Times Standard

Not My Fault: The Younger Dryas: Abrupt Climate Change in the Recent Geologic Past and What it Could Mean

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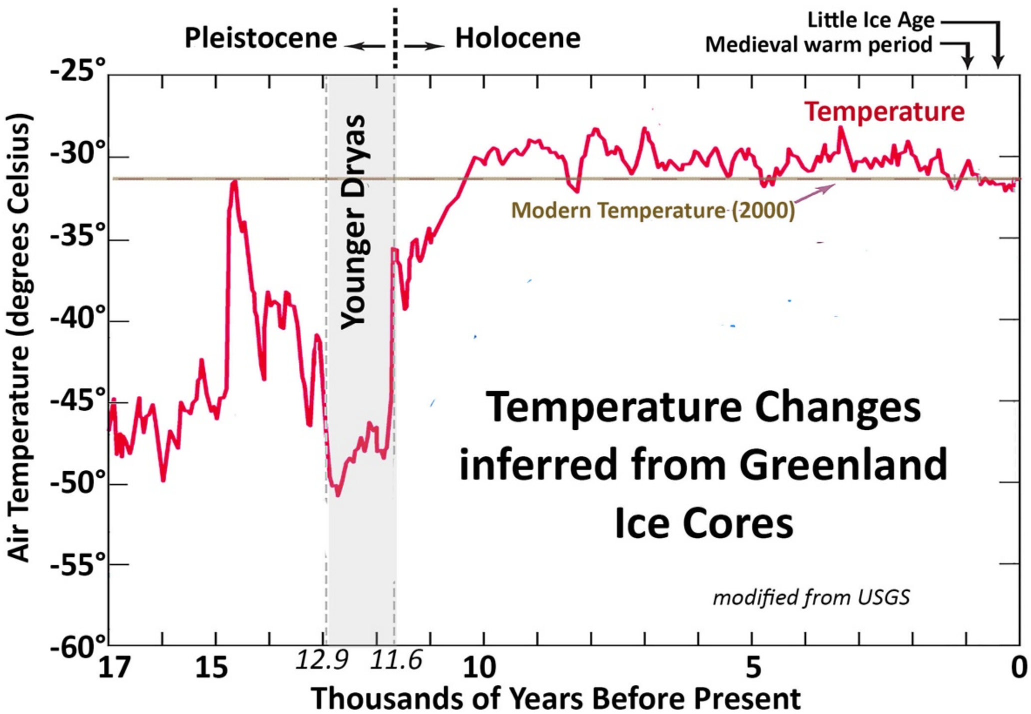
Posted April 4, 2026
https://www.times-standard.com/2026/04/04/lori-dengler-the-younger-dryas-abrupt-climate-change-in-the-recent-geologic-past-and-what-it-could-mean/



This graph shows temperature fluctuations in Greenland over the last 17,000 years inferred from ice cores. The Younger Dryas occurs as a sharp colder anomaly between 12,900 and 11,600 years ago, where temperatures plunged to between -45° to -50° Celsius (-55° to -60° Fahrenheit). The brown line is the Greenland temperature in 2000. The much smaller temperature swings during the Medieval warm period and the Little Ice Age are also noted, adapted from the USGS.

No matter how you look at it, March weather was unusual. We measured a whopping half inch of rain at our gauge in McKinleyville, the lowest in our forty years of living here. Our data is backed up by the National Weather Service who declared March 2026 the second driest in its 126 years of record keeping, topped only by 1926 when barely a trace of precipitation was documented. Record-breaking temperature highs were reported in many areas of the country with over 180 sites breaking all-time March records and Phoenix, Arizona setting a new national March high of 112° ten days ago.

Weather oscillations on the order of days or months are not unusual, but the planet has seen increasingly volatile weather swings in the last decade as the climate warms. While much attention is focused on record breaking heat waves and rising seas, there are other, potentially more dire, consequences of a warmer planet and it doesn't take much sleuthing into the recent geologic past to uncover some of them.

The quiet earthquake and tsunami beginning of 2026 has given me the chance to explore geologic nooks and crannies that have always fascinated me. As I poked my nose into the geologic unfolding of the greater Mediterranean area, I bumped into a geologic sub-stage called the Younger Dryas. It is considered the strongest temperature variation of the past 20,000 years and its cause and consequences can be examined in a variety of data. The Younger Dryas posed great challenges for humans near the end of the last ice age and provides interesting fodder for pondering current climate issues.

The Younger Dryas is named after *Dryas octopetal,* a tough little shrub commonly called Mountain Avens. Like many northern plants, it's in the rose family with 8-petaled creamy white flowers and can still be seen today in dry, cold alpine and other harsh environments. Scandinavian scientists first discovered Dryas leaves preserved in freshwater clay deposits in the late 1800s. Over the next twenty years, Dryas fossils were found in many areas of Scandinavia, where today, the plants are no longer found. Scientists postulated its presence signaled a short but pronounced cold spell at a time when the planet was emerging from the last ice age. The unit in which the fossil leaves were found was named Dryas. Later studies revealed a more complex history with one or two warmer periods breaking up the unit in some areas, and the last and strongest of these cold pulses was dubbed the Younger Dryas.

