

Study on disaster adaptive site selection of Tibetan villages

- Take the World Heritage Jiuzhaigou Valley as an example—

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This report takes Jiuzhaigou Valley as a case study to research the adaptive Site selection of traditional Tibetan villages. The methodologies mainly include on-site investigation and historical literature review. Overall, this paper finished 2 tasks: 1. the site selections of Jiuzhaigou Valley Tibetan Village was divided into 4 types based on the site terrain of the Tibetan Village in Jiuzhaigou Valley, namely mountain top aggregation type, platform type, hillside gentle slope type and valley riverbank type ; 2. depend on the 4 site selection types and the principle of site selections, the second task reveals the relationship between site selection and disasters (especially geological hazards and fire disasters). Through the comparative analysis of new Tibetan villages and early Tibetan villages, this paper's conclusion is that the early Tibetan villages adopted "disaster adaptability" and "disaster avoidance" principles, while the new Tibetan villages did not keep those principles any more. Therefore, currently, the new Tibetan villages suffered from the frequent disasters. Furthermore, It is hoped that this study can be used for reference in the researches of disaster adaptive sites selection for traditional villages in China.

Keywords: *Jiuzhaigou Valley, Tibetan, Site Selection, Disaster*

1. Background

The World Heritage Site Jiuzhaigou Valley (hereinafter referred to as Jiuzhaigou Valley) is located in Zhangzha Town, southwest of Jiuzhaigou Valley County, Aba Tibetan and Qiang Autonomous Prefecture in Sichuan Province¹⁾ (Fig.1). It is a multi-ethnic settlement centered on Tibetan villages that borders on Sichuan Basin and Qinghai Tibet Plateau, with high altitude in South high North low, belonging to plateau humid climate. The Baihe river flows from west to east through the north of Jiuzhaigou Valley, then Zezhawa and Rize gully meet in Norilang from south to north, and Shuzheng and Zharu gully in the north intersect northwards into the Baihe river(Fig.2). There are nine Tibetan villages in the valley, namely Heye,

Panya, Yana, Jianpan, Heijiao, Shuzheng, Zezhawa, Zharu and Guodu, so it was called Jiuzhaigou Valley²⁾. (“Jiu” in Chinese means nine)



Fig. 1 Jiuzhaigou Valley Location

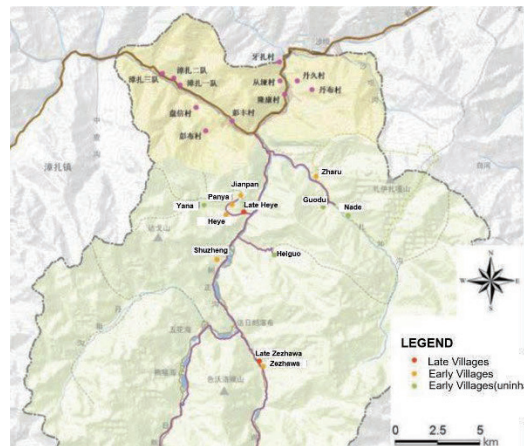


Fig.2 Distribution of Traditional Villages in Jiuzhaigou Valley

2. Overview of Jiuzhaigou Valley Traditional Tibetan Villages

There are three communities in Jiuzhaigou Valley: Shuzheng Community (including Shuzheng village, Zezhawa village, and Heijiao village), Heye Community (including Heye village, Panya village, Yana village), and Zharu Community (including Jianpan village, Rexi village, Guodu village) . Heye Village was formed by three residents of Jianpan village, Panya village, and Wonuo village, which are located on the higher slopes; Shuzheng Village was developed from its current location and joined by Heiguo village from the relocation of the village; Zezhawa Village extends a larger area to the north on the basis of the original late village. The current status of Zharu village was originally Rexi village, and later the residents who moved from Guodu Village joined it. (Fig.3).

