Impact of Climate Change on Ancient Chinese Dynasties

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Abstract. Since the dawn of history of China, the rise and fall of dynasties has been an irresistible historical process. This paper aimed to interpret the succession of dynasties from a historical, social, and cultural perspective. Throughout history, many theories have emerged to explain these factors. Climate change has been a concern in recent years, and many countries have begun to take action to address the issues brought about by climate change. In recent years, when discussing the rise and fall of Dynasties in Chinese history, people tend to explore the essential reasons rather than surface events. This paper focuses on the impact of climate change on several aspects of the dynasties, like development and agriculture. Which may be related to national fortune or productivity, but it is undeniable that the rise and fall of each dynasty has its own corresponding climate characteristics, so when looking at historical issues, it is worth exploring the overall law of climate change affecting the rise and fall of dynasties in history of China.

Keywords: Climate change; history of China; dynasty; social influence; environmental factor.

1. Introduction

For China, the impact of climate change is more profound than that of other countries. As an ancient civilization with a long history, many dynasties in China's history have been affected by climate change. This paper aims to explore the impact of climate change on history of China, hoping to better understand the impact of climate change on human society by reviewing history [1].

For the dynasties in history of China, climate change is an indelible scar. From the Zhou Dynasty to the Jin Dynasty, drought and cold Atmospheric circulation occurred in northern China for more than 200 years, leading to a large-scale catastrophic famine. During this period, the Chinese people had to face disasters such as food shortages, sudden disasters, large-scale hunger, and epidemics. In addition, climate change has also triggered social unrest [2-4]. During the Northern and Southern dynasties, China's heavy rainstorm and floods destroyed many cities, leading to social chaos and turmoil. Even in the relatively stable period in history of China, climate change has been affecting people's lives.

During the Tang and Ming dynasties, climate change brought severe catastrophic floods, destroying many crops and villages, leading to social unrest and economic deterioration. During the Qing Dynasty, a 70 year long famine of white flowers broke out throughout the country, which was caused by a decrease in national food production and grassland degradation caused by climate change. Therefore, climate change has had a huge impact on China's historical dynasties, thereby affecting China's social and historical development and political and economic forms. This paper will explore the impact of climate change on history of China from a historical perspective, hoping to better understand the impact of climate change on human society through such research [5].

2. Rise and Fall of Dynasties and Definition of Prosperity

Since the Spring and Autumn Period and the Warring States Period, a remarkable feature in history of China is the alternation of 'governing the world' and 'troubled times'. From the Han Dynasty to the Ming and Qing Dynasties, each dynasty experienced ups and downs. The peak of a dynasty's development is that during the ruling period of a dynasty, many aspects of society such as politics, economy, and people's livelihood have reached relatively high levels. And the dynasty declined to the extreme, where an old dynasty perished and was replaced by a new dynasty. Regardless of which

one it is, its essence can be seen as a social state that lasts for a certain period of time, whether good or bad, and the mutual transformation between them.

In history of China, if a dynasty has reached a high level in politics, economy and other aspects, it can often be called a 'golden age', and the time of the golden age is defined by the ruling period of the reigning emperor and the time of the year.

3. Climate Change Effect on the Dynasties

3.1. Basic Definition

In history, dynasties have undergone frequent changes. If start counting from the Xia Dynasty, China has already experienced twenty-three Dynasties and Chaotic Secession. According to the changes of time [6]. It is obviously not enough to simply blame Class conflict and political struggle for the change of dynasties. Overall, the rise and fall of dynasties have never been caused by a single cause, but rather by multiple factors. But one of the most overlooked reasons is climate.

The study of the impact of climate on the changes of dynasties in China has a long history. Overall, China's climate change has had a significant impact on history. The main impact is to cause changes in agricultural product production, which in turn affects taxation and population. Exacerbating the decline in labor productivity.

Firstly, when the average temperature during a certain period exceeds the historical average, it is called a warm period. When the average value is lower than the historical average temperature, it is called a cold period. It can be seen that the warm season time often corresponds toIt is a unified dynasty. The cold period often corresponds to the period of war, separatism, and dynastic succession. In China, the national fortune generally does not exceed two to three hundred years, which is similar to the alternating time of cold and warm in ancient China.