In the early 20th century, a new tool emerged to quantify the distribution and amount of Dryas plants. Palynology is the study of plant pollens. Pollen season is around the corner and anyone who suffers allergies has little appreciation for the beauty and resilience of this part of many plant reproductive cycles. Pollen consists of a tough outer shell encasing male genetic material, and the shape of that shell is unique to the species, identifiable by careful microscope examination. Palynology plays an important role in oil and gas exploration, reconstruction of past climates, and forensics. I'm sure you have seen the perp getting caught on your favorite crime show because of the pollen on his/her shoes.

Dryas octopetal pollen is roughly triangular in shape and about as long as a human hair is wide. Beginning in the 1930s, research teams began collecting sediment cores from European lakes and marshes and quantifying the prevalence of this pollen under the microscope. Similar investigations were launched in Greenland, Iceland, and North America and the picture we have today of its distribution during the Younger Dryas extends as far south as the Pyrenees and Colorado's Rocky Mountains. There is near-uniform agreement among climate scientists that the Younger Dryas was a global cold spell that began nearly 13,000 years ago lasted for more than a millennium.

Our ancestors were faced with extreme hardship during this time when the cold severely restricted edible plants and affected game migration. Studies suggest human populations declined by as much as 50% in Europe and took similar hits elsewhere. The period coincides with the disappearance of Clovis culture in North America and drove people to migrate to warmer areas. Several anthropologists argue the cold conditions triggered the first attempts at agriculture, when wild food and game became less predictable, triggering hunter gatherer groups to tend edible weeds and domesticate animals. The evidence is strongest in the Fertile

Crescent region of the Middle East where domesticated seeds and specialized agricultural tools date to Younger Dryas times.

The big question is what caused this extreme cold spell and why did it end. Most scientists agree the great chill was triggered by an abrupt change in the Atlantic ocean circulation pattern. Anyone who has dipped their toes into the water on an East Coast beach knows conditions are very different than at an equivalent latitude in Northern California. The Gulf stream brings warm tropical waters north along the U.S. East coast, past Greenland and down the European coast. This giant conveyor belt modulates climate and transports nutrients that forms the base of marine ecosystems.

The Gulf stream is just one piece of the Atlantic Meridional Overturning Circulation (AMOC) that is driven by the complex interaction of temperature, rotation, salinity contrast, and coastal intricacies. At the tail end of the last ice age, glaciers were melting fast and rapidly changing ocean salinity where fresh water entered the ocean. Great floods produced by ice-dam failures sporadically released tons of melt water. Lake Agassiz in northern Manitoba was once larger than all of the modern great lakes combined, covering nearly 200,000 square miles at its peak. Like giant Lake Missoula in western Montana, it experienced a number of great outburst floods, the first timed right at the beginning of the Younger Dryas cold spell.

The scientific consensus is that the enormous flood of fresh water severely affected the AMOC by rapidly reducing the salinity of the northern Atlantic. Some argue a meteorite impact exacerbated glacial melting and the freshwater input. We don't know if the Gulf stream stopped completely or just severely weakened, but the results were dramatic. Without the circulation of this warm water, temperatures plummeted in the Northern Hemisphere. And the onset appears to have occurred in perhaps as little as a decade. The speed of this climate turnaround gave animal species no time to adapt, wiping out over 70% of the megafauna in North America. The Younger Dryas coincided with vast human migrations and the extinction of mastodons, woolly mammoths, giant sloths, saber tooth tigers, and the disappearance of horses and camels from North America.

The Younger Dryas ended as rapidly as it started. Greenland temperatures rose by more 15° Fahrenheit in a decade, and pollen studies and other biologic indicators suggest a return to the pre-Dryas warming trend in about 50 years. The Gulf stream again strengthened as the freshwater glacial source declined and re-established the AMOC pattern, once again restoring warmer waters and milder temperatures to North America and Europe.

Research suggests that the AMOC has weakened between 15 – 20% in the past half century, because of a warmer ocean and glacial melt waters. There have been many modeling studies of how it could respond to further warming and increased freshwater inputs from Greenland. Some suggest we are nearing a tipping point (see https://ca.pbslearningmedia.org/resource/nves.sci.earth.oceancirc/global-ocean-circulation/. It's a consequence we don't want to experience.

The Younger Dryas is a lesson in how quickly the climate can change and what an enormous impact it can have on plants and animals. Human societies have grown, developed and flourished in a relatively benign climate. Greenland ice cores and other paleoclimate indicators show relatively little variation in the Holocene (modern) epoch. This stability has allowed for general predictability in the conditions that support an agrarian society. There have been small blips that have had dire consequences for humankind. The 1783 eruption of Laki in Iceland caused only a few degrees of global cooling and caused massive European crop failures, the societal disruption contributing to the French revolution. The Little Ice Age between 700 and 200 years ago saw a lowering of average temperatures by a similar amount but it contributed to crop failure, disease outbreaks, and famine. An ironic consequence of a warming planet could be an abrupt plunge into a cold spell that human civilization will have a very difficult time surviving.

Lori Dengler is an emeritus professor of geology at Cal Poly Humboldt, and an expert in tsunami and earthquake hazards. The opinions expressed are hers and not the Times--Standard's. All Not My Fault columns are archived online at https://kamome.humboldt.edu/taxonomy/term/5 and may be reused for educational purposes. Leave a message at (707) 826-6019 or email Kamome@humboldt.edu for questions and comments about this column or to request copies of the preparedness magazine "Living on Shaky Ground."