

FREEZING LOWER DANUBE DURING THE LAST TWO MILLENNIA

Elena Teodoreanu

Ecological University, Bd. Lascar Catargiunr. 24-26, sc.A. ap. 16, Bucuresti, Romania,

E-mail: elena.teodoreanu@gmail.com

ABSTRACT

Danube froze during cold winters. We have direct information from chroniclers and foreign visitors, but also indirect information: frost Black Sea or nearby rivers. After the establishment of meteorological network we are taken into account weather, with temperatures below -25 ...- 30°C from weather stations near Danube

Keywords; freezing lower Danube, hard winter, historical data

1 INTRODUCTION and METHODS

Danube waters froze in cold winters, more frequently during the Little Ice Age, but also in a historical periods considered warmer, for example during the Little Climatic Optimum, or in modern times.

We have used information from the Romanian chronicles, and from the pages of Turkish chroniclers who accompanied troops crossed the Danube to loot Romanian countries. We have also information from notes of foreign travelers, diplomats, merchants, missionaries in these lands. Also we used some foreign chronicles, from Western Europe or from the Russian chronicles taken over by historians who researched the climate in ancient times until today.

Sometimes, we use proxy data. We can assume that the Danube froze when we have data from chronicles foreign Western or chronicles the Russian's heavy winter, the frozen other waters, nearby, for instance Dniester and Prut, or in regions further away, but at lower latitudes, Po, Tiber or the Adriatic Sea and especially when we have information about frost Black Sea. After the establishment of meteorological stations we are considered winters with temperatures below -25 ...- 30°C at stations near the lower Danube, in Romanian Plain and the Dobrogea plateau.

2 RESULTS AND DISCUSSION

2.1 Ancient period

The oldest information on freezing Danube we have from *Roman poet Ovid*, exiled to Tomis (now Constanța) in AD 8. (Teodoreanu, 2005). He describes the life on the shore of Pontos and cold winters (especially in years 8-10 AD): "Under Ursa, when terrible Boreal start / The flint is Hister then from shore in shore / Where's only ship went wide road / the ice hear hooves as bat" (*Tristia, III*)

The information on this subject in this period are few, sporadic.

So we know that in the winter of **85-86** Dacians crossed the frozen Danube to south, winning the battle with the Romans (*Dio Cassius, cf. Xenopol*, 1888)

In winter **101-102** occurs battle of Adamelisi. Dacians crossed the Danube on the ice and attacking Roman garrisons in Dobrogea (*scene on Trajan's Column*).

In **395**, in winter, the Goths crossed the Danube on the ice, get in Moesia, Thrace to Constantinople. In **401**, the Black Sea and Danube were frozen for 20-30 days.

In **559**, Huns crossing the frozen Danube, to Thrace, and approaching Constantinople.

In **605**, the winter is very harsh and froze Black Sea and in **642**, the Black Sea froze again, but the information is questionable: the thickness of snow in some places is 90 feet (30 m?)

In very cold winter **670**, in Southeastern Europe and of Constantinople perished people and animals. Equally, in **717** it is very cold winter and in Thrace and Constantinople perished horses and camels belonging Saracens who besieged the city.

763-764 is one of the "big winters" known in history and the first that seems well documented in detail for Western Europe. Numerous sources German, French, Dutch, English mentions more detail or summary. (*Easton*, 1927). But in the East too are detailed information: "... in early October, Pontos froze to a depth of 45 feet (15 m), up to thirty miles (15 km) of banks. He landed on the ice of snow 30 feet (10 m) ... From Khazar (Crimea today) ... until ... Thrace, Black Sea ... offered for four months solid path, for the

heaviest carts ... *Teophan history* tells us that he went on one of the floes, and he found the bodies of domestic animals and wildlife. (*Le Beau*, vol. XII, 1831).

