Along with the rapid development of technology and economy, the world is facing increasingly severe energy shocks, global oil crisis occurred three times since the 20th century (1973, 1979 and 1990), and again sounded the energy shortage for human alarm problem.

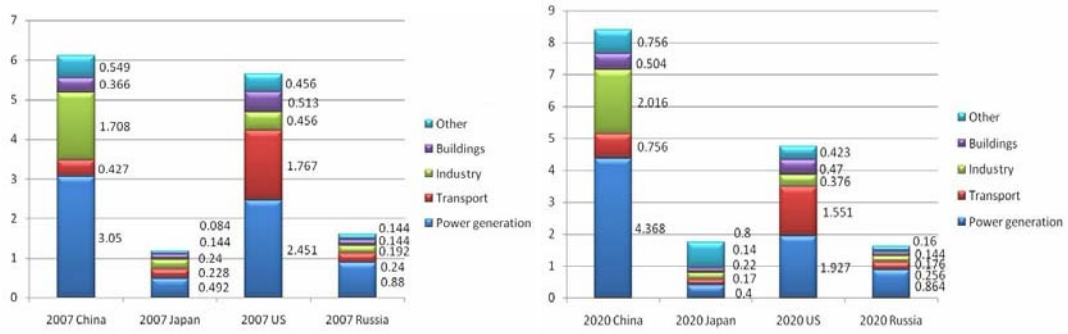

Figure 1 : The major countries and energy-related CO_2 emissions (Gt).

Figure 1 shows the CO_2 emissions associated with energy major countries, CO_2 emissions from energy-related China is 6.1Gt, higher than the U.S. 5.7Gt, just from building energy consumption of CO_2 released, the United States is higher than China, Japan and Russia, Japan and Russia which is almost equal to the release, are 0.144Gt. Figure 1 shows a scenario based on 450, 2020 and energy-related CO_2 emissions in the United States, China, Japan and Russia, in which the concept of prediction is the first 450 scenarios were elaborated in the "2008 World Energy Outlook", refers to the CO_2 concentration in the atmosphere controlled at 450ppm, in order to achieve a global temperature rise of 2 ℃ target control.

Generally western scholars argue that local tourism participation is a precondition for benefits reaching communities. However, in China, particularly in some ethnic minority areas, this paradigm is not easily put into practice. Based on a study in the Kanas Nature Reserve of Xinjiang combining the use of a questionnaire and in-depth interviews, the means by which Tuva residents participated in, and derived benefits from tourism was investigated, and local stakeholders' attitude about community participation ascertained. The results indicate a low level of community participation and the implications of this for future tourism development are discussed with reference to the future development of tourism in the Kanas Reserve[1].

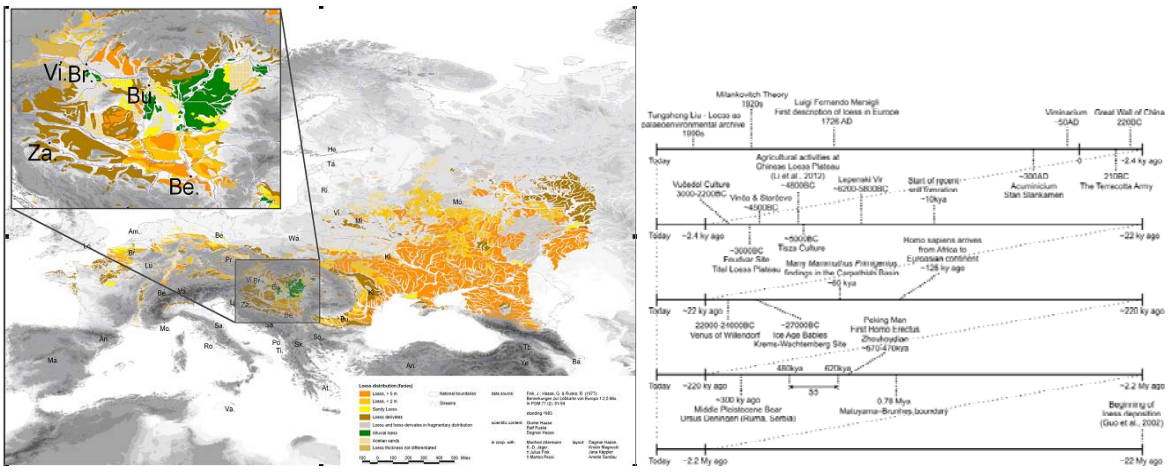

Figure 2 : Loess deposition in Europe with attention to thickness of Pannonian loess sections and interaction and comparison of human civilisation with the development of loess sediments[2].

