

The Not So Little Little Ice Age: Climate Change Impacts on the Collapse of the Yuan and Ming Dynasty

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The term "Little Ice Age" was coined by Dutch-born American geologist F. E. Matthes in 1939 to describe the unstable climate interval during the Late Holocene linked with the period of dramatic mountain-glacier expansion and retreat.¹ The period is traditionally defined as the early 14th century through the mid 19th century, although regions strongly impacted during this time greatly varied on the timeline. The Yuan dynasty and the Ming dynasty are two distinguished Chinese dynastic cycles that both fell during peaks of the Little Ice Age in China. At a time of rise in unusually dry and cold weather in China during Zhu Yuanzhang's seven-year war in 1368 against the Yuan dynasty, the empire fell and Zhu Yuanzhang declared himself emperor of the new Ming dynasty. The Ming dynasty reined for almost three centuries, transforming China in unforgettable ways from the construction of the Great Wall and the imperial palace, known as the Forbidden City, to the complete renovation of the Grand Canal.² Throughout the 16th century the Ming continued commercialization and globalization by expanding China's role in the global economy. In 1644 the powerful and expanding Ming Dynasty, which had seemed like an ever lasting dynasty, came to an end.

¹ Michael Mann, "Little Ice Age," *Encyclopedia of Global Environmental Change* 1 (2002): 504-09.

² Albert Chan, *The Glory and Fall of the Ming Dynasty*, (Norman: University of Oklahoma Press, 1982).

The Little Ice Age produced climatic conditions of severe cooling and increased natural disasters during the decline of the Yuan Dynasty and the Ming Dynasty, triggering unrest in both the Yuan and Ming people. The devastating climatic effects of the Little Ice Age led to serious economic, political, and social problems for both dynasties, resulting in a weakened government, dissatisfied and aggravated population, and depressed economic state.³ Did the Little Ice Age initiate the collapse of two consecutive Chinese dynasties: the Yuan dynasty and the Ming dynasty, although their downfalls were almost 300 years apart? The decline of the Yuan dynasty in 1279 is paralleled with the decline of the Ming dynasty in 1678 nearly three centuries later from the analogous affects of the Little Ice Age.

With interest regarding China's path towards becoming a world power increasing in historical debates today, the research on Chinese dynastic cycles has received a rise in attention. Climate change has also become an increasingly hot topic due to current and predicted changes in temperatures, rainfall patterns, storm intensities, and sea levels.⁴ This has prompted more research into past climate changes and heated the debate concerning past unexpected environmental occurrences. The Little Ice Age is a term that has been highly debated because of lack of documents and data to define the exact period of persistent cooling.⁵ The historic lack of climate records and data during the Yuan dynasty and Ming dynasty prevented an understanding of how severe the conditions were and the severity of the effects. Currently, scientists and researchers are able to gather more accurate data revealing the climate changes during the Little Ice Age, bringing new insight

³ Koh Khee Heong, "The Troubled Empire: China in the Yuan and Ming Dynasties," *China Review International* 19, no. 2 (2012): 215-219.

⁴ Marcy Rockman, "New World with a New Sky: Climatic Variability, Environmental Expectations, and the Historical Period Colonization of Eastern North America," *Historical Archaeology* 44, no. 3 (2010): 4-20.

⁵ Ulf Büntgen and Lena Hellmann, "The Little Ice Age in Scientific Perspective: Cold Spells and Caveats," *Journal Of Interdisciplinary History* 44, no. 3 (2014): 353-368.

into the impact it had on the Yuan and Ming government and their subjects.

The Little Ice Age in China can be broken up into two phases, the first stage beginning around 1290 and lasting until the late 1400's, and the second being after the start of the 1600's. There are several significant historical indications for the Little Ice Age, including the freezing of the Baltic Sea, the expansion of pack ice in the south, and the bitterly cold winters with cool and wet summers.⁶ The conditions had devastating effects: crop failure, population decline, economic downturn, and famine. During these times, a pattern of social unrest rose with starvation and poverty blanketing the lower classes. Historians have discussed the Little Ice Age with a general understanding regarding the time period of its occurrence, yet there are still debates about how serious the effects were. Researchers have studied the causes for the Yuan and Ming dynasties failures, but the Little Ice Age is rarely discussed as a reason. Recently, through greater data collection and research, there has been an increase in evidence to verify that the Little Ice Age had a particularly dominant impact on the dynasties during the periods of their collapses.⁷ Historians should now recognize the significant role the Little Ice Age had in these collapses. The effects of the Little Ice Age on these dynasties changed the course of China, including China's path to modern development and the demise of the traditional government structure of the dynastic cycle and Mandate of Heaven.