From the perspective of scientists, the change of dynasties is basically consistent with the law of warm prosperity and cold decline. A new research result from the Institute of Earth Environment of the Chinese Academy of Sciences also shows that the climate over the past 2000 years has been cold. The warm changes correspond to the rise and fall of some dynasties in Chinese history, with the collapse of most dynasties occurring during [7]. A low-temperature range where the climate becomes colder. This research has been jointly funded by the National Natural Science Foundation of China and the Ministry of Science and Technology of the People's Republic of China. Fig. 1 is timeline of Dynasties in Chinese history.

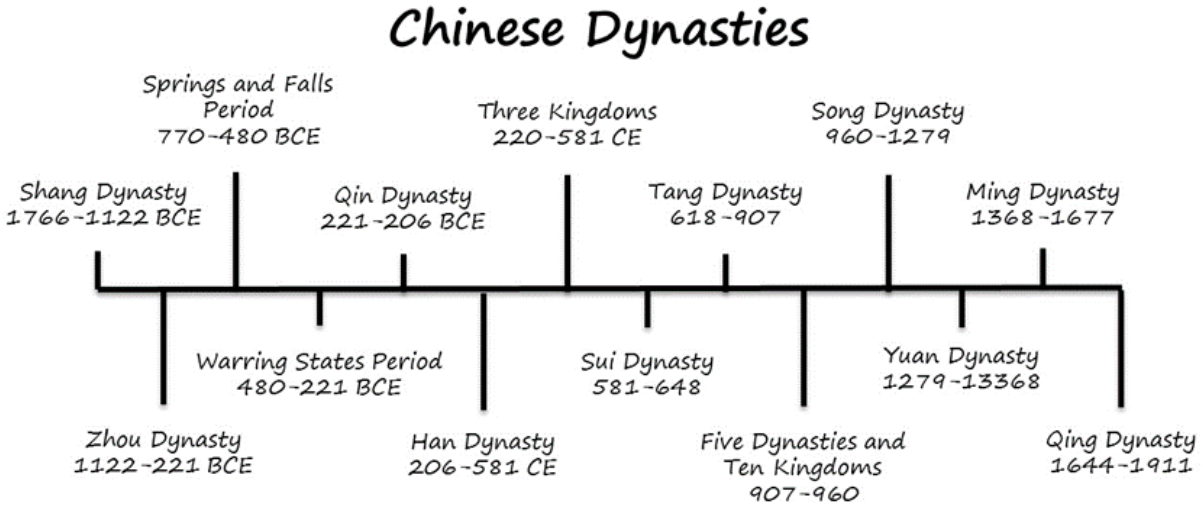

Fig 1. Timeline of Dynasties in Chinese history.
https://d28y5daoc1t3a7.cloudfront.net/35/9ab6664f8e77f5b75aa4a3cd575f58/dynasty.jpg

3.2. Impact of Climate Change on the Development of Ancient Society

Since ancient times, many historians have considered the means of governing the country, the economic basis of rule, the life of the Ruling class and other aspects of the feudal rulers when analyzing the development of ancient Chinese society, the rise and fall of dynasties, and the replacement of dynasties. In addition, when analyzing the causes and background of a historical event, they will adopt the traditional three-step analysis method of "politics, economy, culture (thought)". As for the impact of geographical environment on the development of Chinese society, it is often overlooked. Zhang et al. believe that there are two main types of factors closely related to the historical development of human society: one is the factors of "people" themselves, and the other is the factors of geographical environment. The author is not a believer in "Environmental determinism", but throughout history of China, geographical environment has a certain impact on social development. Of course, this impact is not absolute. As Zhang et al. said, the relationship between the historical development of human society and geographical environment changes with time and space, and the links are really complex. Of course, this conclusion is also applicable in China.

