

When Climate Variability Collides with Human History



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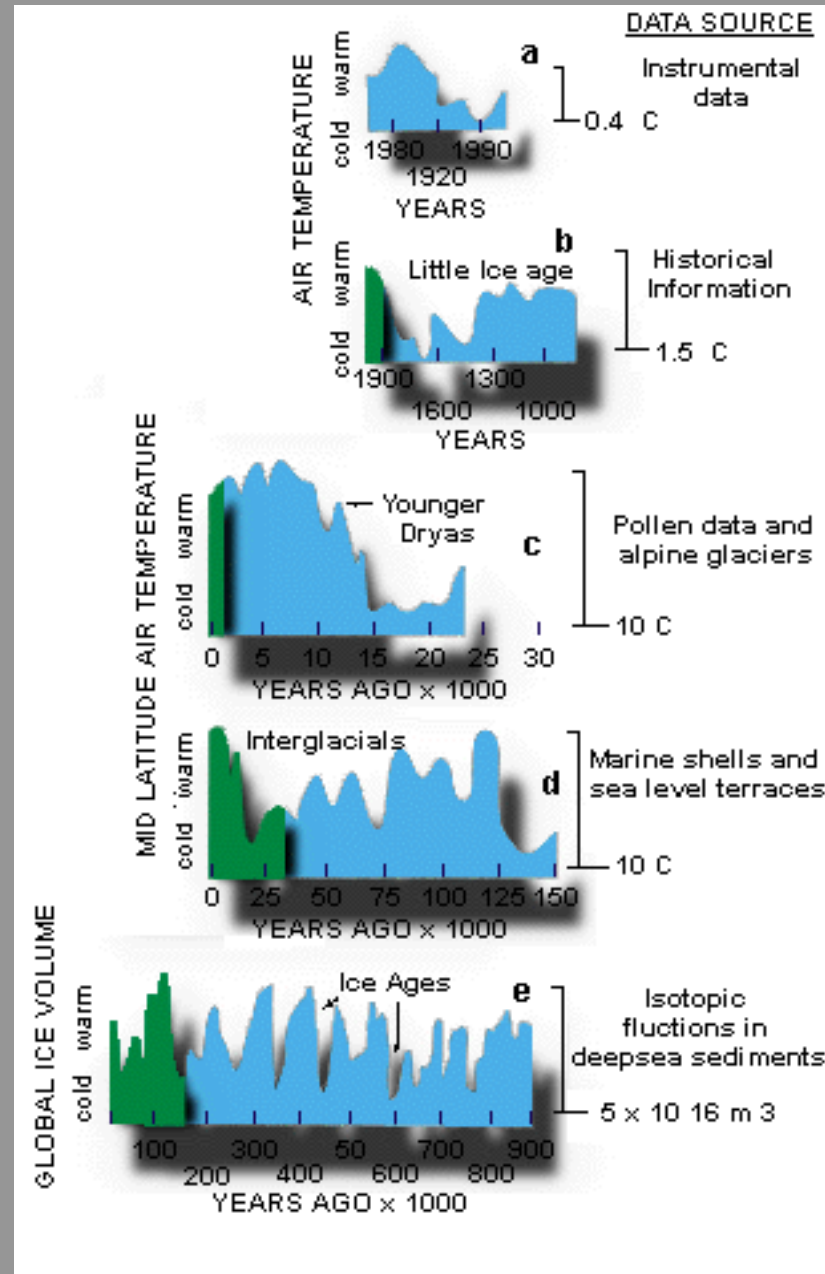
Prof. Kyle Dittmer

Earth Science Instructor

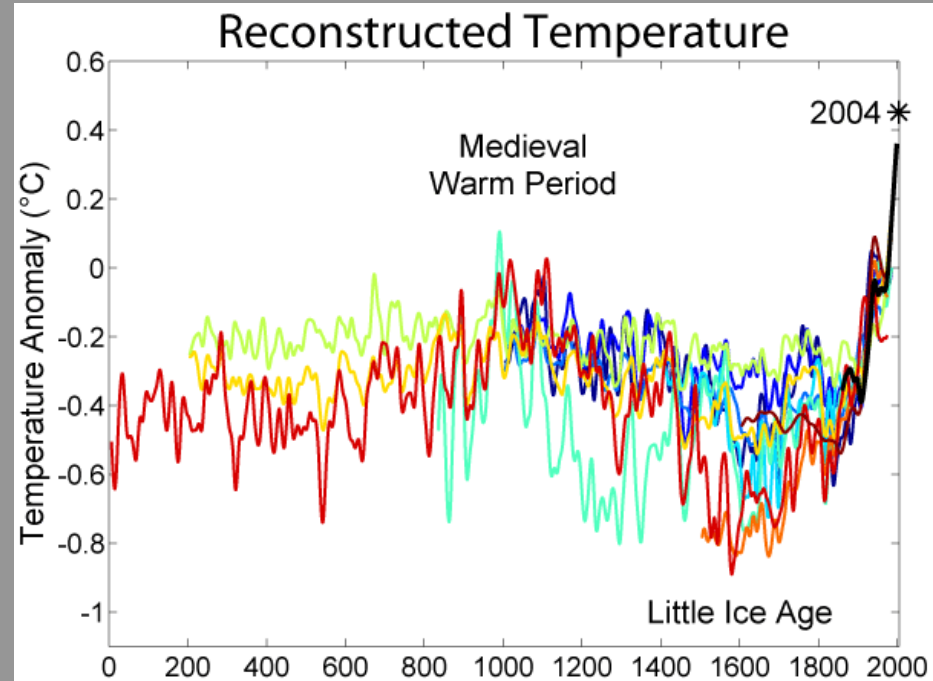
Oregon AMS dinner talk,
Stark Street Pizza Co.,
Sept. 16, 2026



PALEOCLIMATE RECONSTRUCTION – TIME SCALE



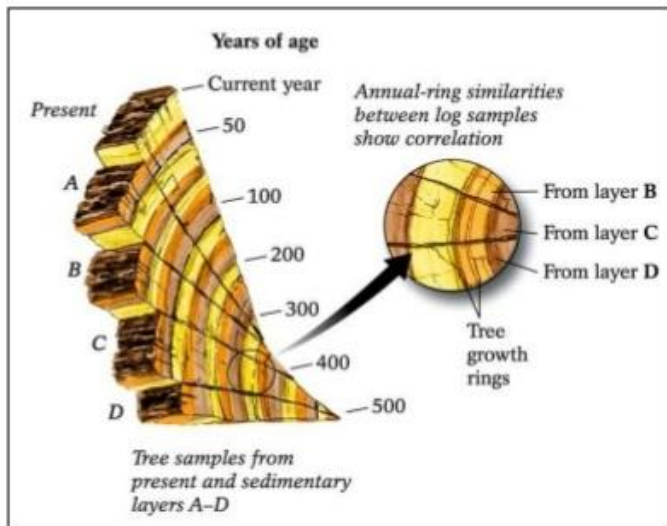
PALEOCLIMATE - HISTORICAL DOCUMENTS, ART, etc.



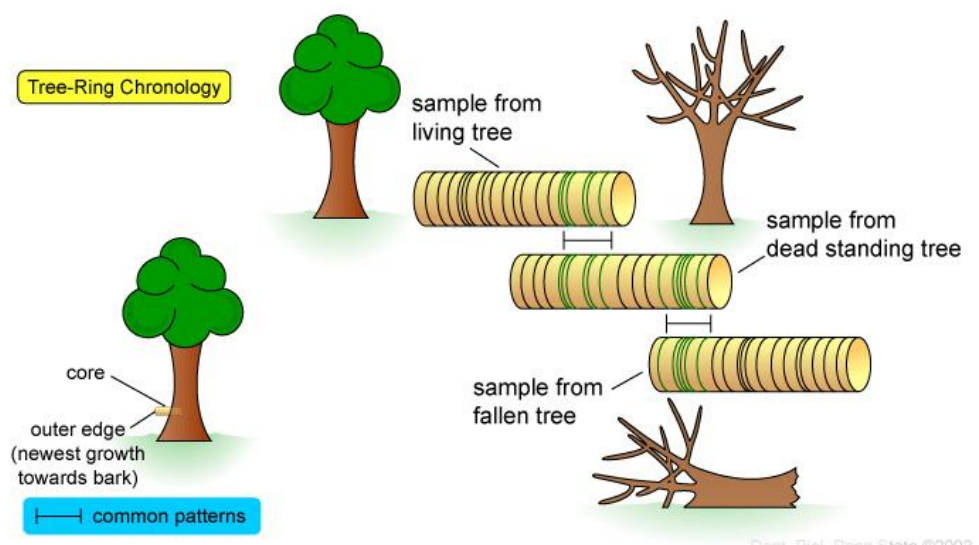
https://en.wikipedia.org/wiki/Little_Ice_Age

PALEOCLIMATE - BIOLOGIC METHODS

Dendrochronology (tree ring counts)