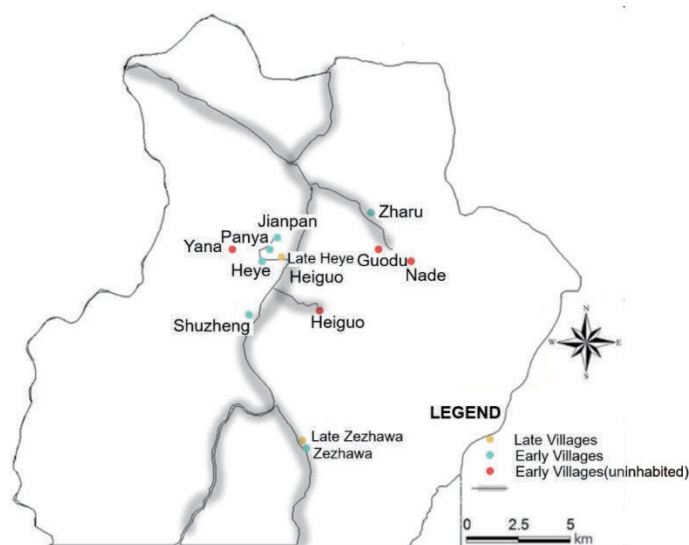


Fig.3 Schematic diagram of village site relocation

3. The relationship between Jiuzhaigou villages and topography

(1) Site selection and altitude

The distribution of Jiuzhaigou villages are closely related to altitude. There is a better agricultural planting environment in the plain area at low altitude, and there are some restrictive factors affecting the normal life of residents, such as strong ultraviolet rays and low oxygen content. Most of the traditional early villages are built along the gentle slopes of the mountain, terraces, hilltops and other areas (2200-2700m above sea level) according to the Steep terrain, and are arranged according to the mountains (Fig.4). While most late traditional villages are on a low-lying area along the banks of valley rivers, with flat terrain and convenient transportation. Thus, they are affected greatly by the earthquake-induced secondary disaster.

(2) Selection and aspect

The location of Jiuzhaigou village cannot be separated from the influence of slope direction when considering wind direction and sunshine factors. Due to the sufficient sunshine conditions in the south-facing area, the location of the village will be set in the south or southeast section to avoid the impact on people or buildings when the landslide disaster occurs. This type of villages are mostly traditional villages (Fig.5). Low-lying areas are dominated by farmland, but when floods occur, they could cause huge losses to villages, and most of these villages are traditional late villages.

(3) Selection and vegetation water

When considering the vegetation and water body in Jiuzhaigou Village, most of the village site selection models are attached to the water body and agricultural land, and are built near the vegetation. Most of the vegetation types are temperate coniferous forest, which is inseparable from the ecological environment of the village and the living conditions of agricultural production. At the same time, it can effectively avoid the dangerous soil area with strong landslide and debris flow, and can provide strong guarantee for residents' life safety. The site construction of the traditional early village is located near the mountainside, terrace or mountain top with rich vegetation and thick branches. The traditional late village is located near the water body, mainly considering the convenience of water intake and the benefit of cultivation³⁾ (Fig.6).

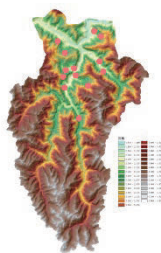


Fig.4 Elevation analysis and village selection

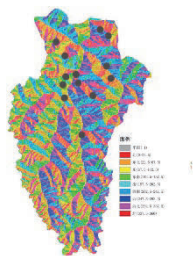


Fig.5 Slope analysis and village selection



Fig.6 Vegetation and water distribution and village selection

4. Division of site selection for traditional Tibetan villages in Jiuzhaigou Valley

Through field investigations of the traditional villages of Jiuzhaigou valley and data collection and collation in the early stage. The location of villages can be summarized into four types based on the relative height and topography: mountain top agglomeration type, platform type, valley type, mountain slope gentle slope type⁴⁾. (Fig.7).

(1) Peak gathering type

This type of site selection is relatively special, and it is often arranged in the winding place of the ridge, which is relatively gentle. Its elevation is 2400-2700 meters. The limitation of the land makes the Tibetan village highly concentrated, with poor external traffic and high hidden density, defense. Small scale of land use.

(2) Platform type

It is generally in the middle of the mountain, with flat terrain and an elevation of 2300-2400 meters. Traffic and water diversion are still not convenient. However, these types of Tibetan villages are more secretive, and the Tibetan villages are more defensive. The size of the population that can be accommodated is only dozens of households, and the land is small.

(3) Gentle slope

This type of village is located on a gentle slope in the middle of the mountain. It is formed in accordance with the terrain and is formed in an orderly manner. The elevation of the village is 2200m-2400m. Due to the limitation of the terrain conditions, the village shape is relatively loose, and the residential buildings conform to the terrain change, and they are combined in an orderly manner into the shape of the village.

(4) Valley type

This type of Tibetan village selection mainly refers to the river bank located at the foot of the valley. Its elevation is mostly around 2000 meters. It is located near the mountain and the water. It has an excellent geographical location. The layout of the building is clustered along the road. Therefore, the relationship with the outside world is close. At the same time, it is convenient for infrastructure layout and convenient road traffic.

