

The Social Impact of Earthquake Disasters in Sichuan in the Ming Dynasty

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Abstract: According to the recorded available literature, 10 earthquakes of magnitude 4.5 to 5.5 and 7 earthquakes of magnitude 6 and above occurred in Sichuan area in Ming Dynasty. This paper discusses the serious loss and social impact brought by the earthquake disaster to Sichuan people in Ming Dynasty.

1. Introduction

Table 1: Earthquake intensity

Intensity	Sensation	Manifestation
1	No sense	Only be recorded by the device.
2	Slight sense	Some sensitive people can sense it in complete stillness.
3	A little sense	A few people indoors can sense it in stillness, and the hanging objects slightly swing.
4	Strong sense	Most people indoors, a few people outdoors have senses, hanging objects swing, and unstable utensils ring.
5	Degree of awakening	Most people outdoors have senses, livestock are restless, doors and windows ring, and cracks appear on the surface of the wall.
6	Panic-stricken	People are unstable, livestock flee, utensils fall, rough huts are damaged, and steep hills slide.
7	House damage	Minor damage to houses, damage to archways and chimneys, cracks to the ground and water spraying and sand emitting.
8	Building damage	Damage to many houses, a few damage to roadbed collapse, and rupture to underground pipeline.
9	General damage to buildings	Most of the houses are destroyed, a few are toppled over, archways and chimneys, etc. are collapsed, and railways are bent.
10	Widespread damage to buildings	Houses fall, roads destroyed, rocks collapsed in large numbers, and waves sweep over the water surface
11	Destruction	Massive collapse of houses, roadbed and embankment, and great changes to the surface of the earth.
12	Destroyed beyond recognition	Destruction of all buildings, dramatic changes in the terrain and the destruction of animals and plants

Historical records shows that earthquake disasters occurred frequently in Sichuan in Ming Dynasty, which brought great losses to the people at that time, seriously damaged the local

economy, politics and social life, and brought extremely serious social impact to the local area. To analyze the influence of ancient earthquake disasters, firstly, the earthquake disasters in Sichuan area in Ming Dynasty should be graded scientifically. At present, in the New China Intensity Scale, the intensity of earthquake disaster in China is divided into twelve scales. The author divides the twelve intensity scales of earthquake disasters from the perspectives of magnitude, sensation and manifestation of earthquake intensity. The detail is shown in Table 1:

Table 2: Intensity-magnitude [1]

Intensity	Magnitude	Damage in meizoseismal area				5. Condition of disaster
		1. Buildings	2.Houses	3. Landslides	4. Ground fracturings	
VI (6)	4¾-5	Outline of city are destroyed(castellated beam)	Residential houses are destroyed	Seismic rock avalanche	Seismic ground fracture	
VII	5-5¾	Battlements, towers and walls are destroyed	Residential houses, official and ordinary farmhouses are destroyed (about <25%)	Loess cliff collapse and steep hills slide	There are cracks in soft and wet places such as river beaches, with water out	There are dead and wounded
VIII	6-6¾	Side of the wall (outline) is partially collapsed, the wall is mostly collapsed, and the ditches and bridges are destroyed. The archway, brick pagodas, stone tablets and other objects collapsed.	Temples, warehouses, etc. are damaged or partially collapsed, and public buildings, houses, etc. are mostly collapsed (about 50%). Trees fall.	The foot of the hill collapses and rocks crack.	There are many cracks on the flat land, sand and water slopes appear, and there are cracks between the roads with the emergence of new and dry old springs.	Many people and animals are killed
IX-X	7-7¾	Most of the walls and piers collapse, the top of the tower fall, the tomb tower collapse, the arch stone columns are broken, and the bridges are destroyed.	Officials and ordinary houses, temples and warehouses collapse	The cliffs are generally cracked, the mountains collapse, and landslides lead to blockage of roads and rivers	There are many cracks in the land, a lot of sand or water gushing into canals, slope and river bank and other land crack vertically and horizontally stretching into a zone, the land has fallen, expanded, and the hot springs dry up.	With serious death and injury
>X	>7¾	A lot of collapses	Collapse to nothing	A wide range of landslides blocked roads, blocked water formed lakes, nine-tenths of the peaks collapsed, and the mountains moved to rifts.	The land split into canals, pouring mud and water over the land	Huge disaster occurs

In ancient China, there was no large-scale precise device that could accurately measure earthquakes as now. Therefore, to study the earthquake disasters in Sichuan in the Ming Dynasty, we can only infer the intensity and magnitude of the earthquake according to the earthquake occurrence process and the tragic situation after the earthquake described in the historical books or documents. In this paper, the evaluation criteria for seismic intensity and magnitude in the Summary Table of Historical Earthquake Intensity and Magnitude are adopted. The detail is shown in Table 2.

