

# TWO PAPERS

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BY

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I.

**THE ICE-AGE IN EUROPE,  
A SIMPLE EXPLANATION OF ITS VISIBLE EFFECTS.**

II.

**HOW THE MAMMOTHS  
BECAME FROZEN INTO THE SOIL OF SIBERIA.**

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# The Ice—Age in Europe.

## A simple explanation of its visible effects.

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The time allotted for each paper being very limited none will be wasted in proving the insufficiency of the Inlandice theory to explain the phenomena. This has already been done by Sir Henry Howorth in his »**The Glacial Nightmare**«, no doubt known to most geologists. I will only point to some few facts:

1:0 We see in the case of Greenland that a general icesheet as a whole does not move.

Nordenskiöld's expeditions in Greenland in Lat. 68° in 1870 and in 1883 taught us that from the innermost point »nothing was to be seen from East North or South but an even field of snow like the horizon of the ocean«.—

In 1888 Nansen crossed Greenland on sledges without seeing a single crack in the inland ice from 24:th August to 19 September about 27 days proving that this ice does not move.

2:0 The coldest part of Siberia is not covered by Inland ice there seems to be required a continual fresh supply of ice to keep the air cold, such as Greenland receives on both sides by the arctic current. **In the alteration of this Arctic current and its ice-transport we must look for an explanation of the effects of the ice age in Europe.**

3:0 Some geologists have at last come to the conclusion that the tool which denuded our rocks was not so hard as the ice of Agassiz on one side, nor so watery as that of the diluvial geologists on the other. The author's theory says it was a combination of the two.

The Arctic current, filled with drift ice reaching to the bottom, carrying blocks of stone, gravel, sand and clay, rolling or pushing the mass along the bottom of the sea, caused the denudation. We now come to the explanation of the principal actor in the play, — the flood.

The trade winds in conjunction with the peculiar contour of the North coast of South America force the ocean water into the Gulf of Mexico, and escaping therefrom at Florida it is forced Northward. Moving thus into smaller circles of latitude, while retaining by the law of Inertia the Eastward motion it possessed nearer the equator from the rotation of the earth, it takes a direction compounded of North and East, in which the Eastward trend continually increases. The result is that the Gulf stream flows from SW to NE presses against the shores of Norway and arriving at the North Cape, and rounding it, strikes the shores of Lapland, as told by every map showing the ocean currents.

When this Northwest part of Europe was below the ocean surface, as the greater part of the European continent was at this period, forming an archipelago, the return current of this mighty stream found its easiest escape over this area, and loaded with ice driven down from the Arctic sea by the prevailing Northwind (Scoresby) it caused the phenomena we now trace.

Then Europe rose and the passage by the present Baltic sea was stopped and in our days the Gulf Stream has to go up into the Arctic sea, and, against its natural inclination it has to turn Westward end escape down both sides of Greenland, now producing an ice age there as it formerly did in Europe.

But a southgoing current in the Northern hemisphere coming from smaller to larger circles of latitude must from the same cause receive a Westerly deviation and this we see confirmed by the ice pressure against the East shores of Spitzbergen, Novai Zemlya and, especially, of Greenland. That this was so in the European ice age is confirmed by the direction of the glacial striae on the rocks of Sweden turning to the West on reaching the South end of Norway.

The mode of working in denuding away large masses of hard rock has long been a riddle.

Our greatest geologist, Sir Charles Lyell was in this as in most cases on the right path. He supposed that it was performed at the bottom of the sea, and by ice forced along by water currents, and great was his delight when on his first journey in North America in 1842, visiting Nova Scotia, at Cape Blomidon he saw recent striae in

sandstone rock on the shore and learned from the inhabitants that they were produced in winter by the drift ice in masses forced along the shore at high water.

Since attention has been paid to this phenomenon several facts have been noted down. In the sound between Sweden and Denmark a strong current runs in some winters and when there is much broken up ice, it packs until it reaches the bottom and rolls blocks of stone along for great distances, and sometimes presses the ice pack far up on to the dry land. It so happened that in Malmö in 1879 the price of granite boulders picked up from the sea bottom and largely used in Engineering works, which had been rising year by year suddenly fell in the Spring. The reason was that the ice drift of the previous winter had delivered a fresh supply all over the bottom. All these blocks are ball or eggshaped.

In the North Baltic the bottom is often altered by such ice pressure. A frigate once touched the bottom where the chart showed a depth of 100 feet. The pilots declared that shoals are often formed by pack-ice scraping the bottom and charts have to be altered as the author has been informed by Commodore Engström of the Swedish Navy. Under such conditions the formation of åsar with the same direction as the neighbouring striae seems easy of explanation.

These are the outlines of this theory. The ice age in Europe not only had the same origin as the present ice age in Greenland but it was **the very same ocean current that produced it** when it passed over the very place where we now stand.

Most thinking men i Sweden, not trained in the Inland-ice theory, agree in the views now given, only the geologists adhere to the miracles of wandering ice fields carrying blocks high up to the mountain tops. Several English Geologists have taken the side of the author and we will hope that as the early part of the nineteenth century saw the birth of the Inland ice doctrine the end of it will witness its funeral.

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## How the Mammoths became frozen into the soil of Siberia.

Amongst the authors working this field no one seems to have gone further than Sir Hry Howorth in his »The Mammoth and the Flood«. He gives an enormous mass of facts proving that these fossil remains of the Mammoth are found not merely in Siberia but in river valleys near the Black Sea, in Belgium, in South England, in the bottom of the North Sea outside Norfolk and Dunkirk; but **not** in Scandinavia, Ingermanland, Esthonia, Kurland, Lithuania, North England, Scotland or Switzerland; and none to the South of the Pyrenees; very few in Prussia, Italy and the West of France. In America they are only found in the North Western part and under conditions similar to those of Siberia.