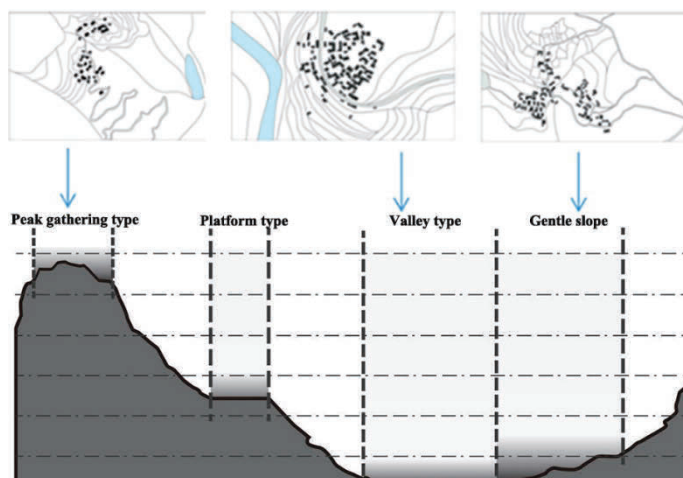


Fig.7 Selection type of traditional villages

Table 1 Selection type of late and early villages

Village name	Late	Early	Selection type
Zaru	O		Valley type
Guo Du		O	Platform type
Nade		O	Peak gathering type
Jianpan		O	Peak gathering type
Heye Village	O		Peak gathering type
Panya			Peak gathering type
Yana		O	Peak gathering type
Late Heye		O	Gentle slope
Heijiao		O	Gentle slope
Shuzheng	O		Gentle slope
Zezhawa	O		Valley type
Late zezhawa		O	Valley type

5. Analysis of the Geological Disaster in Jiuzhaigou Valley

(1) Geological Disaster in Late Villages

In order to promote the development of tourism in Jiuzhaigou Valley Tibetan Villages in World Heritage Sites, the valley riverbank type is the main site selection type of late village, which is located on the flat riverbank with convenient external transportation at the foot of the mountain and establishes a close interaction with the outside world, which can continuously promote the development of economy and culture. However, Jiuzhaigou Valley Scenic Spot is located in the Qinghai-Tibet Plateau seismic area and has abundant rainfall, and late village, located in the valley riparian zone, has had frequent disasters in recent years⁵⁾ (Fig.8-11):

1) Heye Village

Heye Village is the first village to enter the ditch and the largest Tibetan village in Jiuzhaigou Valley. Heye village can be divided into two parts, one is the early Heye Village on the mountain and the other is the late Heye Village under the mountain. Compared with the architectural layout of other villages with free layout and distribution along the mountain trend, the early Heye Village has a regular and compact layout, which is closer to the community of the city and the low-lying section adjacent to the highway. Heye village is located in the earthquake 9 degree influence area, the earthquake damaged the geological environment, but also damaged a large number of houses. According to the investigation, there are five geological hazards in the evaluation area: one unstable slope, three collapses, and one debris flow.

2) Shuzheng Village

Shuzheng Village develops from the selection of the original Shuzheng Village and joins the residents who come from the relocation of Heiguo Village. There was no overall migration. Shuzheng Village'

buildings grow freely along the terrain, and half of them have a slope of more than 15%. According to the investigation, there are three geological hazards in the evaluation area: one landslide, one collapse, and one debris flow.

3) Zaru Village

Zaru Village, also known as Rexi Village, is located at the foot of the Zayizaga holy Mountain, close to Zaru Temple, which is formed by the voluntary relocation of residents of the early zaru Village and Guodu Village. Because Zaru Village is far away from tourist attractions, the building is basically self-living for residents. The low-lying terrain, compared with the platform type and hillside gentle slope type, effectively reduces the secondary disasters caused by earthquakes, or local seasonal heavy rainfall brings about large floods and landslides on the village. According to the investigation, there are four geological hazards in the evaluation area: two landslides, one unstable slope, and one debris flow.

4) Zezhawa Village

Zezhawa Village is located about 200 meters south of the Y-shaped trench intersection in Jiuzhaigou Valley, showing a typical zonal structure, and the whole village is arranged along the sightseeing highway and extends inward. The Zezhawa Village is located in a small slope area, so it is in a zonal structure, and the whole village is arranged along the sightseeing highway and extends inward. There are three geological hazards in the evaluation area: one collapse and two debris flows⁶⁾.



