NO PREP

How Climate Change Is Both Revealing and Destroying Archaeological Sites

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Name: Period: Date:

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What the Ice Gives Back

For thousands of years, glaciers and ice patches across the world have served as accidental time capsules, preserving organic materials that would have decayed long ago in warmer conditions. Leather shoes, wooden arrows, woven textiles, animal remains, and even human bodies have been locked in ice for millennia, perfectly preserved in the freezing conditions. As global temperatures rise and ice retreats, these artifacts are being exposed for the first time, emerging from glaciers and ice patches like messages from the past. The most famous example is Otzi the Iceman, a 5,300-year-old naturally mummified man discovered in 1991 in the Alps on the border between Austria and Italy. Otzi was found by hikers as his body emerged from a melting glacier. He was carrying a copper axe, a bow and arrows, a flint knife, and a leather backpack, an astonishing assemblage of personal belongings that provided unprecedented insight into life during the Copper Age. Analysis of his stomach contents revealed his last two meals. DNA analysis identified genetic conditions and dietary patterns. Even the sequence of wounds on his body told a story: Otzi had been shot in the back with an arrow and likely murdered. Since Otzi, glacial archaeology has become an increasingly urgent field. In Norway, the Secrets of the Ice program has recovered over 3,000 artifacts from melting ice patches, including 1,500-year-old arrows, Iron Age textiles, and Viking-era horse equipment. In the Canadian Yukon, melting ice has exposed wooden hunting tools and the remains of animals that were driven into ice patches by ancient hunters. In the Swiss and Austrian Alps, researchers monitor retreating glaciers with GPS and satellite imagery, racing to reach exposed artifacts before wind, rain, and biological decomposition destroy them.

What the Sea Takes Away

While melting ice reveals artifacts, rising sea levels are destroying coastal archaeological sites at an accelerating pace. Thousands of sites around the world (shell middens, fishing villages, port cities, coastal fortifications, and burial grounds) sit at or near sea level and face inundation or erosion as oceans expand and storms intensify. The sites most at risk are often the oldest, because ancient coastlines were different from modern ones, and many of the world's earliest coastal settlements are now at or below current sea level. In Scotland, some of the most important Neolithic and Bronze Age sites sit on eroding coastlines. The famous Skara Brae settlement in Orkney, a 5,000-year-old village preserved beneath sand dunes, is increasingly threatened by storm surges and coastal erosion. In the Pacific Islands, rising seas are submerging cultural sites that are central to Indigenous identity and oral history. In the southeastern United States, shell mound sites built by Native American communities over thousands of years are being washed away by hurricane storm surges and chronic tidal flooding. The challenge is scale. There are far more threatened sites than there are archaeologists and funding to document them. Organizations like CyArk and the Scottish Coastal Archaeology and the Problem of Erosion project use digital documentation, such as 3D scanning, photogrammetry, and drone surveys, to record threatened sites before they are lost. But digital records are not a substitute for the sites themselves. A 3D scan of Skara Brae captures its appearance, but it cannot preserve the unexcavated layers of soil and artifacts that still lie beneath the surface.

The Permafrost Problem

Permafrost, ground that remains frozen year-round, covers about 25 percent of the Northern Hemisphere's land surface. For centuries, it has served as a natural deep freeze, preserving organic materials in extraordinary condition. Frozen archaeological sites in Siberia, Alaska, and northern Canada contain preserved wood, leather, animal tissue, and even intact human bodies that would have decomposed within years in warmer climates. As global temperatures rise, permafrost is thawing at unprecedented rates. This has exposed remarkable finds. In Siberia, melting permafrost has revealed the frozen remains of woolly mammoths so well preserved that their muscles, blood, and stomach contents can be studied. While mammoths are not archaeological finds (they predate humans in most cases), the same thawing

process is exposing ancient human campsites, burial grounds, and village sites that have been frozen since they were occupied thousands of years ago. The problem is that once thawed, organic materials begin to decompose rapidly. A wooden tool that survived intact for 3,000 years in frozen ground can disintegrate within a single summer once exposed to air, sunlight, and microorganisms. Researchers in the Arctic face a cruel paradox: climate change is revealing some of the best-preserved archaeological material in the world, but the same warming that reveals it also destroys it. Teams have days or weeks, not months or years, to reach, document, and recover artifacts before they are gone.

Salvage Archaeology in a Warming World

The scale of the problem has forced the archaeological community to rethink its priorities. Salvage archaeology — the emergency excavation and documentation of sites threatened with imminent destruction — has always been part of the discipline. CRM archaeology is a form of salvage, protecting sites from construction. But climate-driven salvage is different. Construction projects are planned and scheduled. Climate change is not. A glacier can retreat faster than predicted. A storm can erode a century of coastline in a single night. Permafrost can thaw years ahead of projections. Funding and logistics are major obstacles. Most archaeological funding is tied to specific research projects or development compliance, not to climate emergencies. When a melting ice patch in Norway reveals a 1,500-year-old arrow, there is no automatic mechanism for dispatching a team to recover it. Researchers rely on citizen reports, satellite monitoring, and sheer luck. In the Arctic, the challenges multiply: remote locations, extreme weather, short field seasons, and the staggering cost of operating in polar environments. Despite these challenges, the archaeological community is adapting. International networks of glacial archaeologists share data and coordinate rapid responses. Training programs teach local communities — especially Indigenous communities in the Arctic — to identify and report emerging artifacts. Drone and satellite technology allow remote monitoring of vast landscapes that would be impossible to survey on foot. And partnerships between archaeologists, climate scientists, and indigenous knowledge holders are producing some of the most innovative and urgent research in the field. The race is real, and the stakes are enormous. Climate change is simultaneously the greatest threat to and the greatest revealer of archaeological material in human

history. Every year, the ice gives back treasures that have been hidden for millennia. And every year, the sea, the storms, and the thaw take them away. The question is whether we can document and learn from what is being revealed before it is destroyed — and whether we will invest the resources to try. The urgency of this work has created unexpected opportunities for collaboration across scientific disciplines. Climate scientists need archaeological data to understand past environmental conditions. Archaeologists need climate models to predict which sites will be threatened next. Indigenous communities possess traditional knowledge about landscapes that complements both scientific perspectives. These partnerships, born of necessity, are producing some of the most innovative research in modern archaeology — research that may help us understand not only how past societies responded to environmental change, but how we might navigate our own climate crisis using lessons preserved in the archaeological record.