Scientists at the University of Colorado-Boulder have continued studies to track down a closer estimated time for the period of the Little Ice Age. A researcher there, Jean Grove, has disclosed that although no one cause can be traced or explained from changes in earth's orbital pattern, evidence suggests that the Little Ice Age was caused by internal processes in the climate

⁶ Jean M. Grove, "The Little Ice Age," *Arctic and Alpine Research* 21, no. 3 (1988): 321-322.

⁷ Jan de Vries, "The Crisis of the Seventeenth Century: The Little Ice Age and the Mystery of the Great Divergence," *Journal Of Interdisciplinary History* 44, no. 3 (2014): 369-377.

system, such as solar variability, geomagnetism, and volcanism. Through radiocarbon dating of plants from the Baffin Island and sediment from Iceland lakes, there is indication that between 1275 and 1300, the start of internal turmoil and social unrest within the Yuan dynasty, severe cooling began.

Many ideas have been explored for the cause of the decline of the Yuan dynasty, but researchers rarely mention the climatic changes from the Little Ice Age as one of these explanations. Class conflict and government corruption are cited as fundamental sources for the collapse of the Yuan dynasty. The increased taxation from corrupt Yuan court officials, especially in 1308 during the rule of Emperor Renzong, also known as Buyantu Khan, expanded class divides and social unrest. From Emperor Renzong's reign in 1308 to Emperor Huizong's reign in 1333, eight emperors ruled through bribery of subordinate officials rather than on merit or experience.⁸ Historian Herbert Franz Schurmann from the Harvard-Yenching Institute Studies discusses the economic structure of the Yuan dynasty in great detail, explaining the social and economic history of China during the Mongol emperors rule. His research originates from monographs on the economy of the Yuan, as well as data on the land survey, monopolies, agriculture, and currency. The information from his translations and research of Yuan imperial documents reveal that although the wealth of the Chinese sources was abundant, the institutional aspect of the economy lacked state intervention. The government focused attention on the basic tendencies of economic development, ignoring the people's need for government assistance. Schurmann acknowledges that even with the Yuan government structure's faults, the dynasty was able to still prosper. It was not until the start of the Little Ice Age that the ignorance of the government towards the people's needs became an intolerable problem. The lack of intervention from the government remained

⁸ Herbert Franz Schurmann, "Economic Structure of the Yuan Dynasty," In *Harvard-Yenching Institute Studies XVI*, ed. Robert Sheer (Cambridge: Harvard University Press, 1956), 325-330.

throughout years of success for the dynasty, but when the environmental problems struck smaller Chinese communities, the people realized they had to make a change in the regime.

During the last emperor's reign, the power of the Yuan dynasty fell into the hands of the prime minister, Bo Yan. Bo Yan was born from a Mongolian noble family and announced several policies against the Han Chinese people.⁹ Historian Zhi'an Li explores the ethnic tensions between the Han Chinese and Mongol people.¹⁰ His research reveals the severity of the tensions, and he names it as a key reason for why a social uprising began. The ethnic strains that existed during Bo Yan's reign were not abnormal for a large country with different dialects, cultures, and backgrounds, but these tensions were worsened due to climate changes from the Little Ice Age, thus contributing to the collapse of the Yuan. In 1344, the Yellow River flooded, resulting in calamitous poverty and devastation of homes and agriculture. Desperate to rebuild the banks as fast as possible, the Yuan government forced people, mainly the Han Chinese, to build new embankments for the Yellow River. The horrible treatment of the workers who had already lost everything and felt ethnic inequality led the people to unite together to fight for a regime change. In 1351, a huge peasant uprising, the Honjingjun Uprising led by Liu Futong, broke out in Ying Zhou. Several battles between Hongjinjun military and the Yuan army followed, and eventually the regime was overthrown.