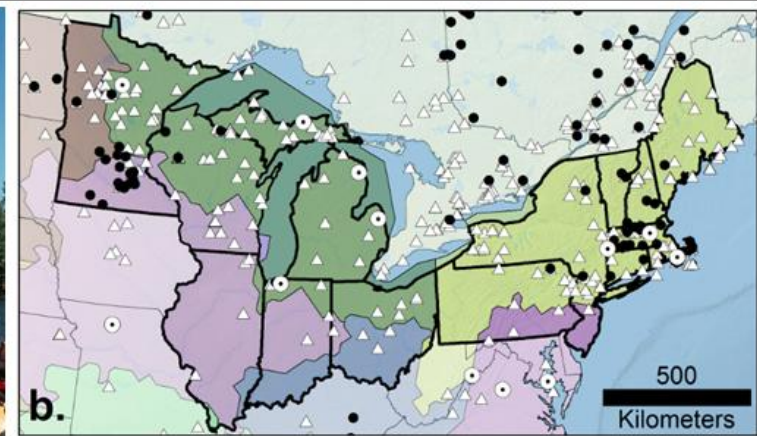
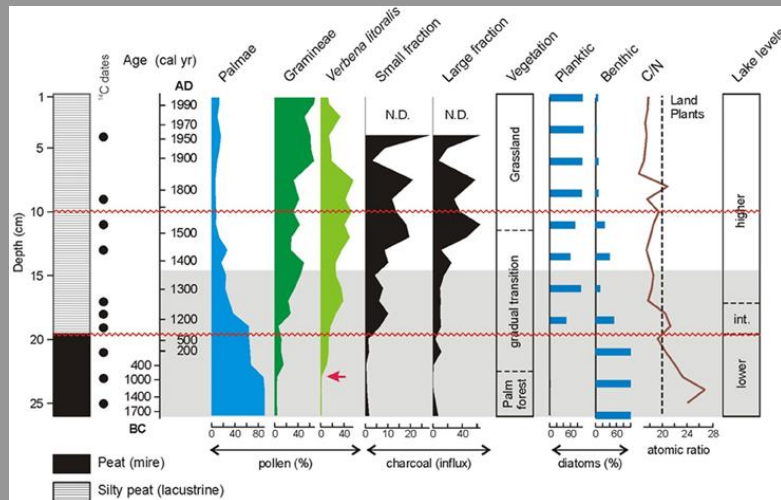
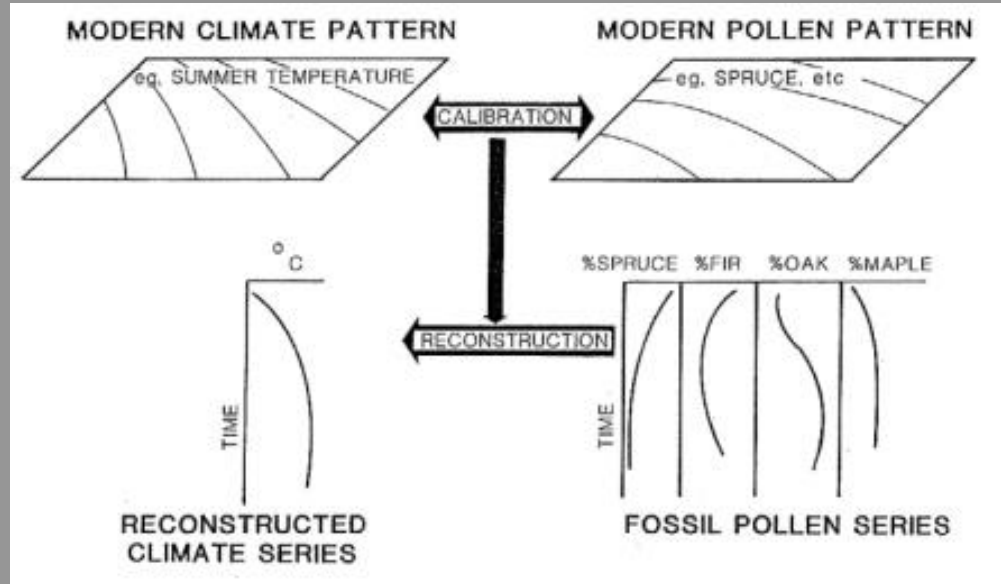
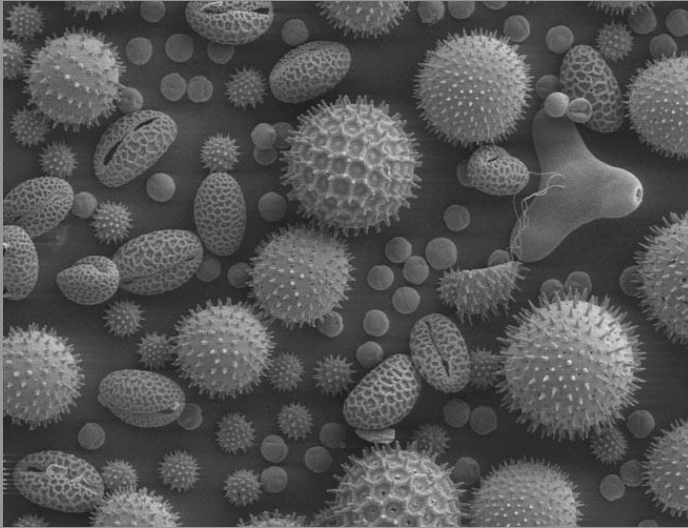


Searching for the **World's Oldest** Living Thing



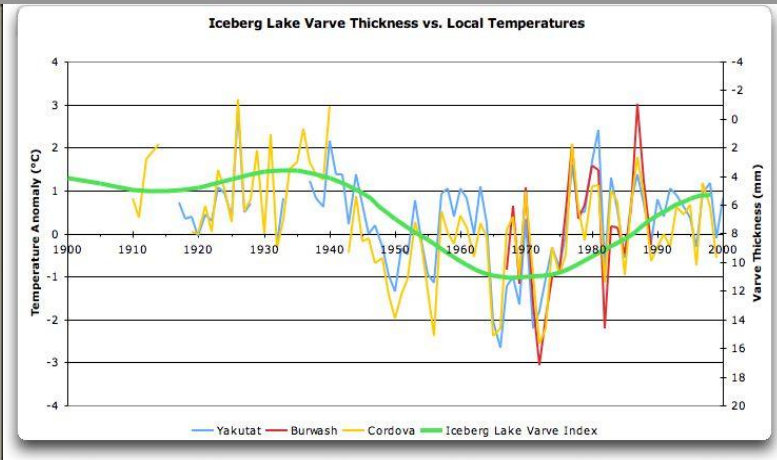
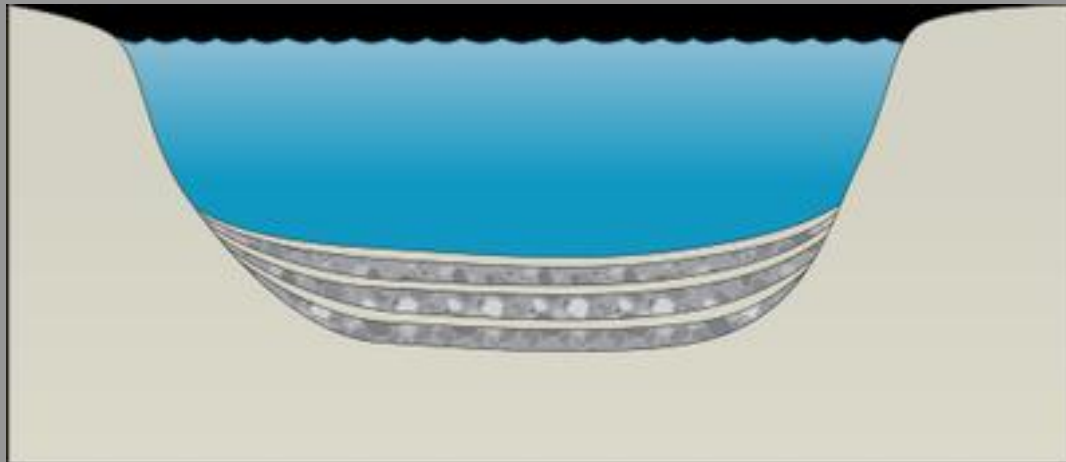
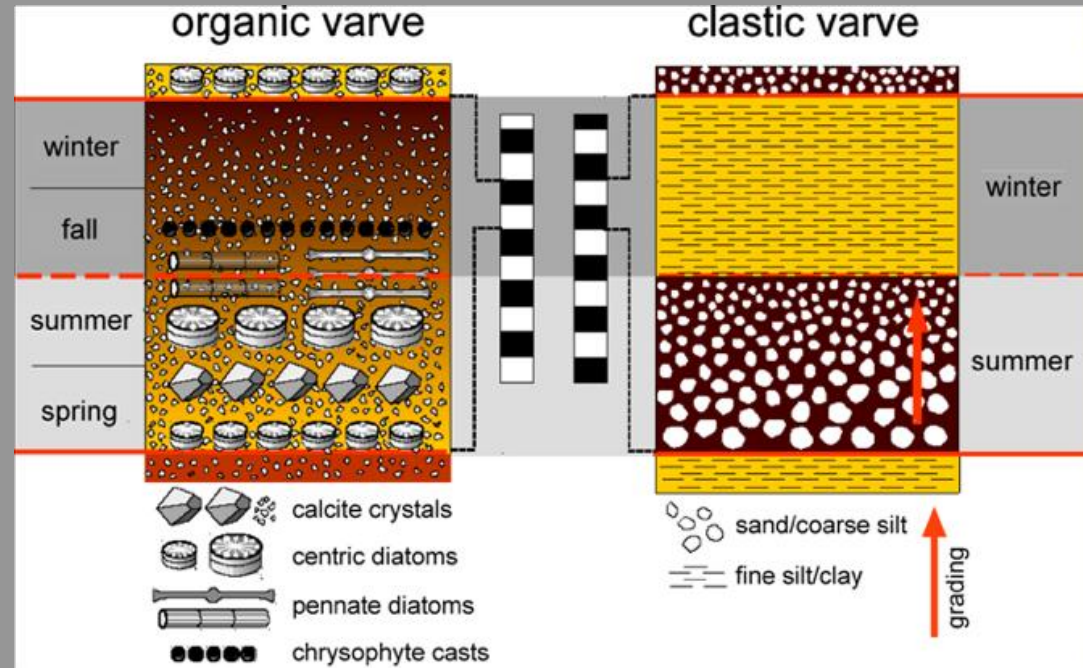
PALEOCLIMATE - BIOLOGIC METHODS

Pollen analysis (counts, types)