Key Information: Climate Threats to Archaeological Sites

Threat	Example Region	What Is at Risk	Current Response
Glacial melting	Norway, Alps, Yukon	Preserved organic artifacts (wood, leather, textiles)	GPS monitoring, rapid recovery teams, citizen reporting
Sea level rise	Pacific Islands, Scotland, SE United States	Coastal settlements, shell middens, port cities	3D scanning, photogrammetry, digital documentation
Coastal erosion	Orkney (Skara Brae), Mediterranean coasts	Ancient villages, burial grounds, harbor structures	Emergency excavation, seawall construction, monitoring

Threat	Example Region	What Is at Risk	Current Response
Permafrost thaw	Siberia, Alaska, northern Canada	Frozen campsites, burials, organic remains	Satellite monitoring, community reporting, rapid excavation
Intensified storms	Caribbean, Gulf Coast, Southeast Asia	Shipwrecks, island sites, coastal fortifications	Post-storm surveys, digital recording, salvage excavation
Wildfire increase	Western US, Australia, Mediterranean	Surface sites, rock art, paleobotanical evidence	Fire-risk mapping, preventive documentation

Case Study: Dr. Natsiq Amaruq and the Thawing Village

Dr. Natsiq Amaruq stood at the edge of the eroding bluff, watching chunks of frozen earth calve into the Beaufort Sea like a slow-motion glacier. Below her feet, preserved in the permafrost for roughly 800 years, were the remains of an Inuit village: collapsed sod houses, stone tool caches, carved bone implements, and the frozen bones of seals and caribou that told the story of life in one of the harshest environments on Earth. Natsiq was Inuvialuit — the people whose ancestors had built this village. She was also the lead archaeologist on a salvage project funded by a one-year emergency grant that would not be renewed. 'We have maybe two field seasons before the bluff is gone,' she told her team of four on the first day. 'The permafrost is thawing from the top down. What took 800 years to freeze is going to rot in 800 days.' Her team worked 16-hour days in the brief Arctic summer, photographing, mapping, and collecting what they could. Every morning brought new damage — a section of floor exposed by overnight thaw, a carved harpoon head slipping toward the sea. 'This is my family's history falling into the ocean,' Natsiq said quietly to a visiting journalist. 'And we do not have enough hands or enough money to save it all.'

1. How does Dr. Amaruq's situation illustrate the 'cruel paradox' of climate change and archaeology described in the reading? What specific challenges does she face?

2. The reading discusses how partnerships between archaeologists, climate scientists, and Indigenous communities are producing innovative research. How does Dr. Amaruq's identity as both an Inuvialuit person and a professional archaeologist relate to this idea?

Multiple Choice

1. What is the 'cruel paradox' of climate change and archaeology described in the reading?

a) Climate change reveals preserved artifacts while simultaneously destroying them

b) Climate change creates new archaeological sites but destroys natural landscapes

c) Climate change helps fund archaeological research but reduces public interest

d) Climate change makes it easier to dig but harder to find artifacts

2. What makes the discovery of Otzi the Iceman archaeologically significant?

a) He was the oldest human body ever discovered anywhere in the world

b) He was the first human body ever found in Europe

c) He proved that glaciers existed in the Alps during ancient times when climate was different from today

d) His well-preserved remains and personal belongings provided unprecedented insight into Copper Age life

3. Why is salvage archaeology related to climate change different from traditional salvage archaeology related to construction?

a) Climate-driven salvage only affects sites in cold environments

b) Traditional salvage is always more urgent, because climate-related salvage can wait

c) Climate change is unpredictable and cannot be scheduled like a construction project

d) Climate-driven salvage is easier because funding is always available

Matching

Write the letter of the correct definition on the line next to each term.

Term	Definition
1. ___ Permafrost	A) Emergency excavation and documentation of sites threatened with imminent destruction
2. ___ Salvage Archaeology	B) Ground that remains frozen year-round, preserving organic materials for millennia
3. ___ Glacier	C) The gradual wearing away of land by wind, water, or storms, which can expose or destroy sites
4. ___ Erosion	D) The increasing height of ocean waters due to climate change, threatening coastal archaeological sites
5. ___ Sea Level Rise	E) A large body of ice that moves slowly over land, capable of preserving artifacts when frozen

Fill-in-the-Blank

1. Emergency excavation and documentation of sites threatened with imminent destruction is called _____.

2. Ground that remains frozen year-round and can preserve organic materials for thousands of years is called _____.

3. The gradual wearing away of land by wind, water, or storms, which threatens archaeological sites along coastlines, is known as _____.

Short Answer

Answer each question in 2-4 complete sentences.

1. Explain how melting glaciers and ice patches have contributed to important archaeological discoveries. Give at least one specific example from the reading.

2. Why is the thawing of permafrost both exciting and devastating for archaeologists? What happens to organic artifacts once they are exposed to air?

3. The reading argues that 'digital records are not a substitute for the sites themselves.' Explain what this means and why it matters for sites threatened by climate change.