During times of climatic trouble, people hold institutions responsible for response and recovery, and search for a solution to an uncontrollable problem, particularly with the Chinese

⁹ John W Dardess, "From Mongol Empire to Yuan Dynasty: Changing Forms of Imperial Rule in Mongolia and Central Asia," *Monumenta Serica* 30, (1972-1973): 117-165.

¹⁰ Zhi'an Li, "Mongol Influence on Ethnic Han Chinese in the Yuan Dynasty," *Historical Research / Lishi Yanjiu* (2009): 24-50.

philosophical idea: the Mandate of Heaven.¹¹ The idea that the Yuan dynasty was responsible for, states that the emperor, the Son of Heaven, is bestowed the mandate when god chooses a worthy and just ruler. The idea that the ruler was chosen from heaven had a great impact on how the Chinese people interpreted times of trouble. During hard times within the emperors reign, such as climatic or economic suffering, it was believed that god had withdrew the Mandate of Heaven and that there should be a shift in government to the new ruler with the Mandate of Heaven. The climactic turmoil brought on during the start of both the dynasty's' collapses is a key cause of the economic, social, and political problems that arose, and the people's disapproval of the Son of Heaven. During times of climatic trouble, people will blame the institution and search for a solution to an uncontrollable problem, such as accusing the dynasty as having lost the Mandate of Heaven, which then causes shifts in government and change in power.

Although there are fewer records documenting the climate patterns during the Yuan dynasty, there have been more recent discoveries through scientific research and technological innovations that have revealed more specified dates for when the peaks of the Little Ice Age began.¹² The peasant uprisings from the Yuan people reflect the exact timeline for the climate changes that had the greatest impacts on the rural communities. These severe climatic conditions forced the people to turn to the government for help when losing their homes, land, and crops, and the government's lack of action to help them was a source of unrest and dissatisfaction. The Little Ice Age led to famine, flooding, and associated economic decline due to decreased agriculture production from the cold conditions. Due to the inability to grow crops in the harsh weather conditions, famine broke out in many of

¹¹ Yonglin Jiang, "The Mandate of Heaven and the Great Ming Code," *Asian Law Series* 21. Review by: Pengsheng Chiu, *Journal of the Economic and Social History of the Orient* 55, no. 1 (2012): 192-196.

¹² Zhongtai Wang, "The Little Ice Age of the Northwest Region, China," *China Geographical Science* 2, no. 3 (1992): 215-225.

the villages that depended on crops for food and income.¹³ The Yuan peasants were forced into dire starvation and poverty stricken conditions, and were in desperate need of government assistance. The conditions brought by the Little Ice Age uncovered and worsened several problems that already existed, including ethnic tensions, class problems, and government corruption. Without the Little Ice Age to expose and highlight these conditions, the Yuan dynasty may have continued without peasant uprisings and rebellions, and prospered for many more decades.

After years of research and testing, livestock mortality has been recorded to be more sensitive to severe winter weather, than to droughts, revealing that the cold temperature spikes during the Yuan dynasty dramatically reduced the livestock population.¹⁴ Livestock was a main source of income for farmers, and having the livestock population decrease from the Little Ice Age climate changes brought upset to the lower class. The rebellions against the Yuan government recorded in imperial documents reiterates that the climate changes led to these uprisings. The severity of the uprisings reflects how big the impact of the Little Ice Age was on the people during the fall of the Yuan dynasty. The Yuan's final collapse meant a new beginning for another dynasty. The beginning of the Ming dynasty seemed to mark a new era for an everlasting dynasty, but, although almost 300 years later, the past repeated itself and the Ming faced the same fate as the Yuan.

The decline and fall of the Ming dynasty has been the topic of historical debate, having many causes argued as the ultimate cause of the collapse. One of the most popularly debated reasons is the decline of the Ming emperors competency and values, in particular the political structure that put all power in the hands of

¹³ Elizabeth Anne Jones, *Surviving the Little Ice Age: Family Strategies in the Decade of the Great Famine of 1693-1694 as Reconstructed through the Parish Registers and Family Reconstitution* (University of Chapel Hill; North Carolina, 2006).