Among many geographical and environmental factors, many people would like to focus on discussing the impact of climate change on China's social development. The ancients believed that the three factors of timing, location, and people were the key to victory. Considering that ancient Chinese society was based on a small-scale peasant economy, the development of agriculture played a crucial role in the entire society. In feudal societies with low productivity, agriculture was easily affected by climate change. Therefore, "timing" is of great significance for the development of Chinese society. This article will attempt to explore the impact of climate change on China's socio-economic and political aspects, and explore the correlation between climate change and China's social development.

Climate is a wide-ranging concept that includes factors such as temperature, precipitation, and wind. Due to significant regional differences in precipitation in China compared to spatiotemporal differences, it is difficult to analyze. Therefore, this article regards temperature as the only criterion for climate change, especially in winter. As for the research on climate change in history of China climate, many scholars have contributed to it since the 1970s. Of course, when it comes to changes before and after, it have to be refered to the monumental work written by Mr. Chu Coching-Preliminary Research on Climate Change in China in the Past Five Thousand Years. According to historical and archaeological excavation materials, Divide the history of climate change over the past five thousand years into four periods: Firstly, during the archaeological period, from around 3000 (BC) to 1100 (BC), there were no written records of exceptions carved on oracle bones. Secondly, during the phenological period, from 1100 (BC) to 1400 (AD), there were written records of phenology, but no detailed regional reports. Thirdly, during the local chronicle period, from 1400 (AD) to 1900 (AD), there were locally written and modified local chronicles in most parts of China. Fourthly, during the instrumental observation period, China began to have instruments since 1900 Observing meteorological records, but limited to the eastern coastal area, "he also divided into four warm periods and four cold periods. Of course, there are areas for discussion regarding the accuracy of specific stages.

3.3. Impact of Climate Change on Agriculture

The Chinese nation originating from the Yellow River basin is obviously a farming nation, and the economic model of the entire ancient Chinese society was dominated by the small-scale peasant economy. This self-sufficient, men's farming and women's weaving Traditional economy model was not broken until modern society. It can be said that since ancient times, China has been a major agricultural country, and the agricultural policies of successive rulers have also demonstrated the importance of agriculture [8]. He et al. believe that agriculture, as a product of the combined effects of economic reproduction and natural reproduction, is deeply constrained by climate conditions. The author will conduct a simple analysis of the impact of climate change on the scope of agricultural areas and crop yields.

Regarding the impact of climate change on the scope of agricultural areas, He et al. summarized this conclusion in their paper "Several Advances in the Study of the Impact of Climate Change on Ancient Chinese Agriculture during the Historical Period": the warm period is beneficial for agricultural development, while the cold period is the opposite. When the climate is warm, the agricultural planting boundary in the north shifts northward and the agricultural cultivation area expands, while when the climate is cold, the agricultural planting boundary retreats southward. When the climate is warm, the scope of agricultural areas expands, while when the climate is cold, the opposite is true. The author believes that this conclusion is relatively reliable [9]. Looking through relevant studies, it will be found that the northern boundary of agricultural areas in history of China has moved northward or retreated southward with the temperature being cold, warm, dry and wet.