The study has shown that loess-palaeosol sequences in Europe and China exhibit certain similarities concerning their human appreciated values, especially scientific and cultural. Loess worldwide presents a significant part of the Earth's geo diversity with numerous sites that need to be statutorily established as geo heritage and thus legally protected on both national and international levels. However, many other values (e.g. functional and economic) have devastating effects on loess geo sites. This study's analysis has demonstrated that loess in the case study areas is put under serious and constant pressure as a consequence of people's, often worsened by their ignorance, activities. The main threats to loess by people are from extensive agriculture, soil extraction for brick and ceramic production, and urban is at ion. Therefore, it is essential to establish a strategy that delivers the most effective geo conservation measures for loess. The first step should definitely be the establishment of an inventory of the most significant loess profiles and sections. As it is impossible and impracticable to protect and/or conserve all loess-palaeosol sequences it is fundamental to find the most representative ones that could serve various scientific, educational, cultural, (geo)touristic and other activities' needs[2].

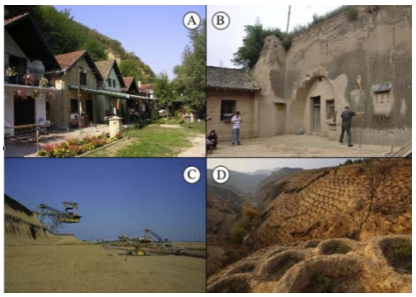

Figure 3 : Different kinds of loess exploitation: Illegal settlement just below Titel loess plateau, Serbia (A); Loess dwellings in Luochuan, China (B); Extensive loess exploitation in Kostolac, Serbia (C); Loess terracing for agriculture in China (D)[2]

Loess-palaeosol sequences preserve the most significant continental record of climatic and environmental changes during the Quaternary available for scientific study. The Eurasian loess belt in particular could be regarded as one of the most important Quaternary terrestrial records of climatic and environmental changes on a global scale. The Preliminary strati graphical correlation has determined that loess sections in south-east Europe and China have, perhaps surprisingly, shown many similarities. Unfortunately, these sites, due to their economic (e.g. agriculture and brickyards) and functional (e.g. remote sections as waste disposal sites) values, share the same (both human-induced and natural) threats and are constantly endangered by numerous causes and could be naturally degraded or permanently exploited as a geo resource[2].

Biton, R. summarizes typological and technological research on a small assemblage of pottery containers recovered at Kfar HaHoresh (KHH), a Pre-Pottery Neolithic B site in the Southern Levant. The majority of the sherds belong to a distinguishable fabric, composed of local marl matrix tempered with vegetal material originating from herbivore manure[3].

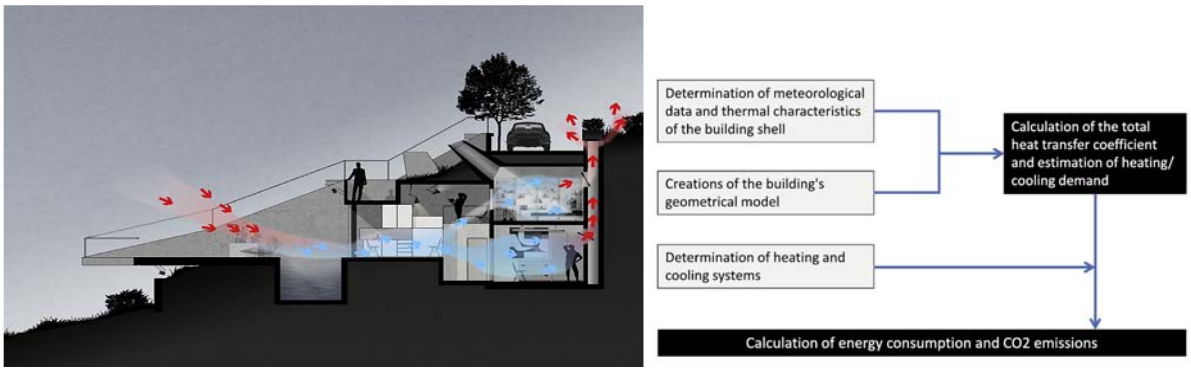

Figure 4 : Section presenting the air flow through the residence and steps followed for calculating