¹⁴ Xunming Wang, "Climate, Desertification, and the Rise and Collapse of China's Historical Dynasties," *Human Ecology* 38, no. 1 (2010): 157-172.

the emperor. The centralized authority and the decline in quality of the emperor greatly impacted the support of the people, and there is little debate regarding the negative results that arose from Hong Wu's ruling. Hong Wu was seen as a brilliant politician, but soon after his reign, the emperor, Yung-lo, seized control and ruled from 1403 to 1424.¹⁵ Yung-lo was an active ruler who moved the capital back to Beijing; however, he was not highly regarded due to his reversal of the Hon Wu emperor's ruling that court eunuchs remain in government positions. Although he was a dedicated and competent administrator, he enforced rulings that the emperor had an *absolutist imperiate*, and he ruled cruelly, executing families who opposed him, as well as arbitrarily executing and imprisoning thousands of innocent citizens. This added to political unrest and peasant uprisings, however this was not the first time that these types of injustices had been carried out by Chinese dynasties, and in these other instances, the dynasty had not been overthrown solely for these reasons.

The empire at the beginning of the 1600's faced severe monetary problems due to natural calamities and rebellions that destroyed court monetary funds.¹⁶ On top of the depletion of money, there was also a significant reduction in the flow of foreign money coming into the empire. Silver was being exported to the Americas rather than kept within the Ming dynasty.¹⁷ With silver prices rising, along with the natural disasters of the Little Ice Age, farmers were unable to pay taxes, which were commonly paid in silver. Court revenues were destroyed and farmers faced an extreme burden from the taxes they struggled, but could not afford, to pay. It has been discussed that this monetary crisis during the

¹⁵ Wenxian Zhang, "The Yellow Register Archives of Imperial Ming China," *Libraries & the Cultural Record* 43, no. 2 (2008): 148-175.

¹⁶ Man Cheng Oi, "Engendering Ming-Qing Socio-Economic History: With References to Agricultural History, Textile History, Commercial History, and Consumption History," *Journal Of Chinese Studies* 52 (2011): 95-127.

¹⁷ Brian Moloughney and Weizhong Xia, "Silver and the Fall of the Ming: a Reassessment," *Papers On Far Eastern History* 40 (1989): 51-78.

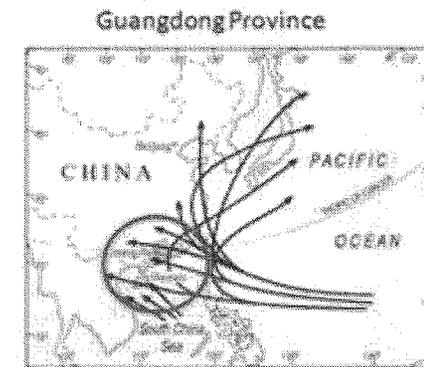
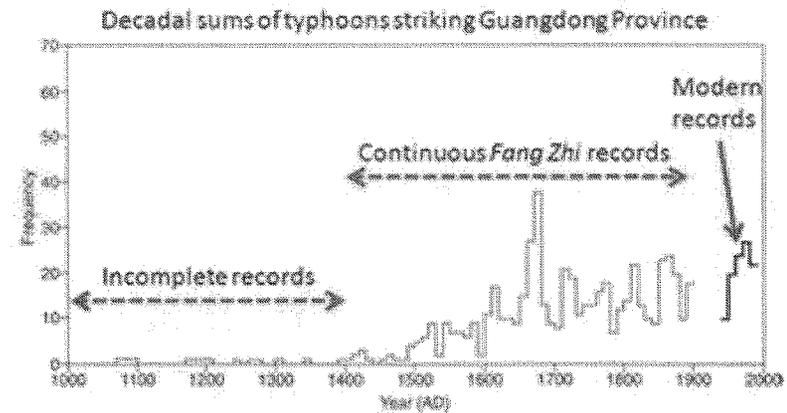
Ming empire is a principal reason for the collapse of the empire. Although the monetary crisis did have a large impact on the dynasty, historians fail to recognize other reasons for the monetary crisis, including the Little Ice Age. The Little Ice Age instigated the depletion of money and is the root cause for the monetary crisis that injured the Ming dynasty to the point of its ultimate destruction.