For example, during the cold period of the Wei, Jin, Northern and Southern dynasties, the average temperature in the eastern and central regions of China in the winter half year was more than 0.4 ℃ lower than today, and the average temperature in the winter half year was 1.2 ℃ lower than today. In this cold period, the agriculture and animal husbandry of Nomad such as the Huns, Xianbei, Jie, Qiang, etc. were greatly affected. The low temperature made the pasture on the grassland insufficient to supply the survival needs of livestock, so they moved to North China one after another to establish a state. However, these Nomad are still accustomed to farming and animal husbandry, which has caused the northern agricultural areas to retreat southward in a large scale, and the animal husbandry has entered the North China Plain. One of the reasons for the historical event that Emperor Xiaowen of the Northern Wei Dynasty moved his capital to Luoyang was the "cold ground in Pingcheng", agricultural recession and insufficient food supply. After the relocation of the capital, it can be seen that the area of the agricultural areas at that time had significantly decreased, as the "imperial edict for the inspection and grazing of horses" was located west of Shiji (now east of Yanjin County, Henan Province) and east of Hanoi (now in the Anyang area, Henan Province). Although the cold climate does not directly reduce the scope of agricultural areas, it is closely related to the large number of Nomad moving southward due to the cold climate [10]. As for the changes in agricultural areas during the warm period, so Sui and Tang dynasties were the most typical examples. The climate of the Sui and Tang dynasties was generally warm, and the average temperature in the eastern and central regions of China in the winter half year was over 0.2 ℃ higher than today. The emergence of "Zhenguan Zhi Zhi" and "Kaiyuan Sheng Shi" is undoubtedly closely related to the prosperity and development of agriculture. During the prosperous period of the Tang Dynasty, ethnic minorities such as Turks migrated back to the outside of the Great Wall, the boundaries of animal husbandry moved northward, and agricultural areas expanded. Furthermore, the Han people migrated westward and northward, reaching counties such as Shangjun, Beidi, and Anding. Their people were diligent in farming; Oasis agriculture in Hexi Corridor has also been well developed. During this period, the northern boundary of the agricultural area was pushed northward to the present day along the lines of Jingyuan, Yanchi, Baichengzi, Hohhot, Zhangjiakou, and the southern foothills of Yanshan.

In ancient societies with underdeveloped productivity, crop yields were highly unstable due to climate change. Modern research shows that if Ceteris paribus remain unchanged, If the annual average temperature increases (decreases) by 1 ℃ or the precipitation increases (decreases) by 100mm, China's grain yield per mu will increase (decrease) by 10%, respectively. It can be seen that small changes in temperature can also cause an increase or decrease in crop yield.

During the cold period of the Wei, Jin, Northern and Southern dynasties, the national grain yield per mu was far from that of the relatively warm Han Dynasty, while the national grain yield per mu in the Sui and Tang Dynasties was much higher than that of the relatively cold Wei, Jin, Northern and Southern dynasties. It is quite strange that during the cold period of the Ming and Qing dynasties, crop yields increased. The author believes that at this time, agricultural production may be more affected by production technology and tools than by climate change. From this, it can be seen that the impact of climate change on agricultural development is not absolute either

3.4. Impact of Climate Change on the Migration of Economic Center

The economic center of ancient China shifted southward from the Tang Dynasty to the Southern Song Dynasty. When analyzing the reasons for the southward shift of the economic center of gravity, Mr. Fan Wenlan proposed the factor of population southward migration, that is, a large number of Han people in the Yellow River Basin migrated southward, most of whom were working people who brought more advanced production technologies from the north to the south. It is obvious that this viewpoint focuses on humanistic factors. But imagine that in history of China, there were three large-scale population migrations to the south, namely, the Upheaval of the Five Barbarians Period, the An Lushan Rebellion Period at the end of the Tang Dynasty and the Jingkang Rebellion Period of the Southern Song Dynasty. However, the economic center of gravity moved to the south only once, and it was completed by the Southern Song Dynasty. Obviously, the southward shift of the economic center of gravity is not just due to the southward shift of population and technology. Zhang Yuxiao and Zhang Luezhao pointed out in their article "The Impact of Climate Change on the Southward Shift of the Economic Center in the Song Dynasty" that the climate change in China during the Song Dynasty was the most fundamental reason for the formation of the economic center in ancient China during the Song Dynasty.

From the above overview of the climate in the history of China period, the Song Dynasty was in the transition period from a warm period to a cold period. The climate in the first and middle periods of the Northern Song Dynasty was mainly characterized by a warm period climate. By the end of the Northern Song Dynasty, the climate change that had gradually become cold became more and more obvious. At the beginning of Emperor Huizong's reign at the end of the Northern Song Dynasty, China entered a new cold period of climate change in its history. Overall, the climate of the Song Dynasty was colder than that of the Tang Dynasty, and the process of changing from warm to cold was slow, with complex changes in the alternating cold and warm climates.

