

The Impact of Climate Extremes on Historical Processes in Central Asia in the Early Medieval Period from the 6th to the 10th Centuries

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Abstract: The paper is based on the tree-ring chronology of the Yamal Peninsula (Russia) which has one of the longest chronologies of this kind in the world (7319 years). This is the first presentation of an analysis of the climate impact on the historical processes in Central Asia in the early Middle Ages. Climate extremes are sharp, strong and sometimes long-lasting falls of temperature with a negative impact on the economy of a nomadic society, often caused by great volcanic eruptions. As a result of the research undertaken by us, a certain connection has been established between significant historical events and climate extremes on the territory of Central Asia during the period under observation, which makes it possible to state that the climatic factor was of primary importance in its impact on historical processes in the east of Central Asia, especially on those territories that had a nomadic economy.

Key words: Central Asia • Palaeo-climatology • Nomads • Climate change • Yamal Peninsula • Turks (Tujue) • Dendrochronology • Volcanic eruption.

INTRODUCTION

Global changes of the climate on Earth at the beginning of the 21st c. evoked an unseen previously interest in the problem of what impact natural and climatic factors can have on the life of human society [1]. In spite of the high level of technology at the beginning of the 21st c. as before, humanity has not found the means that would help it withstand powerful natural elements, such as eruptions of volcanoes (Iceland, 2010; Kamchatka peninsula, 2012 - 2013), tsunami (Sumatra, 2004; Japan, 2011) and earthquakes (China, 2004). When we speak of historical processes and of medieval societies, we mustn't forget that in contrast to modern society medieval economy with its natural character depended on climatic factors to a much greater degree. One of the regions that felt the impact of cataclysms of nature in the early medieval times was Central Asia and the nomadic peoples that inhabited the area.

In recent years scientists have paid great attention to the study of climate changes in the past, but the areas they have studied are countries or regions with written traditions. This factor makes it possible to compare

present-day climate variability with documentary historical sources [2-7]. Central Asia has not been so lucky in this respect because the nomads that lived there left no written monuments which could contain information about natural and climatic phenomena. For this reason there is very little research on the impact of the climate on historical processes in Central Asia [8,9]. Nevertheless, we can find some material in Chinese sources [10], which will give us an insight into the natural and climatic conditions of the period that we are studying and compare it with showings of present-day climatological research. Further on, we will use these data in our interpretation of historical events in Central Asia.

The Main Part: Of special interest to us in this respect is the research undertaken by Russian climatologists on the Yamal Peninsula [11]. This helps us see the climate variability on the planet and in Central Asia in particular precisely to a year, it being based on tree-ring chronology.

Russian scientists began to study specimens of archaeological timbers way back in 1982 in the south of the Yamal Peninsula. The material was collected during 17

field seasons, the result of which was cross-cuts of 3548 trees. This work resulted in the construction of an absolute chronology of tree-rings of the larch for a period of 7319 years which is one of the longest of its kind in the world [11, p. 9].

As a result of the research, scientists came to the conclusion that a considerable part of the extreme temperature changes during the period of growth in the north of West Siberia was due to global cataclysms which were caused by large-scale eruptions of volcanoes, which means that they left their mark not only on the territory of West Siberia, but in other parts of the planet as well [11, p. 10].

As archaeological data show, migration of the Indo-Europeans [12] to Eurasia (along the territory of West Siberia and Central Asia) went southward from the north. This correlates well enough with the general process of cooling, as dendrochronology data show: from 5150 BC to 1850 AD, the mean temperature in summer in the north of West Siberia experienced a cooling tendency [11, p. 10].

It is quite possible that a further southward migration of the Indo-Europeans was prevented by natural barriers - mountain ranges in the south of Central Asia - Kopetdag, the Pamir, Tibet, Tien-Shan, the Altai and the Sayans. That is why further migration on the territory of Central Asia went along the border of the mountain range - from west to east and back again, or from south to north, but there are very few such examples (not taking into account Alexander the Great's conquests which came from the south and the Arab invasion).

The period from 150 to 545 AD was a relatively calm one in the east of Central Asia. The main political power in the region was the Xianbei tribes (2nd - 3rd c.) and the Rouran Khaganate (402 - 545). This situation is also indirectly confirmed by dendrochronology data which shows that the 3rd century was extremely warm and no climate extremes were registered from 194 to 404 AD (Table 1).

Another anomalous fall of temperature in different parts of the planet and in Central Asia was registered as taking place in 536-545. Scientists are still unable to come to any definite conclusion as to the reasons for it (falling of a comet or the eruption of a volcano), but its consequences, according to various assessments, were felt till 550 AD [13,14,15].