According to the standards of the above two tables, combined with the author's statistics on the earthquake disasters in Sichuan in the Ming Dynasty, it can be concluded that there were 10 earthquakes of 4.5 to 5.5 in Sichuan in the Ming Dynasty, 7 earthquakes of 6 and above, and high-level and high-destructive earthquakes occurred frequently [13-14].

From 1368 to 1644, there were 172 earthquake disasters in Sichuan, with an average of about 0.62 times per year [15]. If the Ming Dynasty is roughly divided into 50 years as a stage and these earthquakes are listed in the chronology, we can clearly see the trajectory of earthquake disasters in Sichuan in the Ming Dynasty. The detail is shown in Table 3.

Table 3: Chronology of earthquakes in Sichuan area in Ming Dynasty

Period	Number of earthquakes	Percentage of total
1368—1400	4	about 2.33%
1401—1450	0	0.00%
1451—1500	42	about 24.42%
1501—1550	65	about 37.79%
1551—1600	18	about 10.47%
1601—1644	43	25.00%

From the Table 3, it can be seen intuitively that the period from 1501 to 1550 was the high incidence period of earthquake disasters in Sichuan in the Ming Dynasty, and the number of earthquakes occurred was the first in all stages, with a total of 65 times. The occurrence probability of earthquake in Ming Dynasty showed a trend from low to high and then to low, and then to rise again. From 1451 to 1644, the indicators of Sichuan earthquakes in the Ming Dynasty were at a high level. Among them, the data from 1501 to 1550 were relatively high, with the highest annual probability of occurrence. In just half a century, a total of 65 earthquakes occurred, and the annual probability of occurrence actually reached about 1.63 times per year. This is equivalent to nearly 1.6 earthquakes per year, that is, three earthquake disasters occurred every two years [16]. It can be seen that in the early 80 years of the Ming Dynasty, the seismic activity in Sichuan was in a relatively stable period, accounting for only about 2.33 % of the total number of earthquake disasters in Sichuan in the Ming Dynasty, while the 190 years in the middle and late Ming Dynasty was the frequent period of seismic activity in Sichuan. Earthquakes in this period accounted for about 97.67 % of the total number of earthquake disasters in Sichuan in the Ming Dynasty. If it is in the order of year names of Ming Dynasty emperors to study earthquake disaster collection in Sichuan area in Ming Dynasty, the following table 4 can be obtained [17].

It can be seen from the Table 4, the four dynasties of Hongzhi, Zhengde, Jiajing and Wanli were the concentrated periods of earthquake disasters in Sichuan in Ming Dynasty, which were 40 times, 32 times, 29 times and 32 times respectively. The number of earthquake disasters in these four dynasties alone accounted for about 77.33% of the total number of earthquake disasters in Sichuan in Ming Dynasty, which is consistent with the conclusion obtained above [18].

The earthquake disaster in Sichuan in Ming Dynasty mainly concentrated in the period of nearly 190 years in the middle and late Ming Dynasty. Therefore, the author makes a bold guess that frequent earthquake disasters during this period consumed a large amount of financial and material resources in Ming Dynasty. Moreover, due to the influence of the traditional concept of earthquake

warning, these disasters shook the rule foundation of Ming Dynasty to a certain extent, and brought serious impact to Sichuan area in Ming Dynasty and even the whole Ming Dynasty. The following is to discuss the social impact of the earthquake disaster in Sichuan in Ming Dynasty from three aspects: economy, politics and residents' psychology [19].