In **794-795**, winter is harsh, snowy in north-western Black Sea, recorded the death of a large number of people and animals

2.2 Medieval warm period (Little Climatic Optimum)

Although this period of about 500 years is considerate warmer by about 1°C, (the overall average multiannual compared to the next period), recorded many hard winter, the Black Sea and the rivers of Europe, including the Danube froze, sometimes even Adriatic Sea. Such winters are heavy: **800-801, 821, 822, 850, 858-859-860, 932-933, 911, 1167-1077, 1133, 1167-1168, 1216, 1232, 1233, 1241-1241**. (Teodoreanu, 2012)

In some winters, ice carriages loaded crossed the Adriatic Sea to Venice, for example in **1234**. (*Arago*, cf. *Mihăilescu*, 2004).

In *Memorial portatif in the Chronologie*, Paris 1829, is noted that in **1236** the "old Danube River froze to the bottom" which *Hepites* considered an exaggeration. Sometimes specified size frozen surface: in **1246** "Black Sea was frozen over an area of three miles from shore (approx. 5 km)" (*Bucinschi, Alexandrova*, cf. *Mihăilescu*, 2004)

2.3 Medieval cold period (Little Ice Age).

In the fourteenth century climate cools, more frequent harsh winters and summers are cool and wet. During 1650-1710, called the Maunder's minimum, which was registered in a minimum number of sunspots is considered the coldest in the 500 years due to low solar activity. (Ladurie, 1983)

In **1330-1331** or **1333-1334**, Arab traveler and geographer *Ibn Battutah* (1304- 1377) passing through Babadag (Dobrogea, near the Danube) and describe a cold winter, when freezing water on your face when washing (Teodoreanu, 2010).

Harsh winters are recorded in **1378, 1407** and especially in **1408** considered "one of the great winters" in when the great rivers of Europe remained frozen for a month or more. (Ladurie, 2006). "The winter of 1408 was stretched from northern Europe to the banks of the Danube and has been the toughest winter during five centuries" (*Arago*, cf. *Easton*).

Other heavy winter, when Danube froze are: **1456**, the Turkish chronicler *Mehmed Neşri*, Turkish columnist, writes about, **1458**, when camped on the frozen Danube an army of 40 000 people (*Arago*), **1459-1460**, when the Danube was covered by ice for two months (*Alexantrov*, cf. *Mihăilescu*), **1461-1462**, when it was fighting the Turks with prince Vlad Tepes. Turkish chronicler *Mehmed Hodja Effendi Sa'adeddin* writes about Islamic fighters who "became pitiful praised Allah". Harsh winter are also **1463** (*Zolnay*, cf. *Cernovodeanu, Binder*, 1993) and **1482**, reported by *Mehmed Neşri*. Black Sea and Danube were frozen in **1490** and **1544**. In **1582** are known that frozen rivers Dniester and Prut, nearby Danube.

In January-February **1595** took place battle between the "rebels Romanian Land", led by "wandering Michael" (Michael the Brave) and Turkish armies on the frozen Danube. The event is reminded by two Turks and Wallachian chronicler *RaduPopescu*. Several diplomats and ambassadors passing through Romanian Country talking about freezing river in **1597-1598**, in **1603** and **1608**. (Teodoreanu, 2011)

In **1621**, the frozen Black Sea, and in **1638, 1640, 1644** are recorded frosts of the Prut, Dniester, Dnieper.

Period **1650-1710** (minimum of Maunder) is really a period with heavy winters, and with more information about Freezing River. (Lamb, 1982)

Very interesting are reports about winters of Syrian *Paul of Aleppo*, which for 7 years accompanied the Patriarch Macarios III, in the Romanian country. (Teodoreanu, 2014, a) He writes about **1656-1657** that winter was cruel and hard for peasants and cattle. A lot of snow fell, and Danube froze until thick 9 hands (2,25 m).

A famous Turkish chronicler *Evliya Çelebi* writes on November 25, **1659**: Allah willing, the Danube froze hard. Mohammedans crossed the Danube from Giurgiu on ice and deserted villages. He says that in **1659-1660** as thousands of Silistra put their tents on the frozen Danube, and party with food and drink, they celebrated Bairam (Turkish religious holiday). Meterhanelele (Turkish musical instruments) sing, young people are given ice. Many ice fishermen drill and codfish and sturgeon fishing weighing up to one hundred "ocale" (ancient unit of measurement, about 1 kg).

Other heavy winter froze the rivers Danube and Black Sea are **1684, 1699, 1706, 1708** and **1709**.