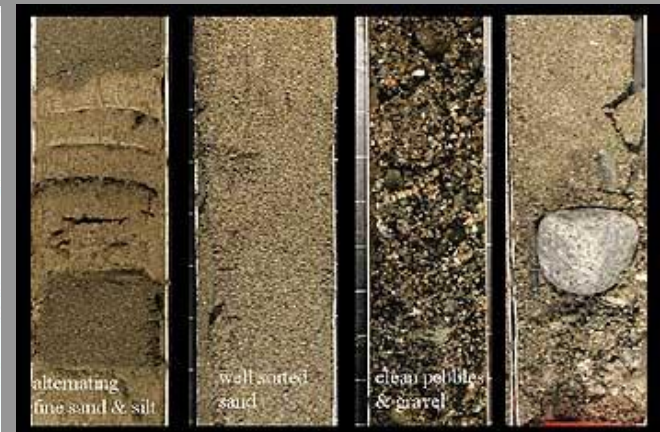
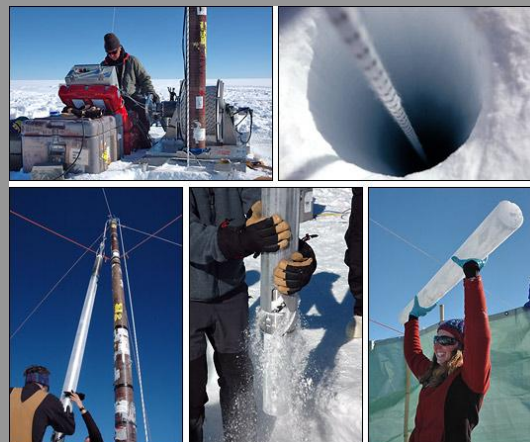
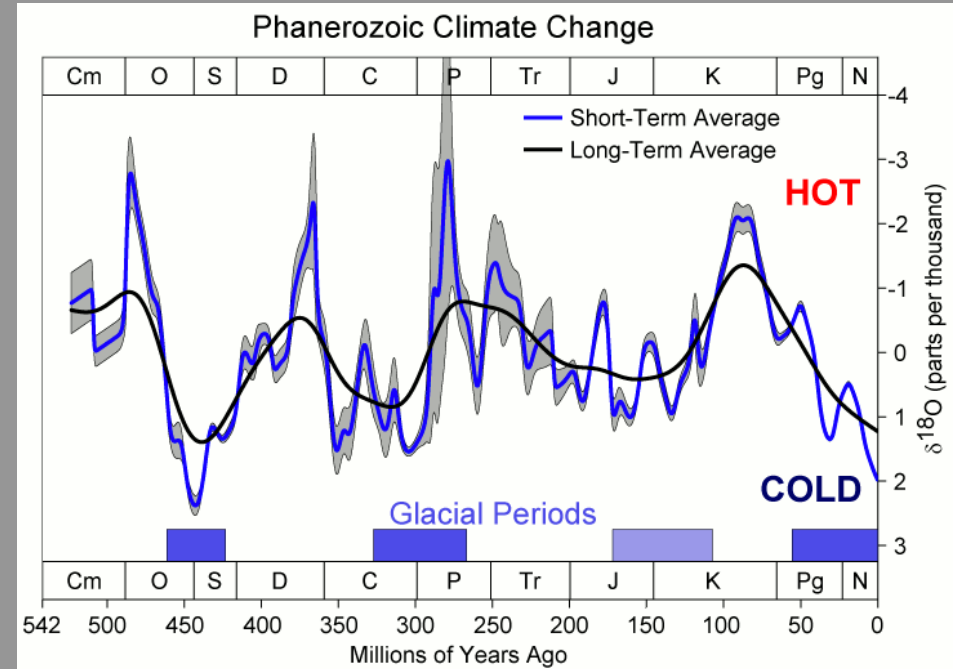
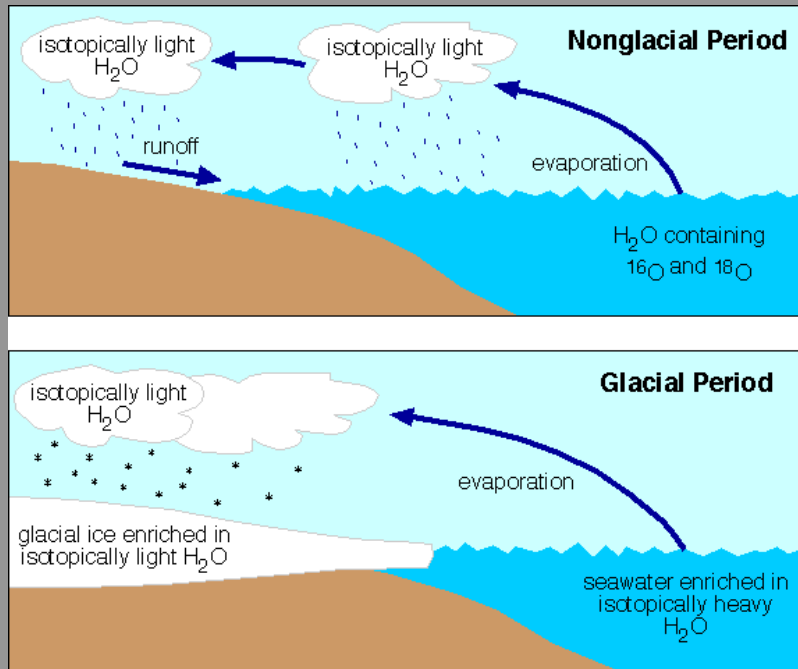
PALEOCLIMATE - GEOLOGIC METHODS

Varves (lake sediment)

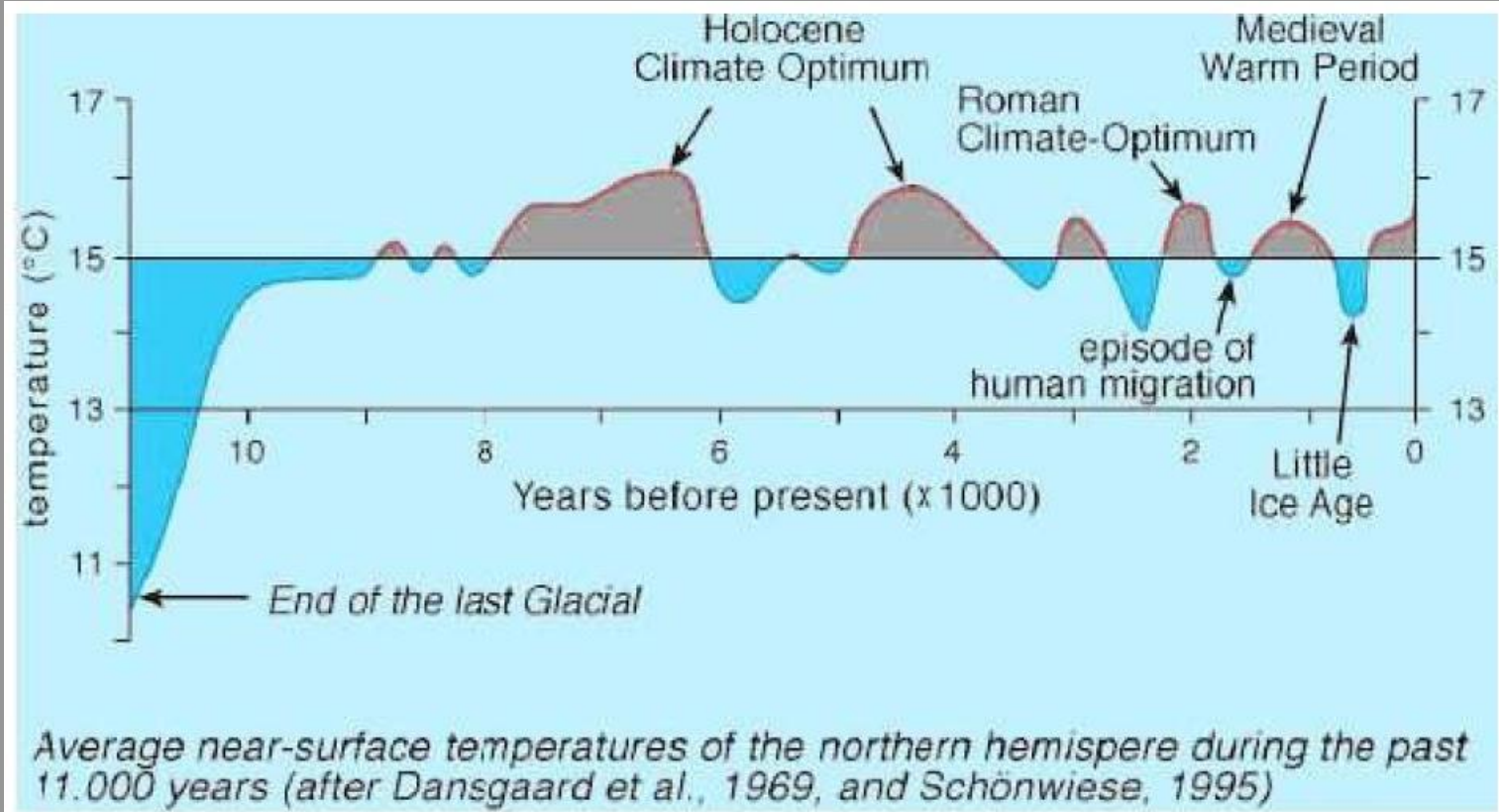


PALEOCLIMATE - GEOLOGIC METHODS

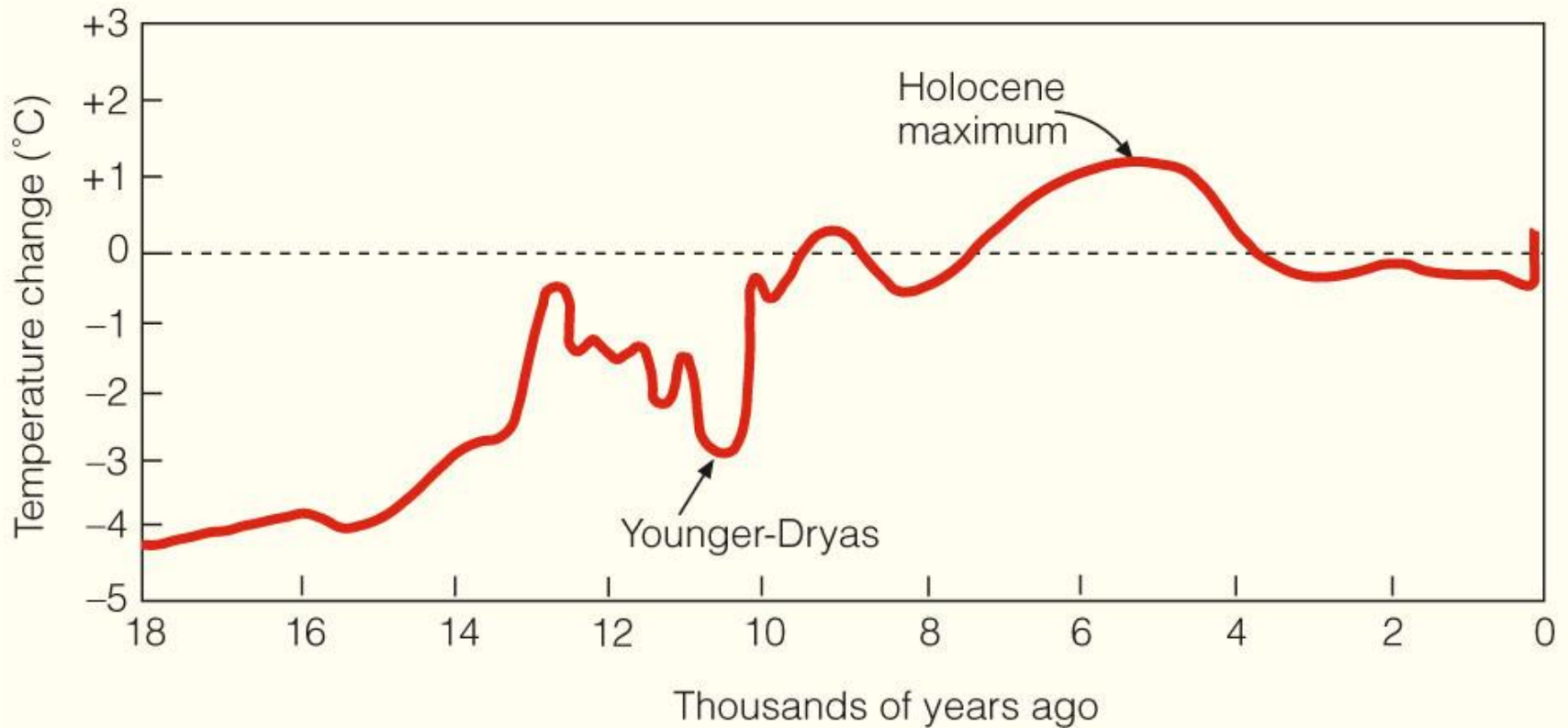
Oxygen-isotopes (temperature)