Table 4: Dynasties of earthquake disaster in Sichuan area in Ming Dynasty

Division of dynasties	Number of earthquakes	Probability of occurrence (times/year)
Hongwu Dynasty (1368-1398 AD)	4	0.13 times/year
Jianwen Dynasty (1399-1402 AD)	0	0.00 times/year
Yongle Dynasty (1403 to 1424 AD)	0	0.00 times/year
Hongxi Dynasty (1425 AD)	0	0.00 times/year
Xuande Dynasty (1426-1435 AD)	0	0.00 times/year
Zhengtong Dynasty (1436-1449 AD)	0	0.00 times/year
Jingtai Dynasty (1450-1456 AD)	0	0.00 times/year
Tianshun Dynasty (1457-1464 AD)	0	0.00 times/year
Chenghua Dynasty (1465-1487 AD)	11	about 0.48 times/year
Hongzhi Dynasty (1488-1505 AD)	40	about 2.22 times/year
Zhengde Dynasty (1506-1521 AD)	32	2.00 times/year
Jiajing Dynasty (1522-1566 AD)	29	about 0.64 times/year
Longqing Dynasty (1567-1572 AD)	1	about 0.17 times/year
Wanli Dynasty (1573-1620 AD)	32	about 0.67 times/year
Taichang Dynasty (1620 AD)	1	1.00 times/year
Tianqi Dynasty (1621-1627 AD)	8	about 1.14 times/year
Chongzhen Dynasty (1628-1644 AD)	13	about 0.76 times/year

2. Effects on the Economy of Disaster Areas

The earthquake disaster in Sichuan in Ming Dynasty was sudden and destructive. If a destructive earthquake occurred, there was almost no possibility to perceive it in advance and take effective measures to prevent and reduce disaster, and its economic impact on the disaster area is incalculable. First of all, the destruction of buildings directly caused a large number of casualties and property losses, and the landslide or flood and drought caused by secondary disasters seriously affected the people in the affected areas to resume production. After the earthquake, the business and handicraft industry in the disaster area stagnated, and agriculture was also severely damaged, which greatly hindered the growth of the local economy, greatly reduced the accumulation value of the total regional economy, and then slowed down the speed of economic development in the disaster area [20].

On March 15th, the 15th year of Jiajing reign (April 6th, 1536), a 7.5-magnitude earthquake occurred in Jianchangwei, Sichuan Province. At that time, the provincial government immediately wrote to the central government, saying, "On March 15th, the 15th year of Jiajing reign (April 6th, 1536), Yuancheng Cao, the official and commander who specialized in judging official affairs in Sichuan, reported that an earthquake occurred in Jianchangwei on February 28 this year, and its roar was like thunder. The office of local army, government and guards, the official mansions, the prison cells, the warehouses, the internal and external military and civilian houses, the city walls, the door walls, the city towers, the crenels, and the city gates all collapsed. The commander in charge of official seals Shi Qian, the commander Yan Hao, the official in charge of thousands of households Zhong Zhai and Sheng Yang, the official in charge of hundreds of households Luan Chen, the town governor Yu Leng, the clerk Jiasong Chen, Weijian Zhu and Jinzhong Yu, the wife of the official in charge of soil and water E Shi, the Tushe Yu An, the township official Zhen Li, the student of imperial college Bei Fu, etc. and households, town villages inside and outside, military and civilian

businessmen, etc. were crushed to death. There were countless deaths and injuries [2]” It is not difficult to see from the historical data that after the earthquake disaster, officials, soldiers, businessmen and ordinary people died and injured in countless numbers, coupled with the collapse of local buildings and warehouses, the local economy and life basically fell into a state of collapse. After the earthquake disaster, the wealth of most local population has been virtually wiped out, and the grain accumulated in previous years no longer existed. The only way to recover the local agricultural economy is to gather from other regions through government mean. The recovery of agriculture was the most important thing at that time, and the recovery of handicraft industry and commercial economy was a long-term thing in the future. At that time, effective measures could not be taken or there was no ability to recover.