It is of interest to note that exactly at this time (545) Chinese sources first mention the appearance of a new powerful political formation of nomads - the Turkic Empire (545 - 581). The ethnic map of Central Asia changed cardinally as a result of Muqan Qaghan's incredibly

forceful conquests. In a period of a few years the territory of the Turkic Empire spread from the west of the Caspian Sea to the east up to Liao-dun Bay, i.e. several thousand kilometers ([10, p. 8]. In the period of their greatest territorial expanse (late 6th c.), the Turks (Tujue) controlled the territory of North-East China, the Altai, the Sin-tsian Uighur Autonomous Region and the western part of Central Asia. In 581 the Turkic Empire broke up into the Western and the Eastern Empires.

A logical question arises: is the appearance of a powerful military state of nomads the result of a prolonged cooling due to climatic anomalies? Unfortunately, up until now historians have not raised this issue, because, in the main, there is no scientific practice of taking into account natural and scientific data. As a rule, only traditional reasons of socio-economic and political character are listed. However, it is here that we can see an interesting cause and effect connection between climate extremes and the self-organization of a nomadic society in critical conditions - a factor that we have to take into account when reconstructing the historical past of the nomadic society of the Turks (Tujue).

The next period of a sharp and prolonged fall of temperature on a planetary scale falls on 627 - 630, which also had its impact on the society of the Eastern Turks (Tujue). According to the information given in the Chinese chronicle Tangshu (The New Book of Tang), each year abundant snow fell on the territory of the Eastern Turkic Empire as a result of which deep snow covered the ground and a great number of sheep, horses and people died. At that period summer was also anomalously cold. Tangshu (The New Book of Tang) tells us: "In spite of it being the middle of summer there are frosts on the territory of the Turks (Tujue); 5 suns have risen at the same time, there are also 3 moons; a red fog covers their pastures..." [10, p. 142].

Scientists today have expressed the view that the large-scale fall of temperature on the territory of Eurasia in 627 - 630 that is marked on the tree-rings in Yamal, in North America and in the north of Middle and Eastern Siberia was caused by a very strong volcanic eruption and the parhelion, fog and red sunsets described in the sources are all well-known indicators of such. European chronicles tell us that starting from October 626 a dry fog covered a vast territory of, at least, Ireland and the eastern Mediterranean [5] for a period of 8-9 months. In China itself (the Tang Dynasty) there is mention of a frost at the end of summer in 627 which killed the harvest in several provinces. Similar events were noted in China in 628-629 [16, p. 97].

The defeat of Illig (Xieli) Qaghan in early 630 at the hands of the Chinese army actually became the last straw in the existing situation in the Turkic (Tujue) society. This defeat was the result of the climatic extreme of 627 and not the war victory of the Chinese Emperor Taizong of the Tang Dynasty. A similar point of view has been expressed by Chinese scholars studying the consequences of volcanic eruptions in 626. They hold to the opinion that the fall of temperature had its impact on all of Central Asia, the northern provinces of China as well, but the area that suffered most was the Eastern Turkic Empire whose nomadic economy could not withstand sharp and prolonged cooling [9, p. 471].

Economic hardships led to the destabilization of the political situation within the Empire. Chinese sources inform us that in 627 the Xueyantuo, the Uighurs and other tribes rose against Illig (Xieli) Qaghan [10, p. 141]. In conditions of an economic catastrophe that placed the Turks on the verge of survival, all the internal contradictions of the Turkic (Tujue) people and all those of the Eastern Turkic Empire came to the fore. The situation was also aggravated by the fact that, in conditions when the poll-tax paying population sharply decreased, Illig (Xieli) Qaghan levied higher taxes on the population that was left and, to all appearances, he used repressive measures to collect them.

This is what the Chinese chronicle *Jiu Tangshu* (The Old Book of Tang) says about the events after 650: "For about 30 years there were no war alarm signals in the north" [10, p. 157]. It is interesting to note here that neither were climatic extremes registered in this period (Table 1).

Several decades later, in 679 - 685, as a result of a number of serious uprisings, which coincided with extreme fall of temperature in 684 (see Table 1), the Turks (Tujue) restored the independence of the Eastern Turkic Empire which continued to exist till 745. The Uighur Empire replaced the Eastern Turkic Empire in 745 - 840.

The Tang Dynasty (China) which existed till 907 (extreme cooling in 903), was the eastern neighbor of the Eastern Turkic and later the Uighur Empire [17, p. 128]. The issue of whether or not the climatic factor had its impact on the history of the Tang Dynasty has earlier been studied by Chinese scholars [18].