The production of grain crops had the greatest impact on the ancient Agrarian society of China, and the southward movement of the economic center of gravity was closely related to the north-south distribution and yield differences of rice and wheat. Before the Song Dynasty, rice was planted in a large range, which was widely distributed in the northern region starting from the Hexi Corridor in the west, reaching Hetao in the north, Huaihe River in the Qinling Mountains in the south, and the sea in the east. Among them, planting is relatively concentrated in areas such as the Guanzhong Plain and the Huanghuai Plain. In the Song Dynasty, the climate turned cold, precipitation decreased, the planting range of rice decreased, and the yield decreased. Because the magnitude of climate change increases with latitude, the south is less affected by the colder climate than the north. In the Song Dynasty, rice was also widely planted in the Yangtze River, the Pearl River and Minjiang River basins. And wheat also began to be planted in the south during the cold period of the Song Dynasty. Because winter wheat needs to undergo certain low temperature conditions to grow, the colder south is suitable for growing wheat. south

The yield of square grain per mu gradually increased and began to surpass that of the north, so there is a saying: "When Su Lake is ripe, the world is abundant". The rapid development of agriculture in the south also promoted the prosperity of handicrafts and commerce, and thus the social economy was able to lead the country. The climate change of the Song Dynasty reversed the advantages and disadvantages of the natural environment in the north and south, and the southward shift of the economic center was destined to be irreversible. Fig. 2 is the Change of Dynasties in Chinese history and Its Prosperity and the Change of Temperature and Agriculture.