3. Destruction of the Political Order in the Disaster Area

The earthquake disaster caused a large number of government officials and office workers to be dead and injured, and the government offices and city walls collapsed, resulting in a lack of government offices and no fixed office locations, and the government was in a semi-paralyzed or paralyzed state. As mentioned above, a large number of officials were crushed to death in the earthquake in Jianchangwei, Ningfanwei and other places in Sichuan Du Si in February of the 15th year of Jiaping reign. In Sichuan Du Si, “the commander in charge of official seals Shi Qian, the commander Yan Hao, the official in charge of thousands of households Zhong Zhai and Sheng Yang, the official in charge of hundreds of households Luan Chen, the town governor Yu Leng, the clerk Jiasong Chen, Weijian Zhu and Jinzhong Yu, the wife of the official in charge of soil and water E Shi, the Tushe Yu An, the township official Zhen Li, the student of imperial college Bei Fu, etc. and households, town villages inside and outside, military and civilian businessmen, etc. were crushed to death. There were countless deaths and injuries [3]” Fan Wei reported that “Commander Ying Liu, the official in charge of hundreds of households Jue Liu and Lian Zheng, and military and civilian men were crushed to death [4]” Among the casualties listed above are the highest local administrators, senior military officials, and local township officials and gentry. Therefore, it is not difficult to see that in the face of sudden disasters such as earthquake disasters, whether it is the ordinary people or the aristocracy, or the officials are the same, there is no slightest ability to resist. The death of military and other officials will inevitably led to the decline of local administrative efficiency and the abnormal operation of government functions, especially when “The office of local army, government and guards, the official mansions, the prison cells, the warehouses, the internal and external military and civilian houses, the city walls, the door walls, the city towers, the crenels, and the city gates all collapsed [5]”, officials and ordinary people had no fixed place to live and no access to turn for help, the local area naturally entered a state of political vacuum. In the earthquake, officials were dead, government offices were collapsed, local warehouses, prisons and other state machineries were completely destroyed, coupled with the previous contradictions between the officials and the ordinary people, these together led to the victims “gathering to loot” [6]. This has seriously damaged the local political order in the disaster area and has had a serious impact on the local disaster relief and mitigation work.

4. Influence on the Psychology of the Residents in the Disaster Area

As a natural disaster, earthquake has its process of gestation, development and outbreak. For earthquakes, humans were not ignorant. Because the productivity of the Ming Dynasty was not very developed, people did not have a correct understanding of earthquakes, and because of the huge destructiveness of earthquakes, people were psychologically covered with a shadow of terror, so when the earthquake occurred, it was mostly “military and civilian shocked” [7], and it was

believed that earthquake disaster is a warning from heaven or a manifestation of a myth. From the perspective of psychological tendency and emotion, there are two main reasons for this shocking situation. One is the poor psychological quality of the ancients, and the other is the lack of scientific knowledge about earthquake and earthquake resistance at that time, and people's emergency response ability is low. In the Ming Dynasty of China, due to the limitation of scientific knowledge, the number of people who really understood the seismic knowledge is extremely rare. This lack of understanding and psychological quality barriers, reflected in the behavior, will inevitably lead to the blind action of the residents in the disaster area, resulting in the occurrence of wrong behavior. A large number of casualties and the secondary damage caused by a large number of aftershocks have led to more rumors in the disaster area, and spread more and more. Today's Xichang area of Sichuan Province was under the jurisdiction of Sichuan du-si in the Ming Dynasty, and the government set up Jianchangwei here. As it is located on the branch fault zone of Xianshuihe-Xiaojiang fault zone, there have been more seismic activities since ancient times, and the probability of destructive earthquakes is very high. Therefore, the local people are curious and fearful of the earthquake disaster, so there are many false legends about the earthquake. Some historical books and local chronicles have also recorded it in detail, so that it has been spread around and copied, and circulated in society. In the Ming Dynasty, the most famous of these rumors was the "land sinking of ancient city" in the 15th year of Jiajing reign in the Ming Dynasty, which evolved from the previous "land subsidence of Qiongzhusi" and "sea sinking of Luzhou". The main meaning of the legend is that the whole city of Jianchangwei will sink due to the earthquake in Xichang area, forming a big lake. According to historical records, "foolish people advocated for the words of the ancient Luzhou sinking into the sea, turned to incite, and almost caused turmoil of the current situation [8]", the emergence of these legends led to the panic of local residents, and even more, they scrambled to flee and provoked uprisings. The local government repeatedly banned them, but still could not stop that, which caused great chaos to the local society and interfered with the normal administrative rule and jurisdiction of the local area. Certainly, due to the specific geographical conditions in Xichang area, earthquake disasters occurred frequently, which made this legend spread widely, leading people to believe that the legend will become a reality. The long-standing legends and rumors have cast an indelible shadow on the psychology of the local residents. As soon as something happened, they would not distinguish between the true and the false, became panic immediately, and a tragic ending was caused [9-11].

To sum up, the earthquake disaster in the Ming Dynasty brought great harm to the people at that time and had a bad social impact. Since ancient times, earthquake disasters have had a serious impact on human society. How to effectively predict earthquake disasters and reduce the impact of earthquake disasters is crucial [12].

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