In China the epoch of the Tang Dynasty is traditionally considered to be the period of its greatest power. The territory of the Tang Dynasty stretched from Liao-dun Bay to the Amudarya mainly thanks to the Eastern Turks (Tujue) and other nomads who came to serve the Chinese after the climatic extremes of 627. The

largest uprising of popular masses in China in the reign of the Tang Dynasty coincided with the climatic extreme of 754 (see Table 1) and took place in 755 - 763, later to be called the Rebellion of An Lu-Shan [19]. The uprising was headed by a Turk (Tujue) or Sogdian, An Lu-Shan, who was in Tang service. The uprising he headed became a turning point not only for the Tang Dynasty, but for all of medieval China.

CONCLUSIONS

Thus, as the material we have presented shows, it is possible to trace a certain connection between historical events and climate extremes on the territory of Central Asia with the help of dendrochronology from the Yamal Peninsula. It coincides with other climatological research carried out in Europe and in China.

We see that climate extremes and historical events coincide with significant events in the eastern part of Central Asia:

- The formation and fall of the Turkic and the Eastern Turkic Empires (in 545, in 630 and in 684).
- The rise and fall of the Tang Dynasty (in 630 and in 907).

It can well be supposed that the periods of the most extreme and prolonged global changes of the climate provoked an unprecedented instinct of self-preservation that led both to a self-organization and, in some cases, to a disorganization of the nomads as the most vulnerable category in the face of natural cataclysms.

In addition to that, after the arrival of the Indo-Europeans to this territory, the main migratory routes of ethnic groups on the territory of Central Asia were mainly from east to west. This factor can be explained by the nomadic type of economy in the eastern part of Central Asia and the climate extremes, i.e. the sharp, strong and prolonged falls of temperatures that had a negative impact on the economy of a nomadic society. The nomads were forced to go from east to west in search of food and more comfortable living conditions.

Thus, all kinds of climatic changes in the east of Central Asia led to the migration of nomadic tribes to agricultural areas - more often than not to the western part of Central Asia or south into China. The conditions for farming were ideal in the western part of Central Asia, but this region was also subjected to climatic changes, though to a lesser degree than nomadic economy which does not give surplus products [20, p. 277].

Table 1: Years of extremely cool summers on the Yamal Peninsula according to dendrochronology data

Years, AD	Intensity of extreme	Coincidence of dates of extreme events in other regions of the planet	Coincidence with dates of traces of volcanic activity in ice columns	Historical events in the east of Central Asia
180	*	+	+	
194	*			
404	**			
536	*	+	+	
537	*	+	+	
543	**	+	+	
545	*	+	+	Formation of the Turkic Empire
627	*	+	+	627 - 630 - as a result of natural cataclysms the weakened Eastern Turkic Empire came to be under the rule of China
652	*			In 650 - 680 Chinese sources speak of relative calm on bordering territories, no climatic extremes registered
684	*	+	+	679 - 685 a number of large-scale uprisings of the Turks (Tujue) and the formation of an independent Eastern Turkic Empire (679 - 745)
754	*	+	+	755 - 763 - uprising headed by An Lu-Shan against the Tang Dynasty
757	*	+	+	
903	*	+	+	907 - the fall of the Tang Dynasty

Thus, the specific dynamics of historical processes on the territory of Central Asia was determined both by climatic factors and by the mosaic character of the environment and peculiarities of the region's landscape that is made up of a multitude of isolated areas due to its mountainous locality. It was this factor that gave an additional stimulus to activation within the limits of the region, the aim of which was to find a quiet haven that would serve as a means of self-preservation and protection from external factors.

The ethno-political processes that in Central Asia in the 6th - 10th c. served as a powerful organizational motivator for nomadic tribes have been affirmed by tree-ring chronology. In most cases climate extremes that were reflected on the tree-rings of the archaeological timbers on the Yamal peninsula, speak of global changes on the planet as a whole. The territory of eastern Central Asia experienced sharp and prolonged falls of temperature which had noticeable effects on nomadic economy because it is to a greater degree dependent on natural cataclysms. This is why the main migratory routes in Central Asia went from east to west or from the east of Central Asia to the south into northern China via the Gobi Desert.

Climatologists have also established the years of the most extreme cooling for the whole period under study (Table 1). The results of comparative analysis show that the number of cases when climate extremes and significant

historical processes in Central Asia coincide is high enough, a factor that lets us come forth with the thesis that it had a great impact on historical processes in Central Asia, especially on the territories with a nomadic economy.

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