# Arctic river deltas may hold clues to future global climate

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Scientists struggling to understand how Earth's climate will change in the next few decades have neglected a potential treasure trove of information—sediments deposited in the ocean by major Arctic rivers such as the Colville and Mackenzie rivers—according to geoscientists at The University of Texas at Austin and Texas A&M University.

The researchers' study was published in the May 19 edition of *Proceedings of the National Academy of Sciences*.

Sediments deposited in large river deltas around the world record information about past sea level, productivity and storminess on the ocean margin, climate on the adjacent continents (including temperatures and precipitation) and human factors that affect sediment delivery to the margin (such as dams and levees), among other things. In addition to these climate factors, Arctic sediments, in particular, could contain records of changes on land due to warming, including permafrost temperature and melting of upland glaciers.

Mead Allison, senior research scientist at The University of Texas at Austin's Jackson School of Geosciences and co-author of the study, said Arctic river deltas have been neglected as records of past climate because the far north is a challenging and expensive environment to work in and it only came to be seen as a bellwether for climate change in the last decade or so.

Arctic river deltas are critical to explore, the researchers reason, because

the largest changes in climate are projected for the Arctic. Large amounts of carbon are stored in Arctic permafrost. As those soils thaw, rivers will transport much of their organic carbon to the oceans. As global warming speeds up the melting of shorefast ice (ice attached to the shore), it will likely accelerate coastal erosion from storms, providing a further supply of organic carbon to the coastal zone.

Allison described several ways these sediments could advance scientists' understanding of the global climate system.

They could help answer a hotly debated question about the role of river deltas in the global carbon cycle. Scientists don't know whether large river deltas are a net source or a net sink of carbon. Do they store more carbon than they produce? That's a critical question because carbon dioxide is a major greenhouse gas. Large river deltas are the interface between the land and the oceans and they deliver large amounts of carbon carried along in sediments. As humans alter river systems by adding nutrients from fertilizers, damming water for power and diverting water for drinking and farming, they may be shifting the ability of those systems to fix, burn and store carbon.

"It's a glaring gap in our understanding of the global carbon cycle," Allison said. "It's a potential gotcha in the global climate models. Each river system is different, but we have to get a handle on the net effects."

Arctic river deposits could also confirm the existence of natural climate cycles that climate models need to take into account. For example, there is evidence supporting the existence of a climate cycle called the Arctic Oscillation that affects temperatures, precipitation and storminess at high latitudes. This cycle oscillates over several decades. But because there are only about 50 years of high quality climate data from the Arctic, it's hard to determine to what extent changes now being observed are natural or due to human influence. River delta sediments might allow

scientists to reconstruct Arctic climate for thousands of years into the past, and possibly confirm this natural baseline.

Finally, these sediments would establish past climate proxies for specific locations that could be monitored in the future to track the changing climate of the Arctic. If it is a region that will experience the biggest climate changes in this century, it will be important to establish how climate is recorded in sediments.

One advantage of studying margin sediments adjacent to large rivers in the Arctic and elsewhere is that they are deposited at a very high rate. This makes it possible to extract information on a year-to-year basis with high resolution.

More information: The paper "Large-river delta-front estuaries as natural "recorders"of global environmental change" appears in the May 19 *Proceedings of the National Academy of Sciences*.

Source: University of Texas at Austin (news : web)