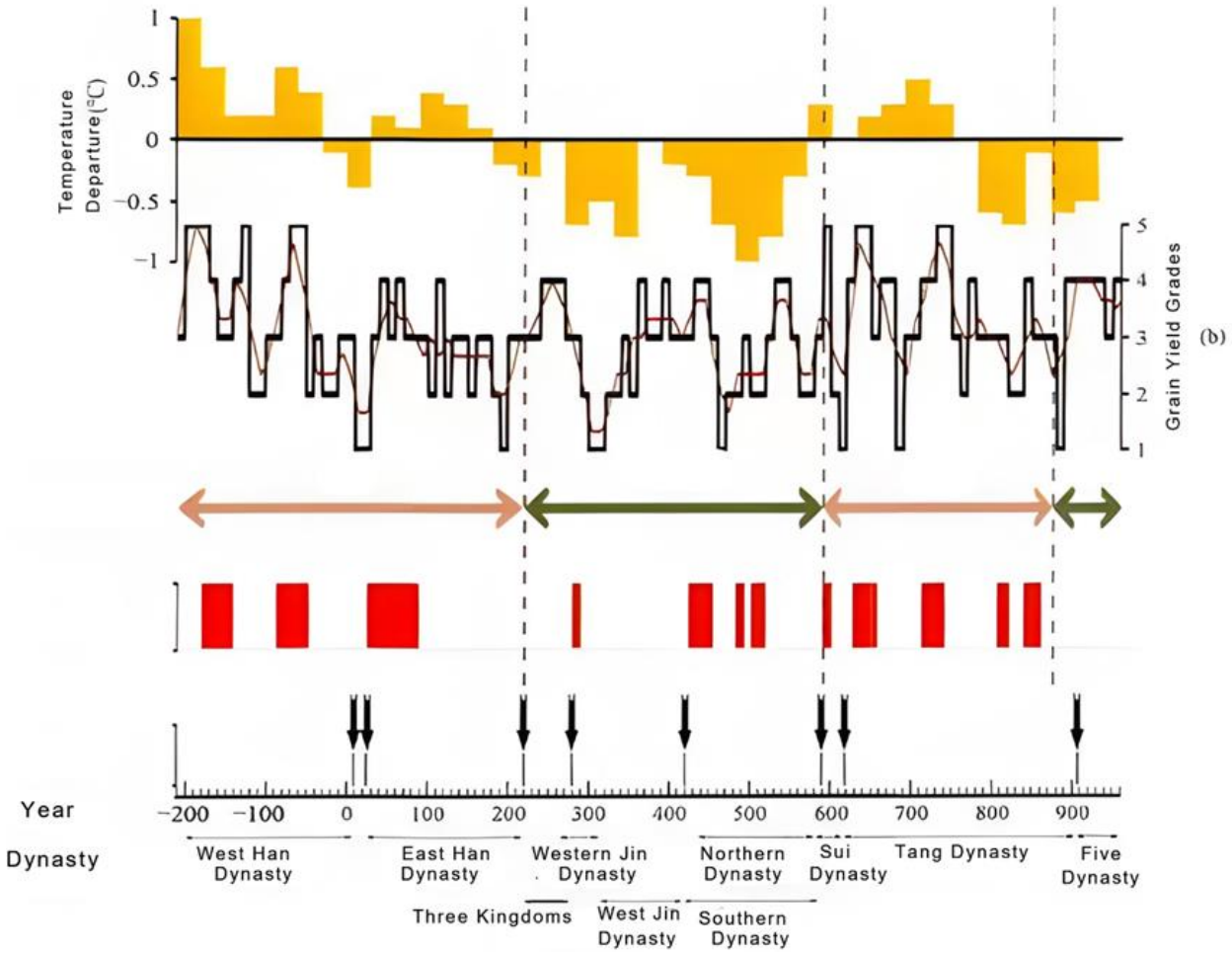

Fig 2. The Western Han Dynasty to the Five Dynasties (210BC-960AD): The Change of Dynasties in Chinese history and Its Prosperity and the Change of Temperature and Agriculture. (Photo/Picture credit: Original)

3.5. Impact of Climate Change on the Destruction of Dynasties

When it comes to the impact of climate change on the downfall of dynasties, the Ming Dynasty is definitely an excellent example, because the downfall of the Ming Dynasty was caused by its period which is called the Little Ice Age.

Astronomers believe that the luminosity of the sun and the gravitational and radiation changes between the Earth are the main reasons for climate change on Earth. When the luminosity of the sun weakens, the amount of radiation entering the Earth decreases, and the Earth naturally cools. When the radiation is too low, it can lead to the appearance of an ice age climate. The Geophysics school believes that the appearance of the Little Ice Age should be considered from the physical factors on the earth. In terms of atmospheric physics, the frequent volcanic activities lead to a sharp increase in the amount of Volcanic ash in the atmosphere, which reduces the transparency of the atmosphere. Therefore, the amount of radiation in the atmosphere decreases, leading to the cooling of the earth.

From a geographical and geological perspective, one can approach it from the perspective of plate movement. The movement between different plates can cause land to rise and fall, and the displacement of plates changes the distribution of sea and land in the past as well as the circulation of climate. Under the influence of natural climate factors such as clouds, rain, and snow, the Earth's cooling state will instantly lead to the arrival of an ice age.

Whether in ancient or modern China, the impact of climate change on society and human life is immeasurable and often beyond the control of ordinary people. Even though our technological level has advanced by leaps and bounds compared to the Ming and Qing dynasties, human are still at a loss when facing some environmental problems, let alone the people of the Ming dynasty more than 400

years ago. The Little Ice Age of the Ming Dynasty not only affected the people's lives, but also made the rule of the Ming government more precarious.

According to historical records, snowfall was common during the Ming Dynasty, even in the southern regions. The water surface of the Yangtze River and Qiantang River has been frozen for more than a month, and the perennial warm Guangzhou has also seen more than a foot of snow.

This is still the case in the south, let alone the north. According to records, in the 48th year of the Wanli reign of the Ming Dynasty (1620AD), the Shandong region had already experienced extensive rainfall and snow as early as October. The snow accumulated over several feet, and even the branches could not bear the heavy burden of the blizzard. They all broke off on the roadside, causing birds and animals to freeze to death and starve to death; Hebei is even more severe. In the eleventh year of the Chongzhen reign of the Ming Dynasty (1638AD), heavy snowfall began to fall in early May, making the winter scenery even more unimaginable.

