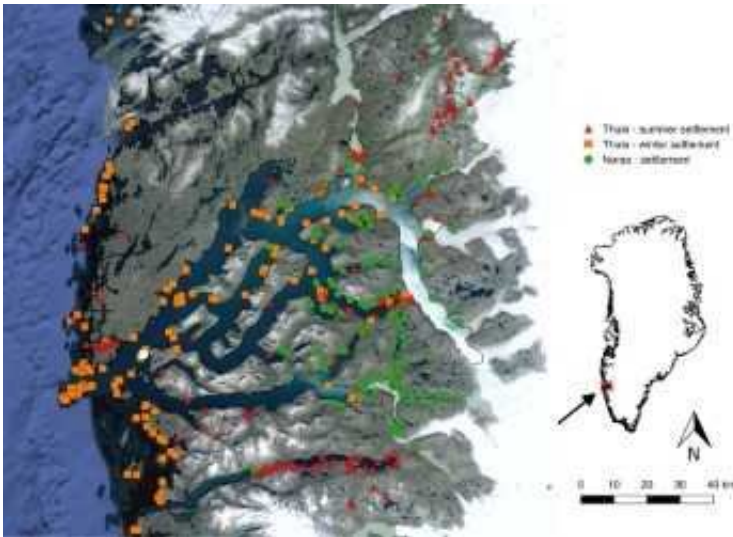


Coastal erosion threatens archaeological sites along Greenland's fjords

December 18 2017, by Jeremy Rehm



The distribution of registered archaeological settlements in the Nuuk region in western Greenland. Credit: Google Earth

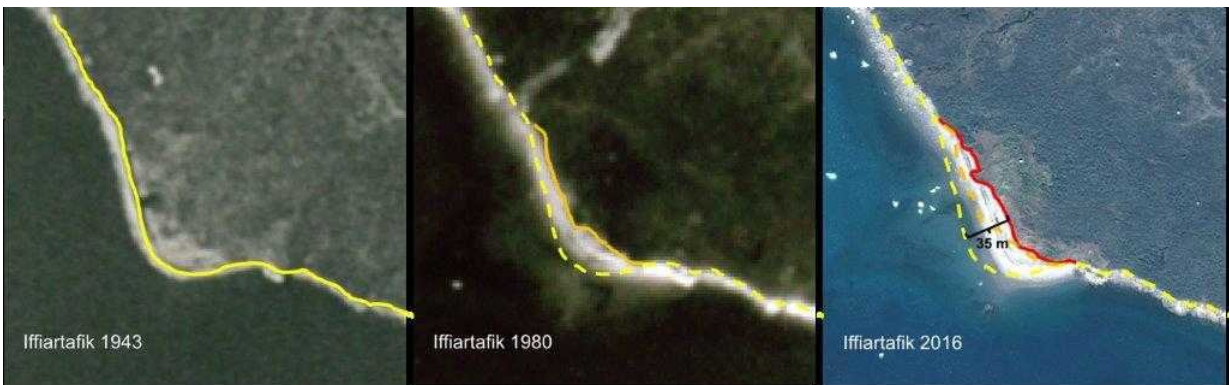
Hundreds of archaeology sites lie along the shores of Greenland's fjords and coasts, revealing the entirety of the country's ancestral cultures from as many as four thousand years ago.

Coastal erosion, however, may soon drop many of those ancestral links into the ocean, a group of geographers reported of their preliminary work this week at the 2017 American Geophysical Union Fall Meeting in New Orleans. And a warming climate may only make matters worse.

"These sites are the only thing we have if we want to understand these old cultures," said Rasmus Fenger-Nielsen, a doctoral student from the University of Copenhagen in Denmark who presented the new research. "There's no written sources or anything, so we're bound to these places to understand how these people lived."

Some of these archaeological sites show how ancient relatives of the Inuit people like the Dorset and Thule (1300 CE – present) moved from ocean shores during winter, where they'd hunt marine mammals, to the settlements inland up the fjords during summer to track reindeer and fish. Others show cultures, like the Norse Vikings (985 – 1350 CE), stayed still, farming in the warmer, highly productive climate inland.

Regardless of their lifestyle, these ancient people shared one thing in common: the [shore](#). In a small 150- by 120-kilometer (93- by 75-mile) area surrounding the Nuuk fjord in western Greenland, roughly 600 of these ancient settlements dot 3,000 km (1865 miles) of coastline—70 percent of them within 200 meters (650 feet) of water.



Shoreline changes at the Thule/Norse settlement Iffiartafik in the inner part of the Nuuk fjord. Aerial photos from 1943 and 1980 reveal that the site has been under erosion within the past 70 years and is threatening the site today. Credit: Danish Agency for Data Supply and Efficiency

In ancient times, the coast was a lifeline to food. But coastal proximity today concerns Fenger-Nielsen and his colleagues because the closer a site lies to the shore, the more likely it can fall victim to [coastal erosion](#). But nobody knows how many will and what factors are causing the erosion.

A few months ago, the team decided to begin addressing that issue by using a method called the "cultural resource vulnerability" index. The index quantifies an assortment of parameters about each archaeological site, including how fast the closest shore is eroding, the average wave height impacting the shore, the shore's geologic composition, and the range of tidal influences.

They used a combination of aerial imagery and regional environment models to estimate each parameter for nine different sites and found that not all sites are equally vulnerable. Images from Google Earth, for example, showed that only 13 percent of the coasts were made of erodible sand, but about a third of the archaeological sites they studied sat on those shores. Almost all sites sit along inland shores where wave action in the fjord is low yet powerful enough that between 1943 and 2016, the sandy inland shore by the settlement Iffiartafik eroded 35 meters (115 feet), now leaving the settlement at water's edge.

"It's a joint problem of high tides in combination with waves that makes the biggest impact," said Aart Kroon, an associate professor of geography at the University of Copenhagen and a co-author of the new study.

Near the fjord's rocky ocean edge, impact from high-energy waves were and still are quite common. Unsurprisingly, the Thule people built their winter settlements farther inland away from those waves. "They've

already thought, 'that's not where we should build our winter house,'" Kroon said.



Scientists excavating the Iffiartafik archaeology site along the Nuuk fjord, where the only remnants of Greenland's ancient hunting and fishing cultures can be found, including artifacts such as a harpoon head (bottom). Credit: Rasmus Fenger-Nielsen

But farther inland, where crashing waves typically dissipate to no more than a gentle wash, sites of both Thule and Norse people lie closer to the water. And in a warming climate, the team suspects these sites are the most vulnerable to erosion.

As the climate warms, the season of ice-free water around Greenland has gradually lengthened, allowing coastal wave action to slowly etch away the coasts for a longer period every year, according to the researchers. And in a warmer climate, larger temperature differences across the globe will lead to stronger winds as the atmosphere attempts to balance itself, in turn producing more powerful waves.

The scientists hypothesize that when combined, these effects mean tame water conditions farther inland will intensify, washing away more and more of the sandy shores until they reach these nearby [archaeological sites](#).

The team hopes to confirm this hypothesis over the next two years, but Fenger-Nielsen also noted another reason for their study.

"This is about cultural heritage, about understanding our past" he said. "If we suddenly don't have these sites, then there's an important part of the Greenlandic history that's gone."

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