Resulting from widespread drought, serious economic disruption threatened the Ming empire during the seventeenth century. Thousands of people were killed by malnutrition and hunger, and disastrous epidemics spread like wild fires.¹⁸ The government's draconian response caused rampant revolt among the peasant, and further, the Manchu's attacked from the north with increasing force. The lower classes had little support for the vacant and unsympathetic government that sat back and watched them suffer from the horrid conditions and did little to provide aid. This weakened the government when the Manchu's attacked, and China became less and less unified. All of these problems were brought to light by the climatic changes brought on by the Little Ice Age.

Historical documentation and records were kept in the form of Fang Zhi, resembling semiofficial local gazettes of today, and providing in depth detail of the dataset for the frequency of typhoon strikes in Guangdong province. Data gathered from the Fang Zhi records discloses that during 1600's there was not only a period of the coldest and driest data recorded within the last 500 years, but also an increase in typhoons hitting the northern and central areas of China's coast.¹⁹

¹⁸ Andrew B Appleby, Jerome Namias, and David Herlihy, "Epidemics and Famine in the Little Ice Age," *Journal Of Interdisciplinary History* 10, no. 4 (1980): 643-663.

¹⁹ Kam-biu Liu Caiming Shen, and Kin-sheun Louie, "A 1,000-Year History of Typhoon Landfalls in Guangdong, Southern China, Reconstructed from Chinese Historical Documentary Records," *Annals Of The Association Of American Geographers* 91, no. 3 (2001): 453.



Decadal sums of typhoons striking Guangdong Province²⁰

Cooler temperatures typically reduce the chance of hurricane intensity, but due to an increase of cooler, drier, and windier conditions, and an increase in frequency of dust storms, stronger westerlies may have caused the unpredicted climate changes.²¹ The bigger southward change of subtropical anticyclones and the decrease in sea surface temperatures in the mid-latitude Northwest Pacific have been presumed to have expatriated the predominant storm trajectories to the south.

²⁰ *Annals of the Association of American Geographers* 91, no. 3 (2001): 453-464.

²¹ Brian Fagan, *Little Ice Age: How Climate Made History, 1300-1850* (New York: Basic Books, 2000).

The detailed records preserved through Fang Zhi documentation provided rich data to confirm the climatic severity brought by the climate changes of the Little Ice Age during the Ming dynasty. The Ming government also maintained documents, including the *Ming Veritable Records*, that have been cross referenced with the Fang Zhi to confirm climate change data during the different cycles of the Little Ice Age, spanning from the Yuan to the Ming dynasty.²² Supporting the climate conditions during the beginning of the downfall of the Ming dynasty gives an explanation as to why the government began to have trouble taking care of its citizens during such catastrophic and uncontrollable environmental circumstances.²³ The ruin of homes, crops, and infrastructure weakened the unity between the people and the government, as well as the economic state of the country. A quantitative comparison between the historical and instrumental datasets of damaged local communities and increased tropical cyclones hitting land reveal the significant correlation and confirms that impact climate change can have on communities, and therefore dynasties.

Recent research drives the argument that the Little Ice Age was the core cause for the fall of the Ming dynasty and the Yuan dynasty further than ever before. The imperial records from the Yuan dynasty government reveal the uprisings from the peasants that arose from poor care from their government to help with ruined homes, crops, and communities ravaged by climate changes of the Little Ice Age. The Ming dynasty kept detailed accounts of the climatic changes during the period of decline, revealing that the Little Ice Age brought dramatic climate changes, such as typhoons, during the beginning of the decline of the Ming dynasty. These typhoons destroyed communities and damaged China's economy. The problems that led to the decline of the Ming dynasty can all be

²² Wenxian, "The Yellow Register Archives," 148-175.

²³ Ling Bo, Xiao, Fang Xiuqi, and Zhang Yujie. "Climatic impacts on the rise and decline of 'Mulan Qiuxian' and 'Chengde Bishu' in North China, 1683-1820," *Journal Of Historical Geography* 39, no. 1 (2013): 19-28.

traced back to the event that caused widespread turmoil, upset, and political unrest: the Little Ice Age. The Little Ice Age should be acknowledged as one of the root causes for why the Ming and Yuan dynasties collapsed, and not characterized as just a coincidence. New data on the Little Ice Age needs to be taken into account when explaining the downturn of the Yuan and Ming dynasty, and may alter the initial explanations for their collapses.

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