During the Chongzhen period of the Ming Dynasty (1628AD-1644AD), a rare ten year drought occurred, causing the lakes to gradually dry up, and even the main and tributaries of the Yellow River to experience flow interruptions. This is an unprecedented drought disaster in history. The precipitation in North China has decreased by 11%-47% in the past ten years, and 23 regions have experienced severe drought for more than four consecutive years. Frequent droughts have also led to floods. In the northern Shaanxi region, for example, during the Chongzhen period alone, there were six major floods, with the Yellow River breaking its banks and the city being flooded. North China was the main agricultural production area at that time, and for agriculture, whether the water supply was balanced directly affected the agricultural harvest. During the drought years, agriculture in North China experienced a significant reduction in production, with harvests not exceeding one tenth of previous years and food prices skyrocketing. It is very common for people to eat grass and bark, and even worse, their loved ones eat each other, which is unimaginable. Compared with the early years of the Ming Dynasty, the population of the Ming Dynasty in the 17th year of Chongzhen decreased by a total of three quarters, resulting in the stagnation or even regression of social productivity in the Ming Dynasty. Fig. 3 is the little ice age period.

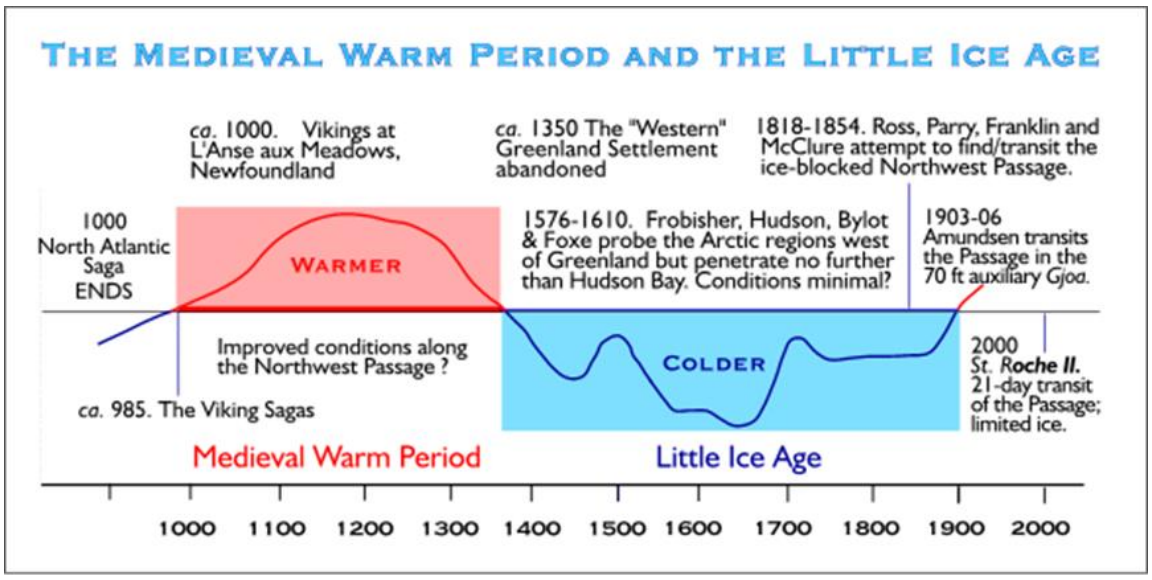

Fig 3. The little ice age period. https://www.spirasolaris.ca/liav3l3s2.gif

4. Conclusion

Through the analysis of the above five factors, in China's two thousand year history, the mild warm and humid climate has shortened, the cold and dry climate has prolonged, and the degree of drought has deepened. This is precisely the reason why the northern Nomad continue to invade southward. So explore the reasons for this rule, the climate change in nature, Undoubtedly, the impact on the

farming and Nomad is quite obvious. This influence will start from social production and extend all the way to social chaos, national strength, and dynastic succession. For example, when the climate was cold, Nomad launched an attack on the Central Plains Dynasty in order to find new areas suitable for grazing, while the Central Plains Dynasty was in a cold period, with a sharp decline in productivity and empty national treasury, and generally vulnerable to large-scale organized attacks. On the contrary, during warm periods, suitable temperatures and abundant precipitation often lead to agricultural recovery, economic development, and the emergence of a peaceful and prosperous era.

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