The utilization of underground space for the development of underground living environments is a practice yet to be commonly adopted from the general public. Although in the past there were examples of underground built space for residential use, such issue has been regarded as something uncommon, far from modern human design culture. The paper deals with the design of an earth sheltered residence in an Aegean island and emphasizes on the advantages of developing underground residences in terms of bioclimatic performance[4]. Chinese residences are precious heritages to mankind, which reserves several thousand years of historical cultural information. Therefore, we have to keep original style of Chinese residences in the process of green building design and green building retrofitting. In this article, authors briefly described the characteristics of Chinese residences. And then wind environment around Chinese residences in cold region was analyzed from the aspect of wind speed and wind pressure by CFD method. The advantages and disadvantages of Chinese residences adapting to the local wind environment were figured out[5]. Yaodong is one representative of western China vernacular dwellings. Its indoor thermal environment is cool in summer and warm in winter. This study interprets the characteristic of warm in winter and cool in summer in such a dwelling by measuring the indoor, outdoor and wall's temperatures in winter and summer[6,9].

WANG YU VILLAGE ARCHITECTURE INTRODUCTION

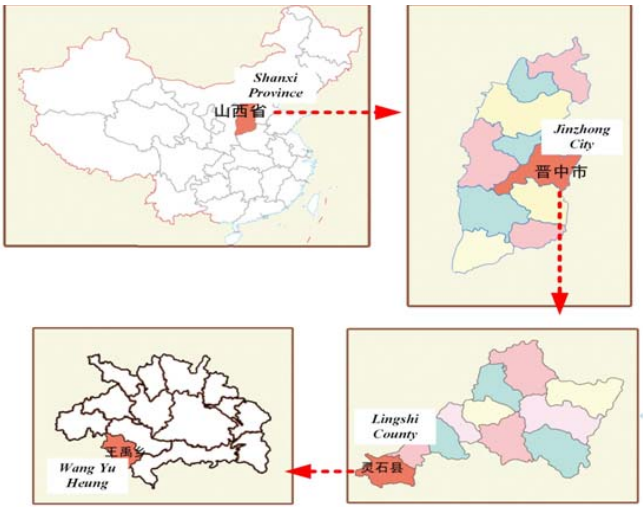

Figure 5 : Geographic area Jinzhong Wang Yu village schematic

Wang Yu village is located in the middle of Lingshi County, Jinzhong City, Shanxi Province, southwest side, located between Taiyuan and Linfen basin basin. Geographic coordinates of longitude 111 degrees 20 minutes to 112 degrees, 36 degrees 40 minutes north latitude to 37 degrees. Wang Yu village where Lingshi County is temperate continental monsoon climate zone. Lingshi County Ground Duo Xinan wind, northeasterly second. Generally northwest wind in winter and spring, summer and southerly winds. Lingshi County is located in the Loess Plateau, due to the tectonic movements and erosion has long been a torrent of wind and rain to form hills, ravines of earth and Rock Mountain.

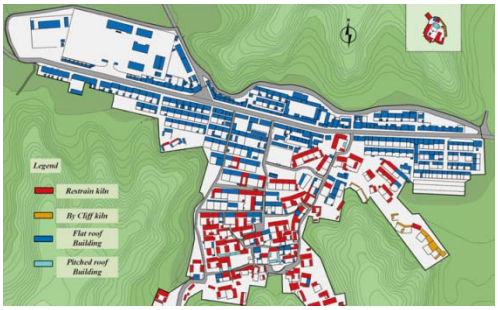

Figure 6 : The schematic of Wang Yu village architectural forms

Village rich historical and cultural resources, Shanxi Province Wang Yu Village is the most complete extant ancient cave dwellings clustered villages. Village south of the county-level cultural relic's protection units Ciyunsi. Yu Temple village surrounded by ruins, ruins nunnery, Dragon King Temple Ruins, ruins and other highland temple.

Figure 7 : The schematic of Wang Yu village distribution of historic buildings

Because Wang Yu village located on a plateau 1,000 meters southwest of the county, so the climate is very cool. Wang Yu Village, the annual average temperature is about 9℃-l0 ℃, summer day night temperature difference, in fact, the ideal place for the summer. Wang Yu village in which the land due to the large temperature difference, so the combination of courtyard houses structural features, arranged Courtyard kiln hospital, hospital cave arched form, are kiln three to five holes, higher than other buildings, located three steps above, two to the left and right side of the kiln three holes, opposite wing. There Jinzhong cave in the village common areas restrain kiln, as well as by Cliff kilns, brick kilns and other forms, called Grand cave. Cave has some regenerative capacity building, so the temperature is relatively stable, fit for human habitation.