GEOLOGIC TIME - HOLOCENE



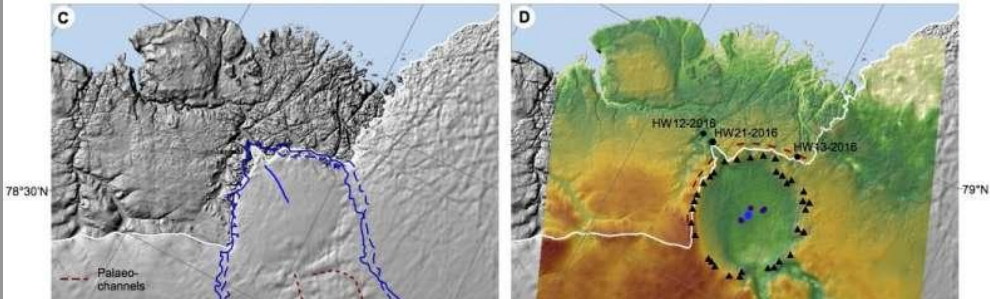
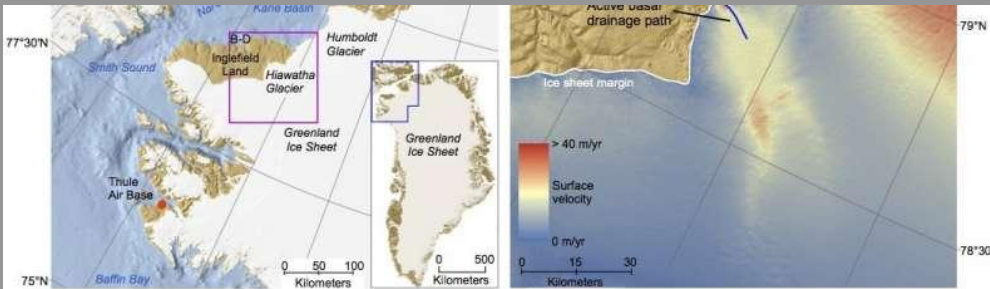
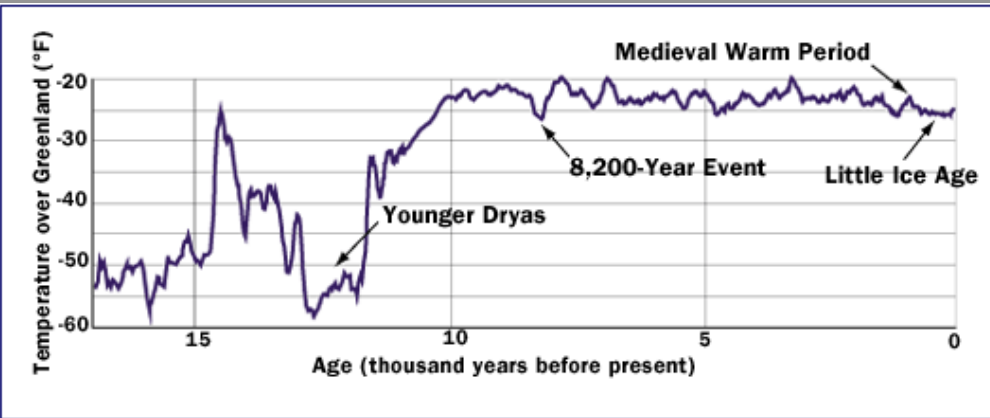
GEOLOGIC TIME: HOLOCENE EPOCH – THE “RECENT AGE”



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HOW STABLE WAS THE CLIMATE 14,000 – 10,000 YEARS AGO?

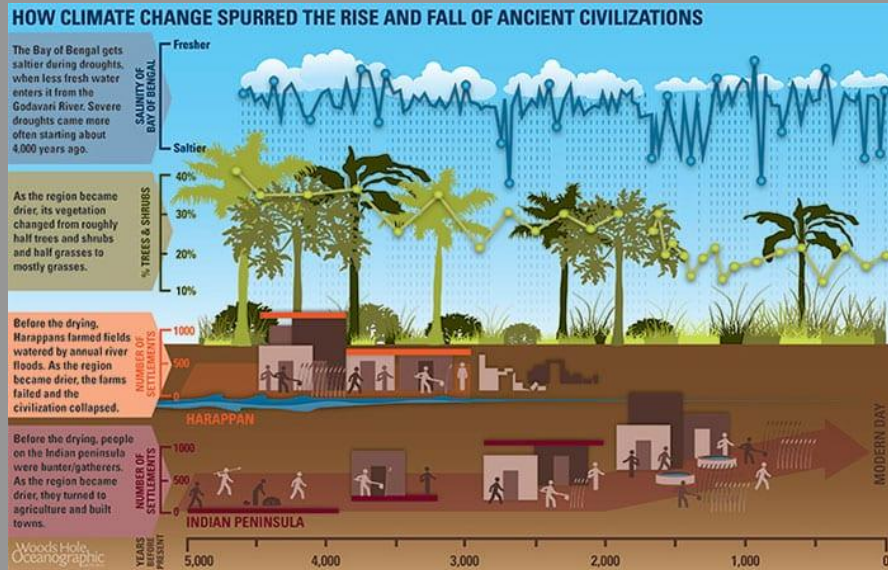
YOUNGER-DRYAS EVENT (10800 BC)



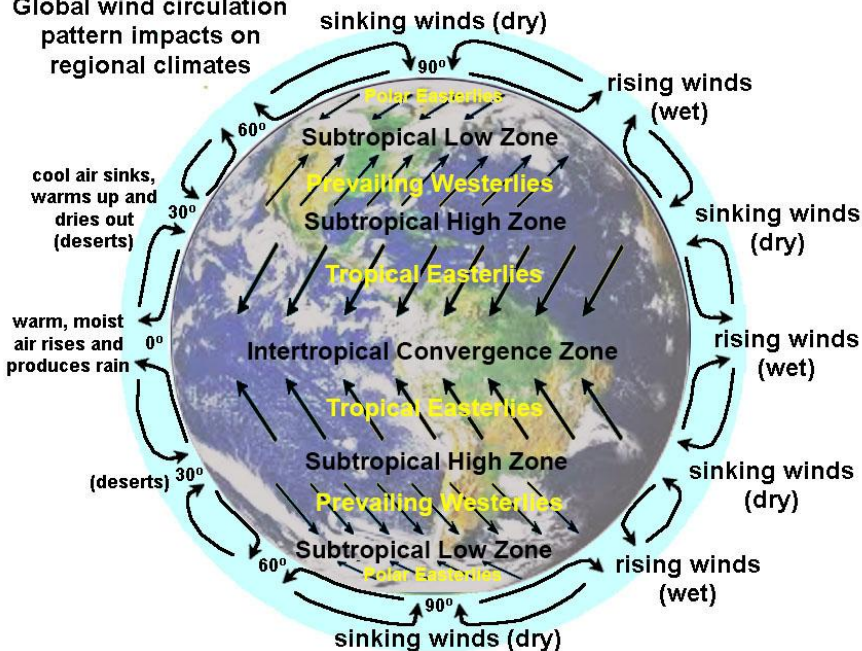
Impacts: Mega-Fires followed by long 1000-year cold ice-age like period

Sources: <https://www.universetoday.com/138463/12800-years-ago-earth-struck-disintegrating-comet-setting-off-global-firestorms>
<http://www.astronomy.com/news/2018/11/massive-impact-crater-beneath-greenland-could-explain-ice-age-climate-swing>

ANCIENT EGYPT (3150 BC – 330 BC)



Global wind circulation pattern impacts on regional climates

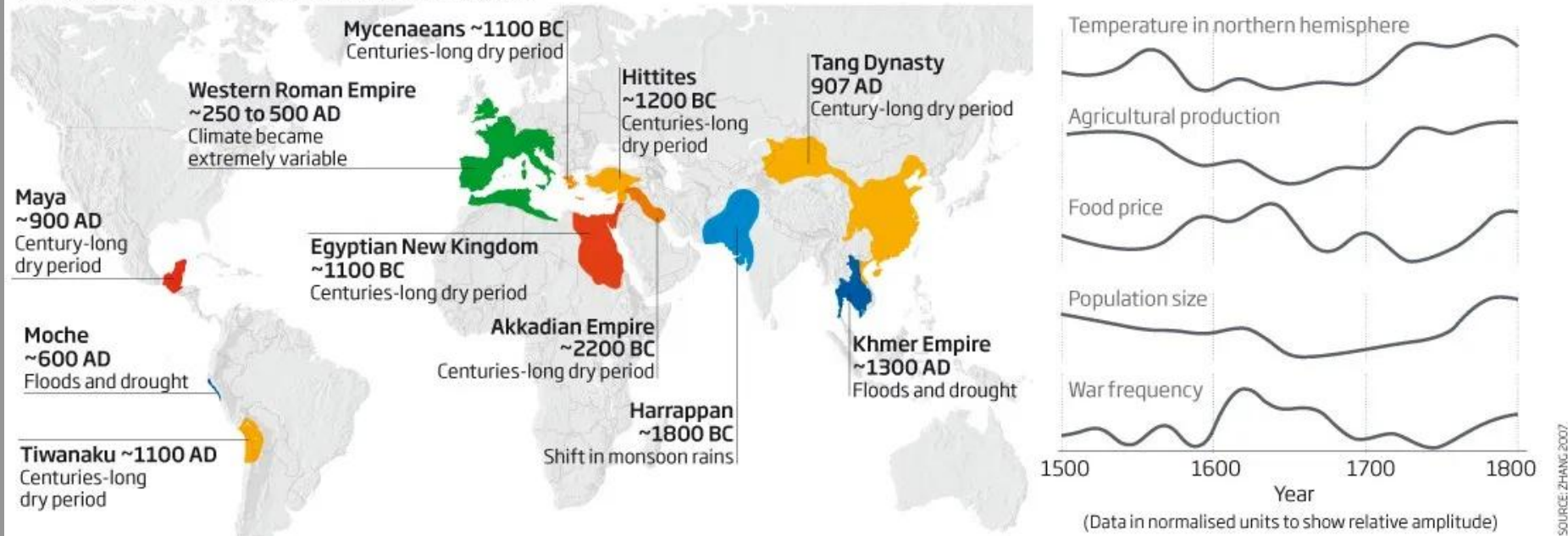


ANCIENT EGYPT (3150 BC – 330 BC)

More than coincidence?