All this seems to harmonise very well with the Author's theory of the Ice age in North Western Europe where he holds it was a local and temporary phenomenon, during which it can be proved that in Sweden for example more than 600 feet of Silurian rocks were removed, and with them of course all tertiary deposits.

The remains of large animals found in different parts of the world are generally found in clay or other deposits from running water and to owe their preservation to this circumstance. Complete skeletons are seldom found. -- The fragmentary remains are often found in caverns mixed without order and with mud or gravel lying on any shelf where it could rest. All this points to the remains having been borne by running water to their final resting place after the death of the animals by drowning or otherwise.

Sir Henry Howorth's conclusion like Erman's, is in favour of floods of a cataclysmic or catastrophic character.

It will be shown that although such exceptional floods have possibly occurred to overwhelm the Siberian Mammoths it is by no means necessary to call in their aid to afford an explanation of the numerous finds of Frozen Mammoths in Siberia.

Professor Huxley maintained that although the slow and ordinary operations of Nature effect the greatest result yet exceptional eruptions and catastrophes have taken place at all times. In our own days we have had the explosion of Krakatoa causing destructive ocean waves of 50 ft to 100 ft high; the earthquake waves at Lisbon and at Callao in the last century and recently in Japan were of 60 ft or more in height and caused immense destruction of life. Intense volcanic activity has been for long in existence in Iceland. If a great wave emanating from some such Northern centre had over-run Northern Siberia, then probably lower than now, it would have drained off down the valley of the Lena and carried the carcasses of the drowned Mammoths to the New Siberian Islands lying off to the North East of its mouth where the chief deposits of their remains have been found.

But it is quite unnecessary to resort to such extraordinary floods to account for the death and accumulation of the remains of numerous Mammoths in a frozen state. Death from old age or from battle or accident or disease comes to all animals, and if it be considered, that the mammoths most probably frequented the river valleys in large herds, and from their great weight were peculiarly liable to the accident of becoming engulfed in soft ground, the ordinary action of a great river wandering in a low alluvial plain, — will quite account for the accumulation of their dead bodies at or near its mouth.

But the Siberian rivers are from their geographical circumstances, ordinarily subject to great and sudden inundations. They are fed from more Southern and warmer regions and the warmer waters in the Spring, flowing over the still frozen land and water of the North, melts the ice and snow to add to the general flood, — and we need not suppose even if the remains were all found in a similar state, that all the animals perished at the same time. If only a very few perished in a century, the facts could be accounted for.

The problem before us is to account not for the death of the mammoths and the accumulation of their remains, but to explain the extraordinary preservation of their softer and more perishable tissues in a frozen state. In the »Voyage of the Vega» Vol I c IV many observations are made tending to the solution of this problem. Nordenskiöld says. »Even in the shallower part of the Kara Sea the

water **at the bottom** is nearly as salt as in the Arctic Ocean and is all the year round of a temperature  $2^{\circ}$  to  $2^{\circ}.7$ , below the freezing point of pure water — while the salinity of the surface water is very variable, being sometimes and in some places nearly fresh and in Summer time very warm. This causes the remarkable phenomenon that the surface water when exposed to the temperature of the bottom is converted into ice.»

This is confirmed in Vol. II c XI where it is stated. »The dredgers often reported the bottom as »hard frozen«, The frozen soil, of Siberia thus contains not only terrestrial but also marine organisms and layers of pure ice, these last are formed in river estuaries or small lakes where the ice formed on the bottom is covered in early Spring with a layer of mud thick enough to protect the embedded ice from melting in Summer«. »We often used to sink the bones of animals to the bottom of the sea to have them cleaned by the invertebrate animals swarming there. But if the perforated sack containing the skeletons and filled with the less salt surface water was sunk at once into the salt and cold bottom water we found on raising the bag one or two days later that it was full of ice and afterwards we had to agitate it to and fro to get rid of the surface water in order to avoid the freezing.«

In this way the carcass of a dead animal sunk to the bottom of this cold sea whose temperature is  $2^{\circ}$  or  $3^{\circ}$  Cent below zero would be frozen throughout, and if covered by sediment, also soaked with surface water and consequently with a high freezing point, the whole would be preserved as long as the conditions prevailed. If the bed of protective sediment were of sufficient thickness and if the sea bottom rose and became dry land, the carcass would be found after thousands of years in the circumstances and condition in which the Mammoths are found in our time. We thus see that the preservation of the bodies of animals in the frozen soil of Siberia can be explained without calling in the aid of miracles as follows.

1:0. The great river valleys of Siberia are so situated geographically as to be ordinarily subject to great floods, apart from any possible catastrophic floods produced by earthquake waves emanating from such volcanic centres as Iceland

2:0 The carcasses of dead animals would have been often swept away by such floods and carried out to sea along with much mud and sand.

3:0 The carcass of a Mammoth thus carried out far into the Arctic sea and sinking to the bottom where the temperature is 2° or 3° below zero would freeze perfectly through and if then or later it were thickly covered with sediment also less salt, than the ocean water at the bottom and with a correspondingly higher freezing point the organic remains would be preserved for an indefinite time

4:0 By the gradual rise of the Arctic lands the sediment-covered Mammoth would be situated, first on the shore and afterwards on the land high and dry. The summer's heat would only thaw a few feet depth of the soil but below that the frozen flesh and soft tissues would be preserved until the erosion of a river or some other mechanical agency revealed the treasure to the wondering geologist.