Follow **1740** when frost raged across Europe, with a mortality enormous, **1776** when he froze the Tiber and the Venice lagoon and hard winter, and **1784**, particularly in Eastern Europe (after a *Russian chronicle*, cf. *Mihailescu*, 2004).

Count *Alexandre d'Hauterive* (1754-1830) personal secretary Prince Al. Ypsilanti write on 2/13 February **1785**: "The Danube is the most beautiful river in Europe. Its waters covered with ice floes, resembling those of the sea channel Dardanelles, in a storm".

Other heavy winter when the frozen Danube are: **1789** when the sea ice was so abundant that offshore ships could not approach the shore, **1795**, **1804-1805**, **1812** during the war between the French and the Russians, and **1813**, where Molodeczno (besides to Minsk), there were -37°C ,

In **1820**, is a rigorous winter from England to Italy, all the major rivers of Europe froze (Sena, Saon, Rhine, Danube, Garonne, Thames, Arno, Venice lagoon). Researchers say that for more than a century has not seen a so rigorous and long winter. *Stefan Hepites* notes that "wolves entered the Bucharest".

In **1829 - 1830**, also *Hepites* show that winter is harsh, navigation on the Danube interrupted by ice floes, heavy snows, spring delayed, "winter began in October and lasted until April. Thermometer without interruption look below -25°C , sometimes down to -37°C ".

1830 went down in history as a "great winter," one of the most rigorous known. Frozerivers : La Meuse, Rhine, Loire, the Inn in Vienna, Garonne, Danube, Rhone. Also in **1838**, the winter is very harsh, snowy and freezing.

2.4 The modern warm period.

Researchers estimated that by 1850 climate enters a heating process that lasts far, with short cooling period (e.g. 1950-1970). However not lacking cold winters, when the Black Sea and Danube froze.

1858 - very harsh winter and long, the Danube and the Black Sea ports of Russia were frozen in January, blizzards occurred Bosphorus and Black Sea.

Winters are recorded years **1863**, **1872** (-30°C), **1876**, cold winter, the frozen Black Sea. **1880** - rigorous winter, especially January (-29°C) and long in all the country. Danube remained frozen until the end of March. (Fig.1).



Figure 1. Frozen Danube in 1880, from Sulina, in Danube Delta

(http://adevarul.ro/locale/tulcea/1880-anul-dunarea-inghetat-101-zile-petreceau-boboteaza-crestinii-musulmanii-1_54a286c7448e03c0fd2939a7/index.html)

The winter was dominated by a strong anticyclone throughout central and southern half of Europe, bringing cold air from northern Europe. (Fig.2).

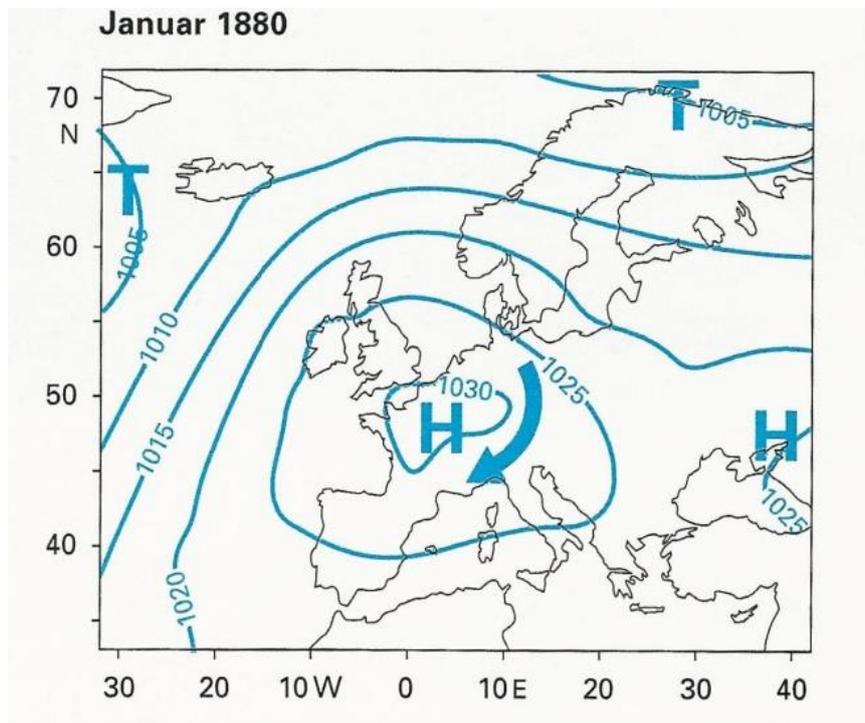


Figure 2. The winter of 1880 (Pfister, 1999)