Fig.8 Distribution of Geological Hazards in Zaru Village

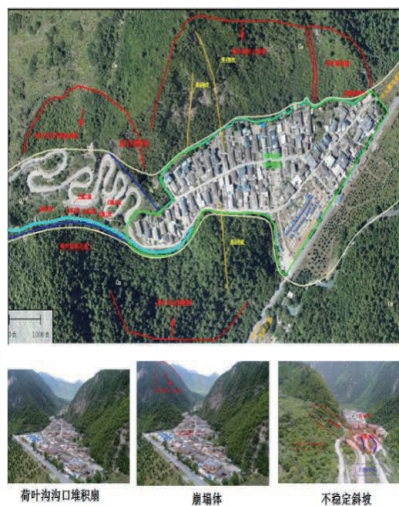


Fig.9 Distribution of Geological Hazards in Heye Village

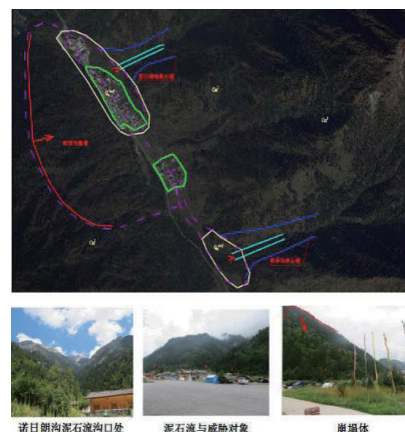


Fig.10 Distribution of Geological Hazards in Shuzheng Village

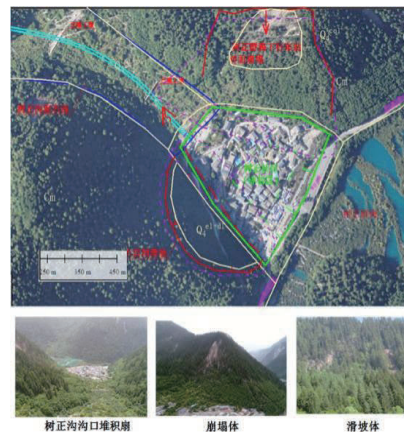


Fig.11 Distribution of Geological Hazards in Zezhawa Village

(2) Relationship between site selection and disasters in early villages

Due to the selection of mountainous areas, Jiuzhaigou Valley in the process of traditional Tibetan site selection, the first encounter is the restriction of geographical space constraints. It is found that because the productivity and production tools of local Tibetans are at a very low level for a long time and there is not enough ability to make great changes to the existing natural terrain, the early Tibetans leave the land at the foot of the mountain to the farmland, and the houses they live in are built on the slope land. The main site selection types are summit agglomeration type and hillside gentle slope type⁷⁾ (Fig.12).

1) Early village of Heye Village

The early Heye Village was composed of the relocation of Spire, Panya and Yana Village, which was forced by military defense at that time. And The main site selection type is a summit aggregation type. Highly centralized layout, very poor external traffic, high degree of secrecy. A few Tibetans live in the Jianpan Village and Panya Village; Yana Village has now died, there are no houses, and only the site remains.

2) Heijiao Village

This is located in the plateau mountainous area at an altitude of about two kilometers above sea level, and it generally takes more than two hours to travel from the mountain steps to the Heijiao Village. Later, with the development of tourism, the overall relocation of Heijiao Village residents to the foot of the mountain road Shuzheng and Zezhawa Village, now uninhabited.

3) Guodu Village

People say that before Guo Du only two or three families lived, and in the past, those in the places such as pointed tray, cross teeth, and Yana, went to Zaru valley to open up the land, because the road was too far away, causing various inconveniences, so they moved to Guo Du to settle down. Therefore, the Tibetan language Guo all means from all sides together. After the scenic area returned to ploughing, all Guodu Village residents moved to the village, now uninhabited.

In the geologic disaster frequent area, the Tibetan early village in Jiuzhaigou Valley is still not seriously affected by the geologic disaster, and its historical context continues to this day. Old villages are mostly located in the high altitude area of the region. Although it is not convenient for people to travel daily, its terrain is relatively flat, soil erosion is weak, and the phenomenon of ecological damage due to filling and excavating soil is avoided, reflecting its adaptability to disasters.



Fig.12 From left to right: Jianpan Village, Yana Village, Heijiao Village, Guodu Village

6. Conclusion

Through the investigation of Jiuzhaigou Valley Tibetan traditional villages, through the comparative analysis of old and new villages, the relationship between the site selection layout and disasters was revealed. In general, the traditional Tibetan village site selection layout in Jiuzhaigou Valley implements the utilization

idea of "adapting to local conditions", and the early site selection layout reflects the concept of "disaster adaptation" and "disaster avoidance" in the face of natural disasters in geologic disaster prone areas, reflects the wisdom of village layout to adapt to terrain and adapt to livelihood survival needs, thus revealing the ecological idea of Tibetan people and nature harmonious symbiosis. Therefore, in the process of site selection in the future, we should give full play to the concept of "disaster adaptation" and "disaster avoidance" of early site selection, avoid blindly pursuing economic development and lead to the infestation of new villages by natural disasters, and inherit the ecological ancestor's wisdom of site selection.

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