CAVE BULDINGUBING ECOLIGICAL MODEL

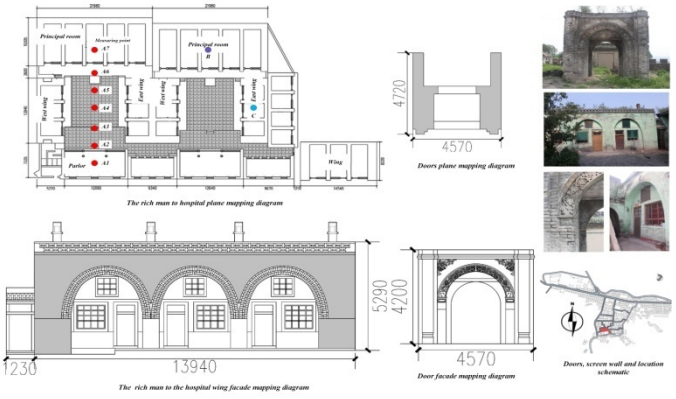

Figure 8 : The schematic model of Wang Yu village cave

Wang Yu village since ancient times is the main area of military conflict, the war on the local accumulation of wealth has played a significant role in the destruction, leading to the development of the settlement are subject to greater restrictions. In the form of architectural space which is different from other regions Jinzhong style.

Defense facilities

As a military defense fortress, village buildings including towers, fortresses and other defense facilities, warehouses, Barracks, headquarters and other military logistics facilities, temples, religious facilities and other cultural stage, ordinary people dwelling that several major categories.

Temples

"Han • Five " records: "Jane family, and do not raise temple, waste ritual, when the Guards, then Mizuki does not run." Traditional cultural emphasis on ancestor worship, there are all kinds of temples ancestral village distribution, showing strong color ancestral culture, prayer by the ancestors of protecting the war.