So are **1888** in Bucharest on 4 January -30.5°C , the lowest temperature found in Bucharest in the nineteenth century (*Hepites*, 1898), **1893**, winter frosty particularly in January, **1901**, in January cold, snowy and blizzards, frozen Danube, and **1907** long cold winter, with temperatures up to -30°C , in March cold and snow as "not known how another" (over 1 m thick for 20 days). In **1924**, snowy and cold winter blizzard, frost, ice on the Danube between 40 and 70 days, most to the spill.

In **1929** winter cold: -38°C , in the mountain, at Vf. Omu, 2500 m, and -30°C to -25°C in some stations in Transylvania and on the coast.

1937 hard winter, with frozen river.

In **1942**, very harsh winter, very long, throughout Europe as a result of prolonged persistence of Scandinavian associated with the East-European anticyclone. In Depression Brasov, January 25, were recorded at station Bod -38.5°C , this value is the absolute minimum in the country, over the entire period of observation on Romanian territory. (In November **1941** Soviet counteroffensive began with fighting in front of Moscow, followed by "the bloodiest battle in history" - Battle of Stalingrad, where between September **1942** and February **1943** is estimated 3 million dead, and when winter was very hard).

Very cold winters in **1947** and **1950**, the Danube froze.

1953-1954, was a terrible winter, very frosty, frozen Black Sea. Record snowstorm in February 1 to 4, for the twentieth century, in the south of Romania, with wind speeds of 70-125 km / h, which Trojans snow at odds of 4-6 m height in southeastern Romania. Synoptic situation: anticyclone in the North and East of the continent, bringing very cold air masses, interfering with a Mediterranean depression, with warm air. In terms of temperature it was estimated to be second after the very cold winter in 1941-1942. On the surface Danube formed ice bridge that is passed easily by tractor in Brăila, Giurgeni - VaduOii - Fetești.

In **1963**, very tough and long winter (in January $-38,0^{\circ}\text{C}$, in the Depression Giurgeu) blizzard 12 days, with wind speeds up to nearly 200 km/h that caused snowdrifts with maximum thickness of 2- 3 m.

Also hard winter in **1969** and in **1985**, severe winter and long ($-38,4^{\circ}\text{C}$, MiercureaCiuc), so in **1995-1996** very heavy and long winter, with freezing Danube.

Even in the new century (and millennium), they are long and harsh winters: **2002**, **2003**, **2006**, when froze the Black Sea. In **2012** In January-February the Danube and Black Sea froze. The winter of 2012 was one of the harshest winters in recent years.

3 CONCLUSIONS

The Danube River in its lower part froze many times, heavy and long winters over the last two millennia. In the period between 0 and 800 AD., information is scarce and sporadic (starting with the Roman

poet Ovid descriptions). However, they are not missing, were recorded more than 10 hard winter, where the river froze, so Dacian people, but also some migratory people could cross over the river froze, either Dacia south in Thrace, either from Dobrogea to Romanian Plain. (Teodoreanu 2014, b). During the period of about 500 years, called Little Climatic Optimum, although researchers appreciate a slight warming of the climate, was recorded about 20 harsh winters, when the Danube froze.

During the Little Ice Age, also 500 years, information is becoming richer. The winters are colder and longer, so there were more than 40 winters freezing Danube and Black Sea.

After warming occurred in the mid nineteenth century it is estimated, however, for a century and a half, more than 20 winters where the river froze.

In the first years of the XXI century, they have already registered 4 cases of freezing Danube and Black Sea.

So, in the last 2,000 years, we can say that the lower Danube froze at least once in 10 years.

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