©NewScientist

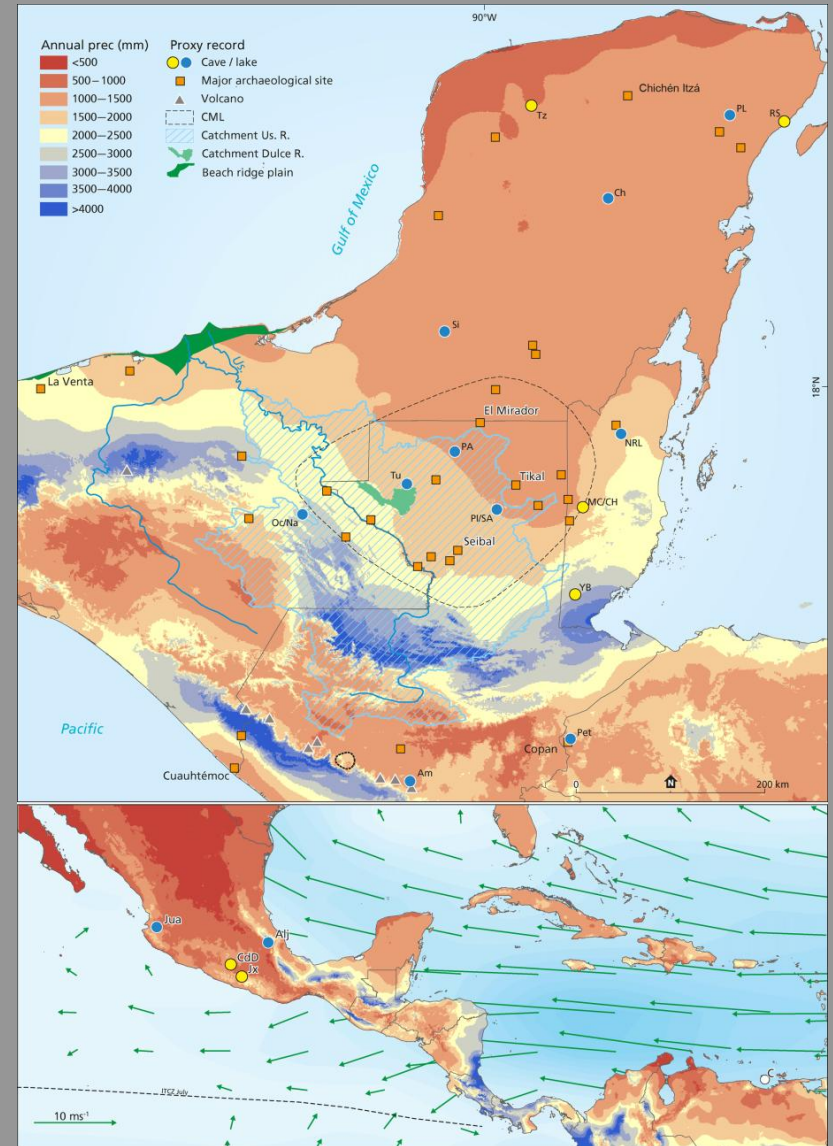
The decline and fall of many civilisations coincided with periods of climate change, and there are also correlations between climate change, population size and the frequency of wars, as data from Europe shows (right)



Causes: Mega-Droughts, shifting Sahara desertification and ITCZ wind zone

Sources: <https://wattsupwiththat.com/2012/08/17/climate-and-drought-lessons-from-ancient-egypt>
http://www.bbc.co.uk/history/ancient/egyptians/apocalypse_egypt_01.shtml
<https://www.bolde.com/14-ancient-civilizations-that-may-have-collapsed-from-climate-change/>

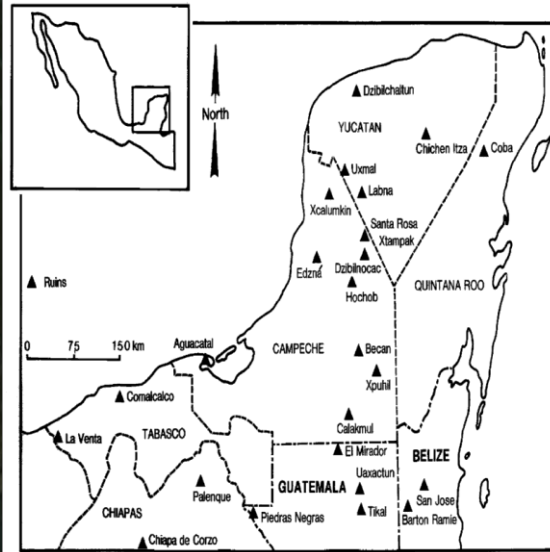
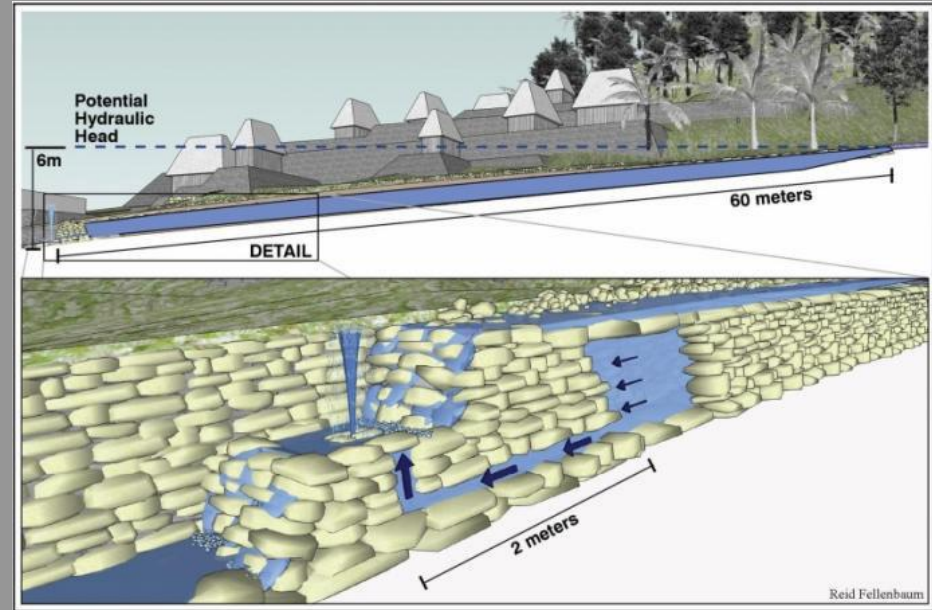
MAYA of CENTRAL AMERICA (1800 BC – 900 AD)



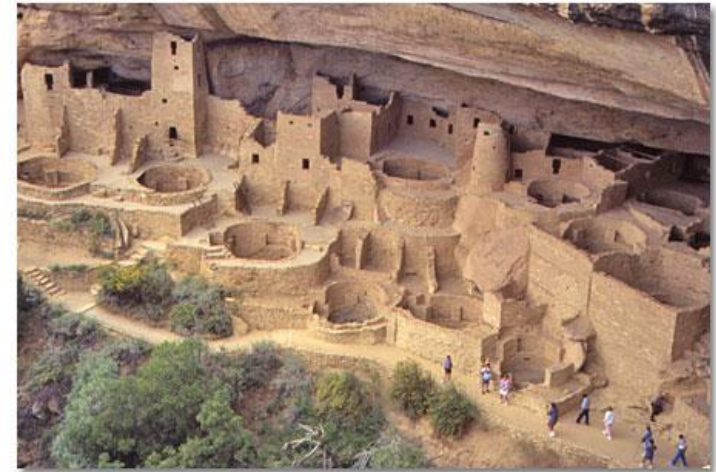
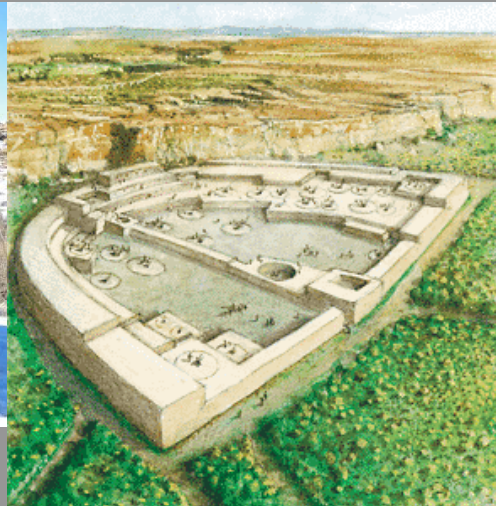
Source: <https://www.clim-past.net/14/1253/2018/>

<https://www.earthmagazine.org/article/aag-eruption-el-salvadors-ilopango-explains-ad-536-cooling>

MAYA of CENTRAL AMERICA (1800 BC – 900 AD)

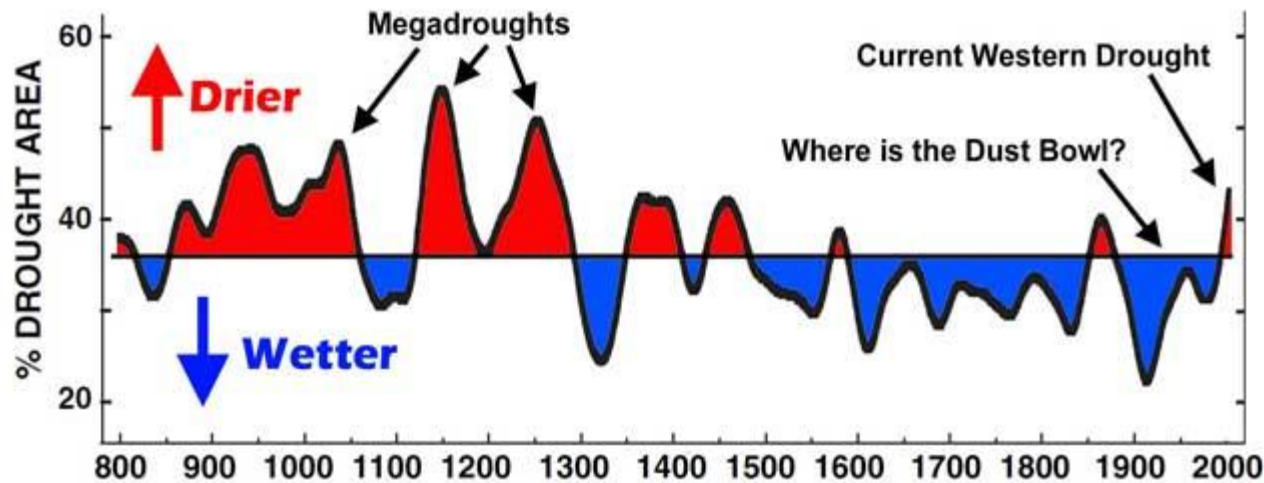


ANASAZI INDIANS (1200 BC – 1180 AD)