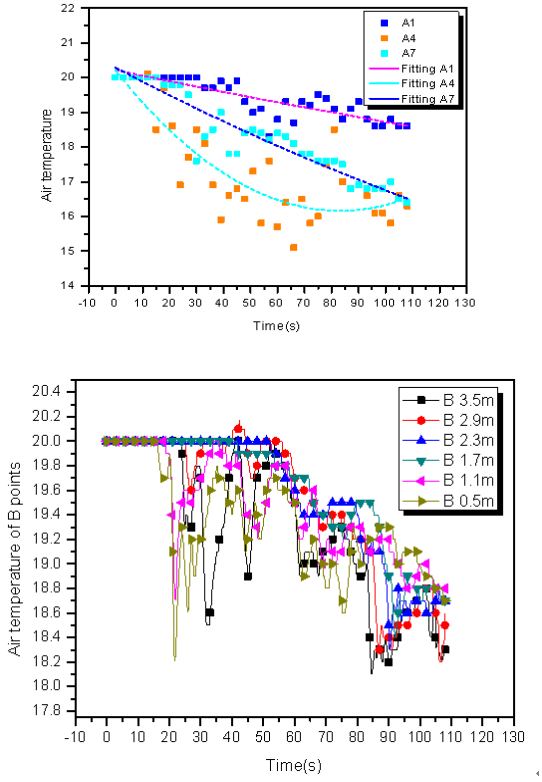

Figure 9 : The temperature of the measurement points A and B versus time

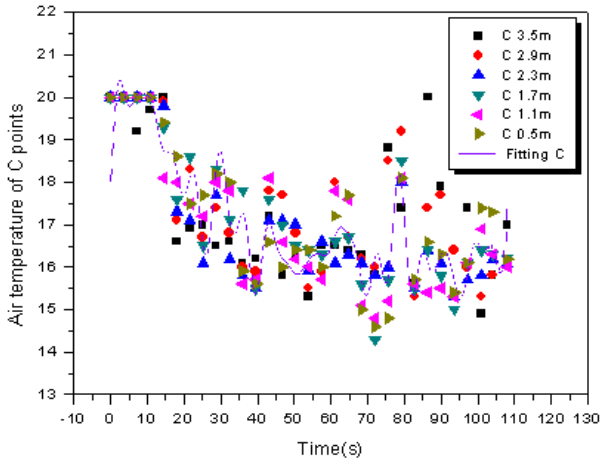

Figure 10 : Measuring point C of temperature versus time

By Chinese traditional culture and its impact on natural forces worship feng shui, widely distributed in the village temple, unique. Wang Yu had Ciyunsi within the village, West Temple, Yu Temple, East Temple, good homes temple, temple, Temple Heights, nunnery and other temples of eight, the existing Ciyunsi West Temple, East Temple three more complete, good homes temple, the temple has been largely destroyed, Yu Temple, Temple Heights, nunnery remaining ruins. From the current situation temples shape is relatively low, the basic three sometimes five bays to combine hard mountain

cave roof of the main structure. Which different temples assume different services, Taoism Buddha, God places their duties, and bless its settings and more successful war, peace related.

Part of the temple also combines the functions of public services, such as the West Temple back seat with a stage, as residents gathered entertainment venues.

The traditional houses

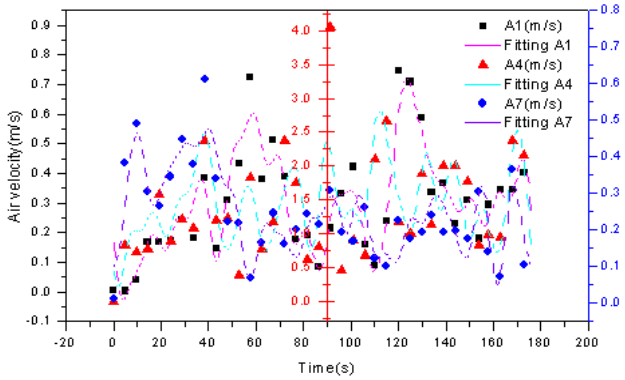

Figure 11 : Building indoor and outdoor air flow rate

Old houses of the village's main focus is the Ming Dynasty to the Republic, after the founding of the Village houses are building. Now reserved generally poor construction quality, especially with the historical style or era of relatively old building, more serious damage, such as cattle courtyard, knight homes. However, most of the historical courtyard features live there without being discarded.

Mostly in the form of cave building construction, partly built veranda built there, the whole building decoration simple, windows, doors and all kinds of brick more features. As the reality of the natural and economic conditions, the rooms are not large bay, with three-bay houses the main east and west sides of the bedroom, in the middle of the living room. More spacious courtyard, courtyard houses or buildings surrounded synthesis courtyard garden for growing vegetables or fruit trees.

Architecture

Village settlements are widely distributed to all levels of households from a large number of different image, similar to the role of symbolic, iconic spiritual components, such as various types of brick, carved wooden doors and windows, roof beast, the amount of doors and so many auspicious patterns, have played the evil town house and regulate the role of the gas field, is entrusted with the good wishes of the residents and misfortunes seek bless blessing. Architecture reflects the ancient city of Jinzhong area unpretentious folk, less overall architectural decoration, the main artistic value reflected in the windows and brick buildings.

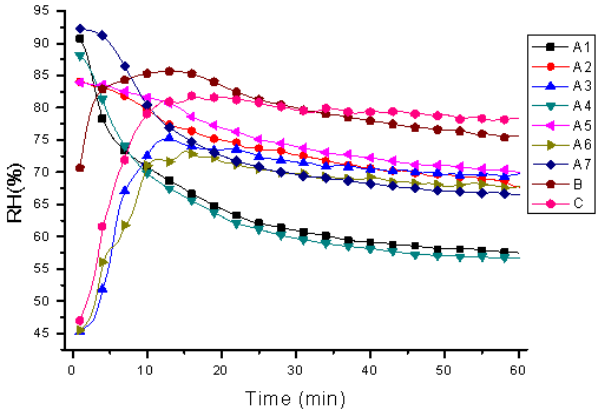

Figure 12 : Each measuring point change in relative humidity in case a

From the figure it can be seen before opening the heat source, the relative humidity of the confined space of different hierarchical apparent height relative humidity levels consistent direction, A1, A4, A7 measuring point relative humidity around 90%, A2, A5, relative humidity of about 84% of the measuring point, the relative humidity measurement point B is about 71%. A3, A6, measuring point C relative humidity 45%. As can be seen, in addition to measuring point B, 2.3m and 1.3m height measurement point relative humidity level is decreased, and the relative humidity at the start of the experiment just measuring point B is lower than the same level as the measuring point A2 and A5 relative humidity, relative humidity measuring point B with the passage of time before the experiment increased to 85%, and then slowly decreased to 77%, followed by experiments with increasing temperature, the relative humidity decreased slightly until the end of the experiment Turn off the heat source. A3, A6, C measuring points in a closed room for a heating source of the heating process, after about 10 minutes the measuring point A3 and A6 relative humidity to 75 % and then decreased slightly, and finally maintained at 73% are substantially vertical, and C at a relative humidity measuring point can rise to 10 minutes 82% relative humidity over time was maintained at 80 % relative humidity greater than A3 and A6.