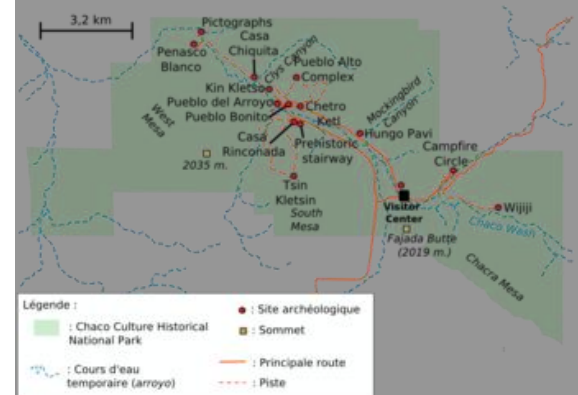


Exploring the ruins in Mesa Verde National Park

LONG-TERM CHANGES IN DROUGHT AREA IN THE WEST



Adapted from: Cook et al., Long Term Aridity Changes in the Western United States, *Science*, 2004.

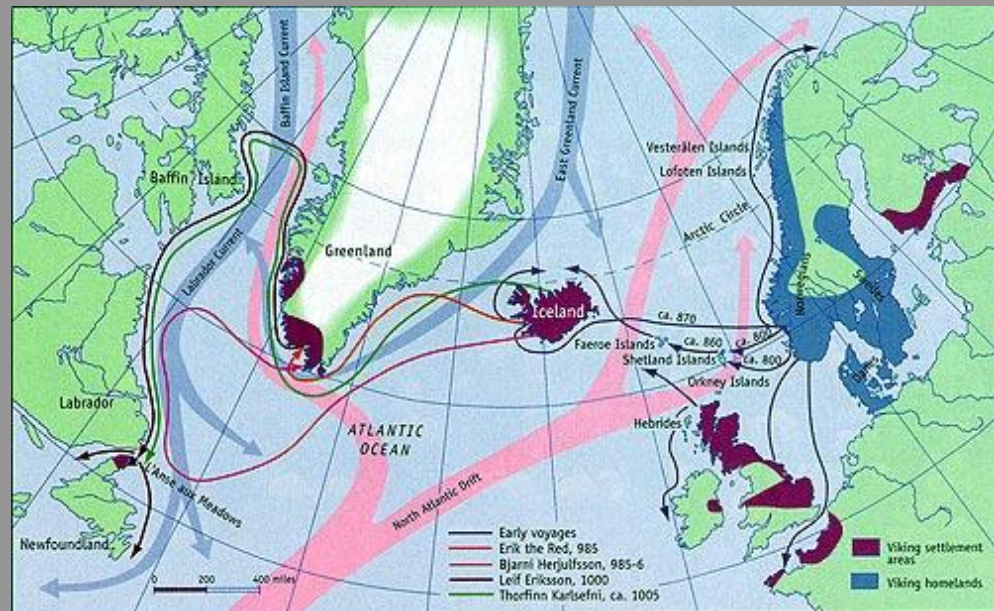


Source: https://en.wikipedia.org/wiki/Ancestral_Puebloans

VIKING AGE (793 AD – 1066 AD)

GREENLAND

ICELAND

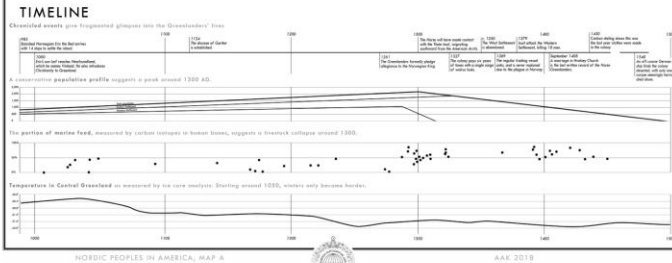
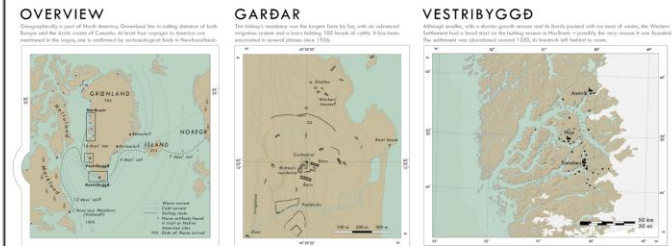
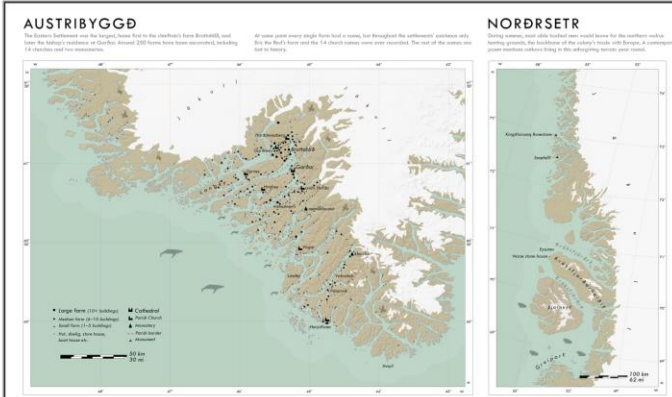


VIKING AGE (793 AD – 1066 AD)

THE SETTLEMENTS OF NORSE GREENLAND 985 – ca. 1500 A.D.

Settled in 985 on the island of Hvalfögr, the Norse settlements in Greenland peaked at around 1200-1300 with 5-8,000 inhabitants. It is thought that the great majority of the Norse population was of Danish origin, with some Norse and some English and Irish settlers. The Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild. The Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild. The Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild.

about, but in the settlement of Gardar, the Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild. The Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild. The Norse population was concentrated in the western part of the island, where the soil was fertile and the climate was mild.



SOURCE:
Hansen, Thomas, et al. *Norse Greenland: The Discovery of a Lost World*. New York: Oxford University Press, 2018.
Hansen, Thomas, et al. *Norse Greenland: The Discovery of a Lost World*. New York: Oxford University Press, 2018.
Hansen, Thomas, et al. *Norse Greenland: The Discovery of a Lost World*. New York: Oxford University Press, 2018.



Source: <https://mapasmilhaud.com/en/historical-maps/viking-settlements-in-greenland-2018/>

VIKING AGE (793 AD – 1066 AD)

THE MEDIEVAL WARM PERIOD

WARMER

CA. 1000. VIKINGS AT
L'ANSE AUX MEADOWS
NEWFOUNDLAND

CA. 1350. THE "WESTERN"
GREENLAND SETTLEMENT
ABANDONED

THE LITTLE
ICE AGE

11TH CENTURY VIKING SHIPS

CA. 1020: HEDEBY 3 (72 FT TRADER)
CA. 1025: ROSKILDE 6, (118 FT LONGSHIP)
CA. 1040: SKULDELEV 5 (57 FT LONGSHIP)
CA. 1060: SKULDELEV 2 (98 FT LONGSHIP)
CA. 1060: ROSKILDE 3 (59 FT TRADER)
11TH CENTURY: SKULDELEV 1, 3, 6 TRADERS

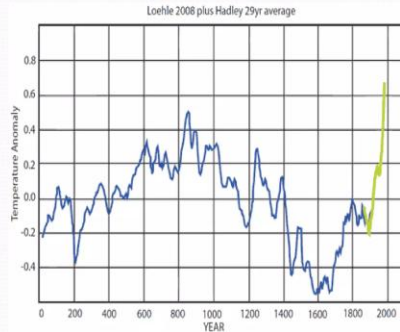
COLDER

1000 1100 1200 1300 1400 1500

THE LITTLE ICE AGE (1400-1850)

When the Ice Age occurred

- The Little Ice Age occurred between the 1300's and 1800's.
- Everyone from North America, all the way to Russia was affected by the Little Ice Age during these times.
- The coldest of these times were recorded to be around the late 1500's to the near 1700's.



Effects

(From Documentary: Little Ice Age)

- Millions perished as the cold triggers a chain reaction across civilization
- Disrupted society and reshaped the world
- New York Harbor froze for five weeks allowing people to walk from Manhattan to Staten Island
- A summer storm desimated the Spanish Armada
- Famines drove Frances masses to Paris demanding affordable bread, fueling the chaos which led to the French Revolution
- Mass hysteria took root. Witch hunts became common practice as many women were burnt at the stake
- George Washington's Victory in the Battle of Trenton can also be attributed to the Little Ice Age



Causes: weak solar activity, increased volcanic eruptions

Source: https://en.wikipedia.org/wiki/Little_Ice_Age

History Ch., *Little Ice Age...Big Chill*, <https://www.imdb.com/title/tt0425199/>

THE LITTLE ICE AGE (1400-1850)

The Little Ice Age in Europe

- Evidence for Climactic Change



THE LITTLE ICE AGE



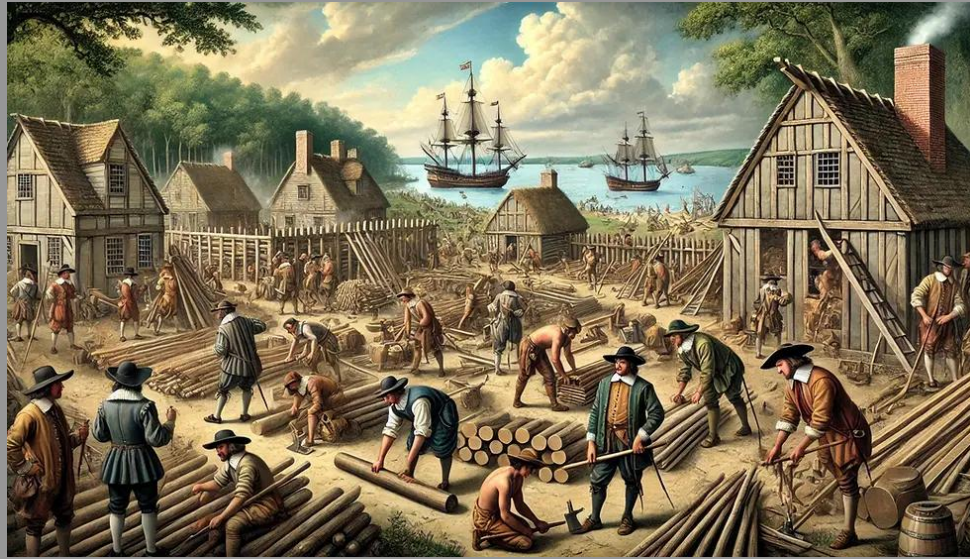
HOW CLIMATE MADE HISTORY
1300 - 1850

BRIAN FAGAN

AUTHOR OF
*Floods, Famines and
Emperors*

<https://www.sciencefocus.com/planet-earth/the-effects-of-the-little-ice-age-went-far-beyond-climate-change/>
<http://www.newenglandhistoricalsociety.com/six-ways-little-ice-age-made-history/>
<https://www.slideserve.com/oceana/the-little-ice-age-in-europe-evidence-for-climactic-change>

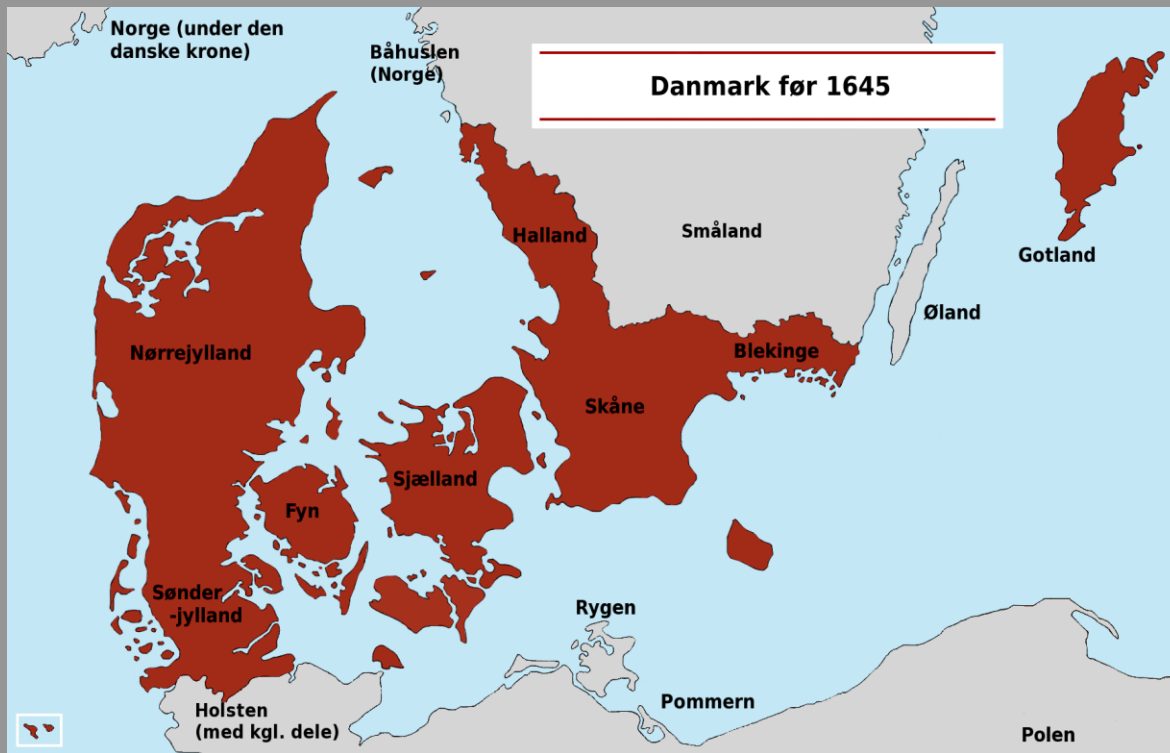
LITTLE ICE AGE (1620-1820) – EARLY AMERICAN COLONIAL ERA



HOME TO THANKSGIVING.

SWEDEN-DENMARK WARS (1521-1721)

"March across the Belts" (winter 1658)



Denmark: Hidden Colonial Empire:
<https://www.youtube.com/watch?v=gNcd5JgUhgw>

SWEDEN-DENMARK WARS (1521-1721)

"March across the Belts" (winter 1658)



SWEDEN-DENMARK WARS (1521-1721)

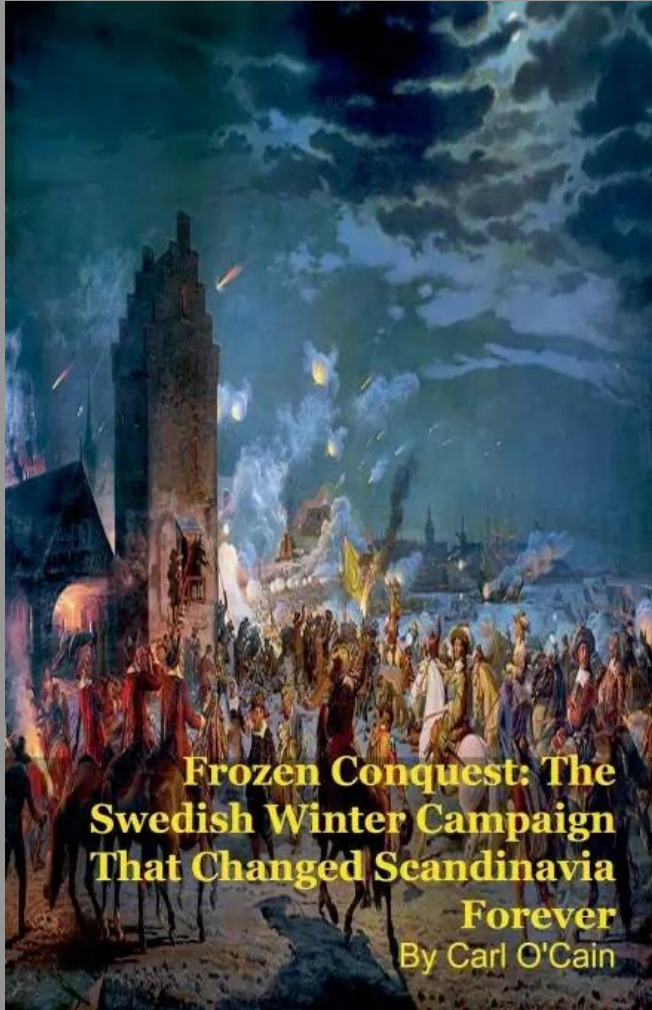
"March across the Belts" (winter 1658)



https://www.reddit.com/r/BattlePaintings/comments/11cdxsj/the_dutch_and_swedish_fleets_clash_in_the_battle/
Background info: <https://www.youtube.com/watch?v=30YDyVkXaMI/>

SWEDEN-DENMARK WARS (1521-1721)

"March across the Belts" (winter 1658)



<https://www.medimops.de/carl-o-cain-frozen-conquest-the-swedish-winter-campaign-that-changed-scandinavia-forever-paperback-M0B0GMYGPRRH.html/>

<https://idvorkin-ai-tools.github.io/scandinavia-2026/explainers/denmark-vs-sweden.html/>

LEWIS and CLARK EXPEDITION (1804-1806)

Lewis & Clark's Northwest Journey

"Weather Disagreeable!"



BY GEORGE R. MILLER



LEWIS and CLARK EXPEDITION (1804-1806)

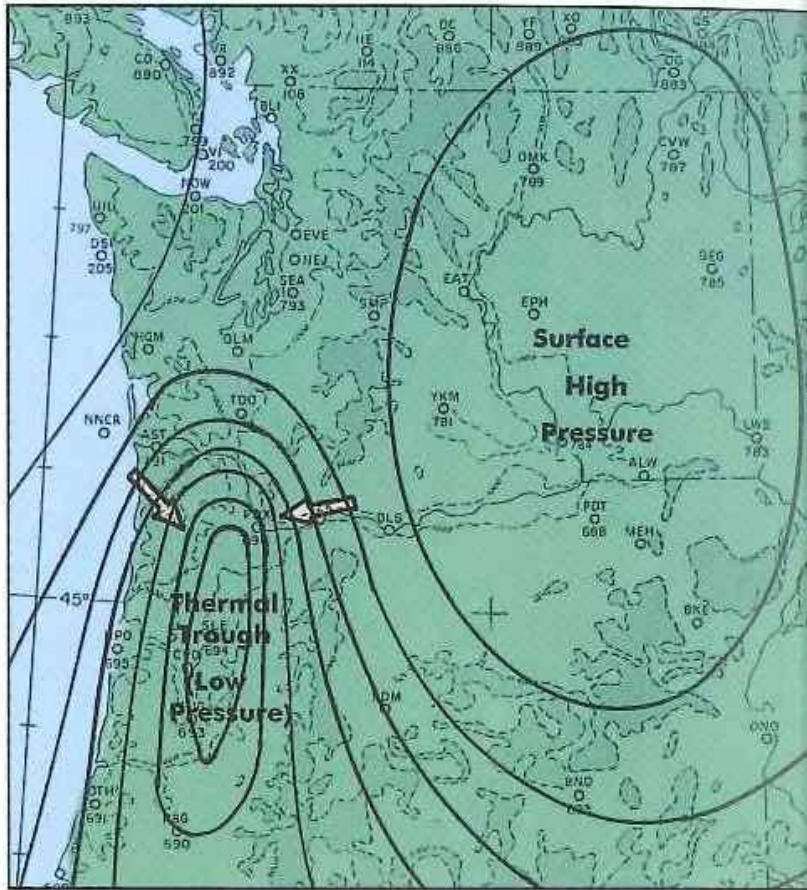


Fig. 3.6 Surface high pressure east of the Cascade Mountains and a thermal trough (low pressure) west of these mountains combine to cause strong east to northeast winds through the Columbia River Gorge.