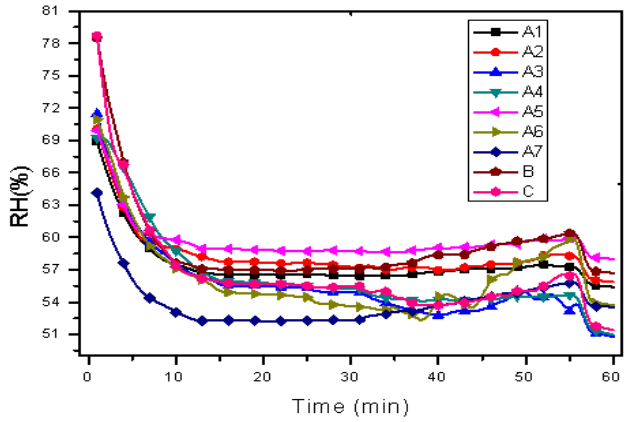

Figure 13 : Each measuring point change in relative humidity in case b

As can be seen from the figure, after the end of the intervention of the closed room environment, the test begins, the relative humidity of the basic initial state are between 69% -72%, B C and relative humidity of the measurement point, with almost 79%, C1 minimum relative humidity measuring point, approximately 64%. 13 minutes after the humidity of the measuring point very little change, continuous humidity 20 minutes each measuring point to keep the humidity level in the respective line in the experiment to 34 minutes, the humidity of the measuring point began to shake up and down to varying degrees, in particular, A3, A6, C humidity horizontal jitter obvious disturbance phenomenon occurs. In the first 55 minutes, all the curves and dips phenomenon occurs.

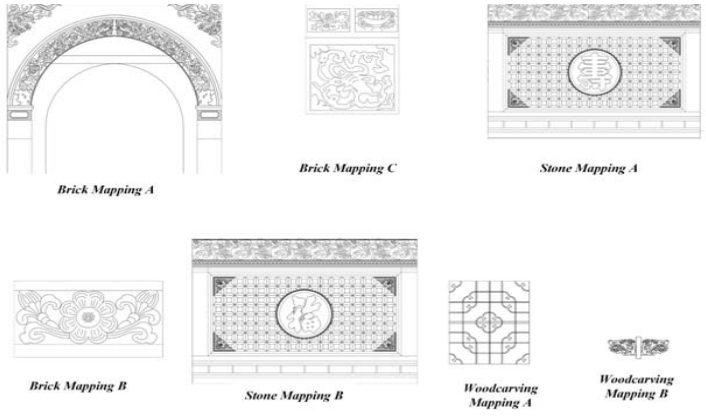

Figure 14 : The Wang Yu village cave mapping

General repair cave on south-facing slopes, sunny, backed by mountains, facing the open area, few trees block, very suitable for living life. A hospital cave general repair three holes or 5 holes in the kiln is positive kiln, kiln after some minutes, someone into 3 open, 4 holes from the outside door open to all, they have come to be found inside a small tunnel door intercommunication semicircular top, so it will cave space increases.

By Cliff Cave patron type and style along the trench, cave often presents a curve or zigzag arrangement, there is a harmonious and beautiful architectural effect. In the hillside height allows, sometimes arranged in layers Desk ladder cave, similar buildings.

Sunken cave is the underground cave, mainly in the Loess Plateau area - no hillside trench wall area available. This cave approach is: first place dig a square pit, then to the walls of the cave, forming a courtyard. In the ground, only to see the treetops to the hospital, but no houses.

Detached houses vaulted cave is a cover soil with soil Ji adobe arch cave, there are brick arch stone arch cave. By this cave cliff without backing, to their independence, yet the advantages cave. Can be a single layer, can also be built for the floor. If the upper hoop kiln that is also known as “kiln”; If the upper house is a wooden structure called “kiln never ending.”