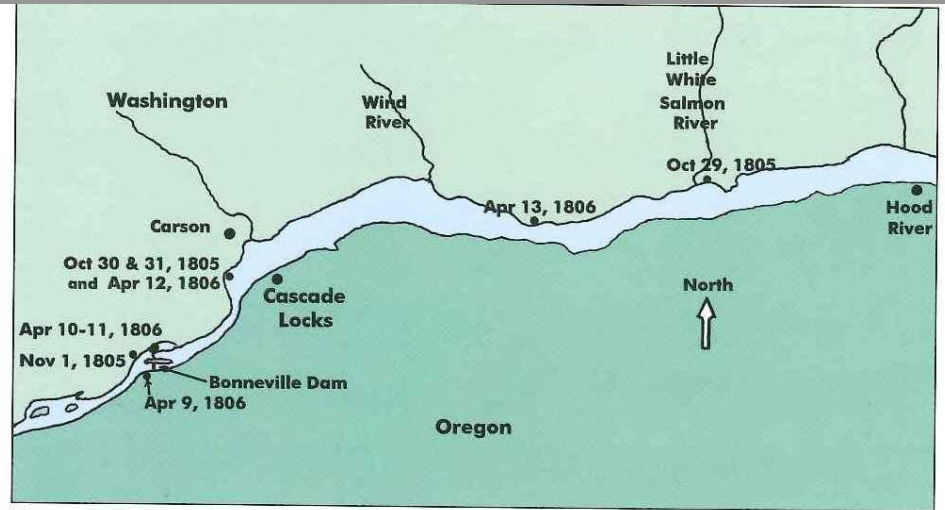


Figure 3.8 The Corps of Discovery campsites for October 29 to November 1, 1805 and April 10-13, 1806 are shown in the above map. Strong winds often disrupted their movement in the Columbia River Gorge.

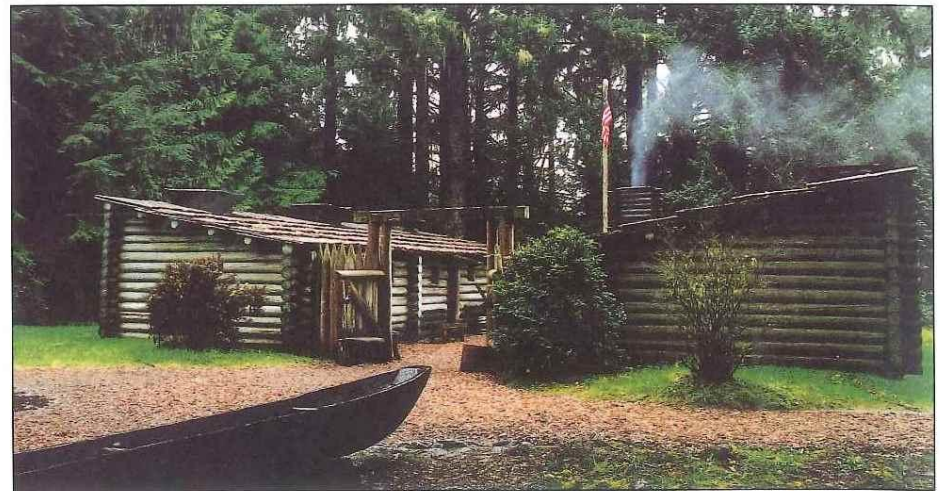


Fig. 2.8 A replica of the site where the Corps of Discovery camped from December 7, 1805 to March 22, 1806 is located at the Fort Clatsop Memorial south of present Astoria, Oregon.

Source: Lewis & Clark's Northwest Journey (Miller 2004)

LEWIS and CLARK EXPEDITION (1804-1806)

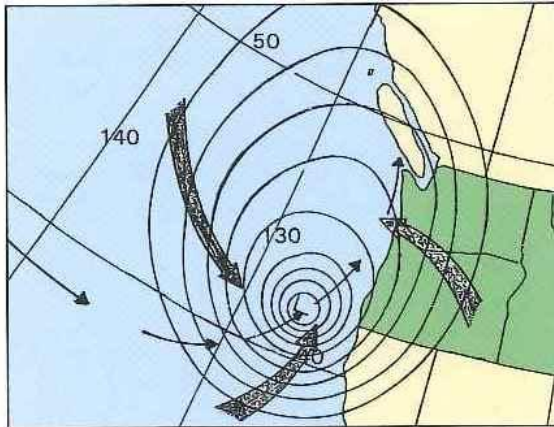


Fig. 2.3 Columbus Day-type storms move rapidly across the Pacific Ocean near latitude 40°N, intensifying, and then curve north along the coasts of Oregon and Washington. Solid lines are isobars.

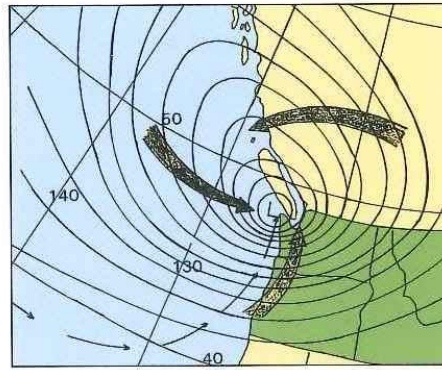


Fig. 2.4 As Columbus Day-type storms move north along the coast, rapidly falling surface pressure ahead of the storm and rapidly rising pressure in the southern quadrant of the storm create strong southeast to southwest winds. Solid lines are isobars.

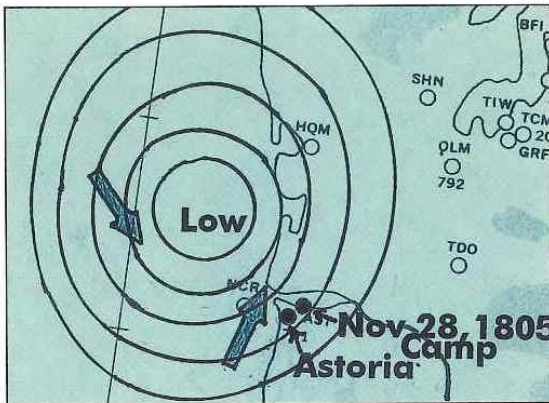


Fig. 2.6a An intense low-pressure system just off the southwest Washington coast would cause strong southwesterly winds at the Corps of Discovery's November 28, 1805 campsite. Solid lines are isobars.

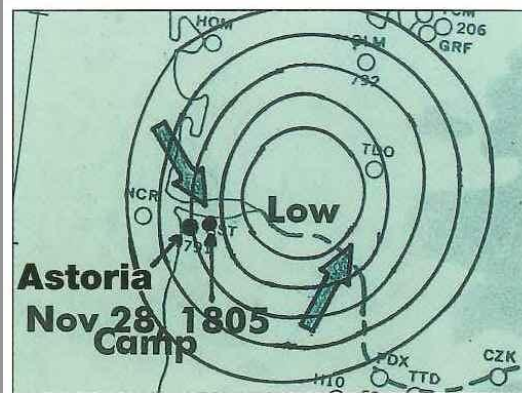


Fig. 2.6b As the low-pressure system moves eastward along the Columbia River, strong southwesterly winds would shift abruptly and blow "with great violence" from a northwesterly direction at the Corps of Discovery's November 28, 1805 campsite. Solid lines are isobars.

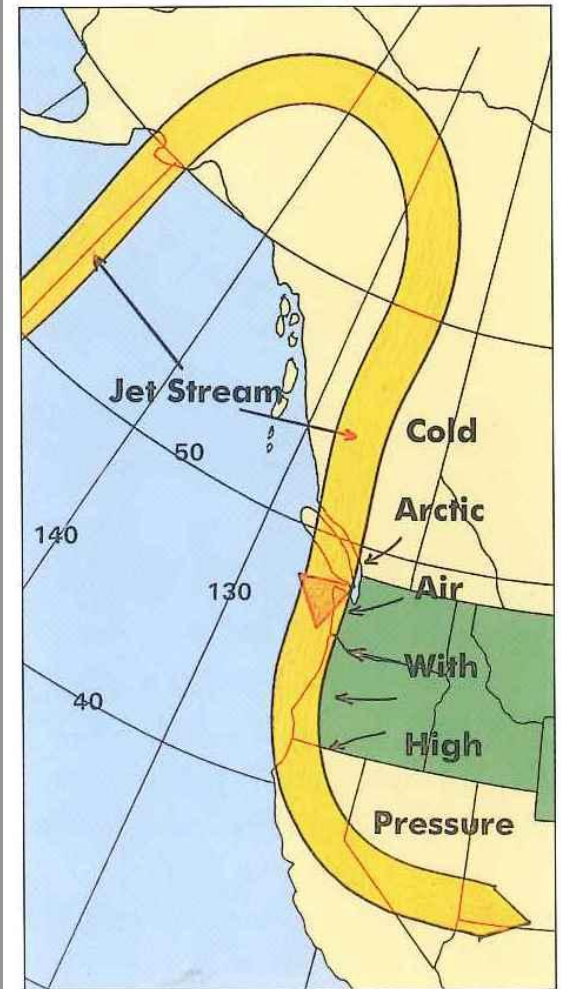
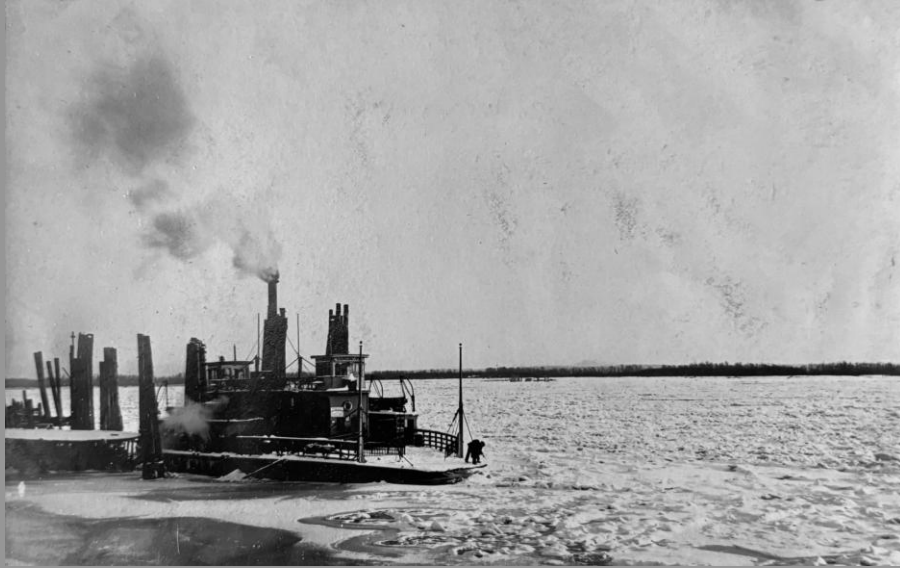


Fig. 2.14 A favorable pattern for cold air to invade the Pacific Northwest is a strong northerly jet stream that brings cold arctic air southward over Oregon and Washington.

Source: Lewis & Clark's Northwest Journey (Miller 2004)

COLUMBIA RIVER...**FROZEN** OVER (1847, 1854, **1909**, 1930)



<https://alamedahistory.org/2024/08/25/when-the-columbia-river-froze/>
<https://northwestprimetime.com/news/2026/01/20/back-in-the-day-the-columbia-river-froze/>