Cave fire, noise, cool, saving land, labor and the economy, is indeed a perfect architectural forms suited to local conditions.

SUMMARY

Cave building houses the world's largest extant living a traditional form, along with the social and economic development, the continuation and development of cave architecture has been relatively large impact. Cave is difficult to meet the housing needs of the construction of contemporary society residents, especially prominent in the town’s performance. Cave buildings are being degraded and disappear, development cave building facing great difficulties, cave dwellings and folk culture has also elapsed. Articles selected for the study area in Shanxi Jinzhong cave building, research and analysis of various aspects of the problem areas in Shanxi Jinzhong cave buildings in the town existence, cave architecture proposed adaptive significance and necessity of updating and development of contemporary society, the study cave construction update and strategy development. Wang Yu village is located in the middle of Lingshi County, Jinzhong City, Shanxi Province, southwest side, located between Taiyuan and Linfen basin. Village rich historical and cultural resources, Shanxi Province Wang Yu Village is the most complete extant ancient cave dwellings clustered villages. Wang Yu village in which the land due to the large temperature difference, so the combination of courtyard houses structural features, arranged Courtyard kiln hospital, hospital cave arched form, are kiln three to five holes, higher than other buildings, located three steps above, two to the left and right side of the kiln three holes, opposite wing. There Jinzhong cave in the village common areas restrain kiln, as well as by Cliff kilns, brick kilns and other forms, called Grand cave. Cave has some regenerative capacity building, so the temperature is relatively stable, fit for human habitation. This paper carried out the construction of ecological cave topography study Wang Yu village, provide new ideas and guidance for the future protection of Wang Yu village cave architecture.

Finally, the paper summarizes the results : Wang Yu particular geographical region of the village landscape features, traditional customs, economic conditions, social patterns and other factors, to get Wang Yu construction and development in rural areas cannot give up the construction of the building in the form of cave with regional characteristics, but pursuit of a cave with an architectural form fit, both to meet the needs of residents but also reflects the contemporary style of the geographical characteristics of the cave architecture, encourage the use of the hillside area of residential land within the established residential area cave establish appropriate countermeasures and updates planning form, the living environment of the cave architecture using current advanced science and technology for comprehensive

improvements. So full of geographical features of architectural heritage, cave dwellings that can be continued and developed.

ACKNOWLEDGMENT

This work was financially supported by the National Natural Science Foundation (51338001and 51278324).

REFERENCES

[1] H.Wang, Z.Yang, et al.; "Minority Community Participation in Tourism; A Case of Kanas Tuva Villages in Xinjiang, China.", Tourism Management, **31(6)**, 759-764 **(2010).**

[2] D.A.Vasiljević, S.B.Marković, et al.; "Loess-Palaeosol Sequences in China and Europe, Common Values and Geoconservation Issues.", Catena, **(2013)**.

[3] R.Biton, Y.Goren, et al.; "Ceramics in The Levantine Pre-Pottery Neolithic B, evidence from Kfar HaHoresh, Israel.", Journal of Archaeological Science, **41**, 740-748 **(2014)**.

[4] A.Benardos, I.Athanasiadis, et al.; "Modern Earth Sheltered Constructions, A Paradigm of Green Engineering.", Tunnelling and Underground Space Technology, **41**, 46-52 **(2014)**.

[5] B.J.He, L.Yang, et al.; "Strategies for Creating Good Wind Environment Around Chinese Residences." Sustainable Cities and Society, **10**, 174-183 **(2014)**.

[6] J.Liu, L.Wang, et al.; "The Thermal Mechanism of Warm in Winter and Cool in Summer in China Traditional Vernacular Dwellings.", Building and Environment, **46(8)**, 1709-1715 **(2011)**.

[7] Shanshan Liu; "Research on Defensiveness of Military Fortresses at Ming Great Wall JuyongGuan Defense Area", Tianjin University Press, China, **(2011)**.

[8] Zhang Li Yan, Yukun Li Zhe; "The Non-Linear Nature of the Great Wall, research on the Stratified System of Military Settlements along the Great Wall Under The Wei-suo System of Ming dynasty", New Architecture, **3**, 118-121 **(2011)**.

[9] Xiangming Cao, Zhou Dian, Yu Yang; "Analysis on the Strategies of Fortress Conservation and Development along the Great Wall, Taking Pingxingguan Fortress in Shanxi as an Example", Architectural Culture, **4(30)**, 189-192 **(2012)**.