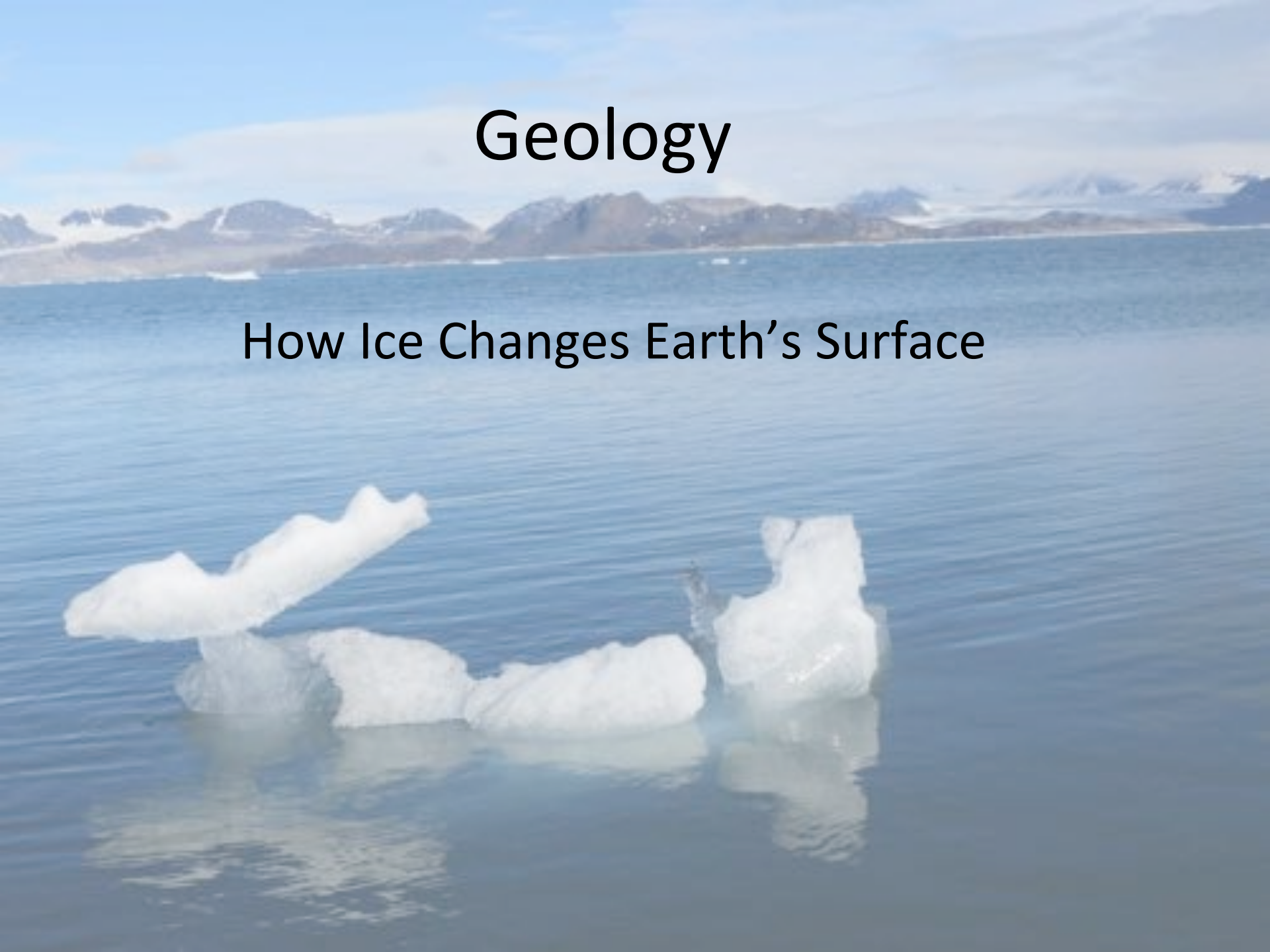
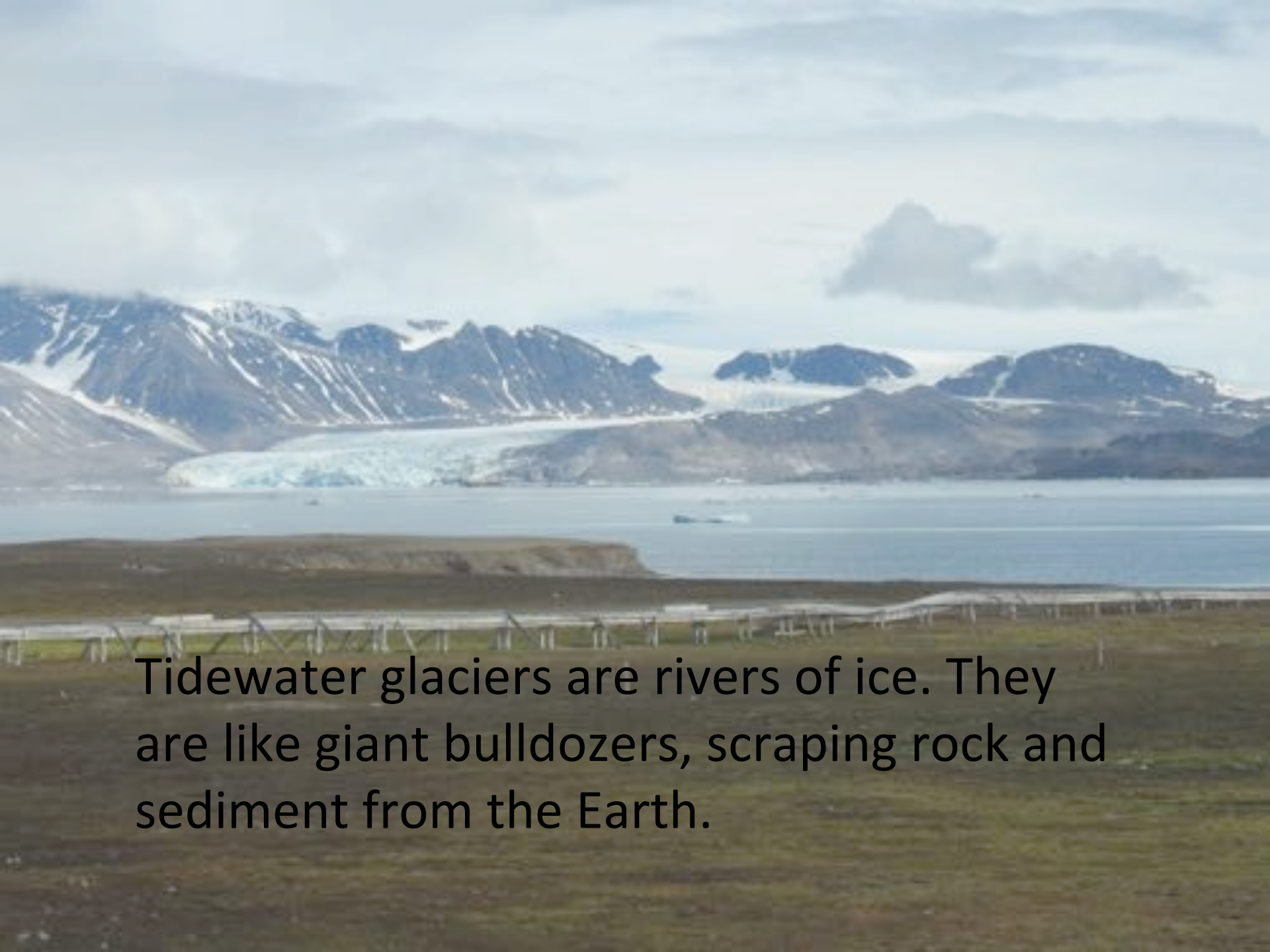
Geology

How Ice Changes Earth's Surface

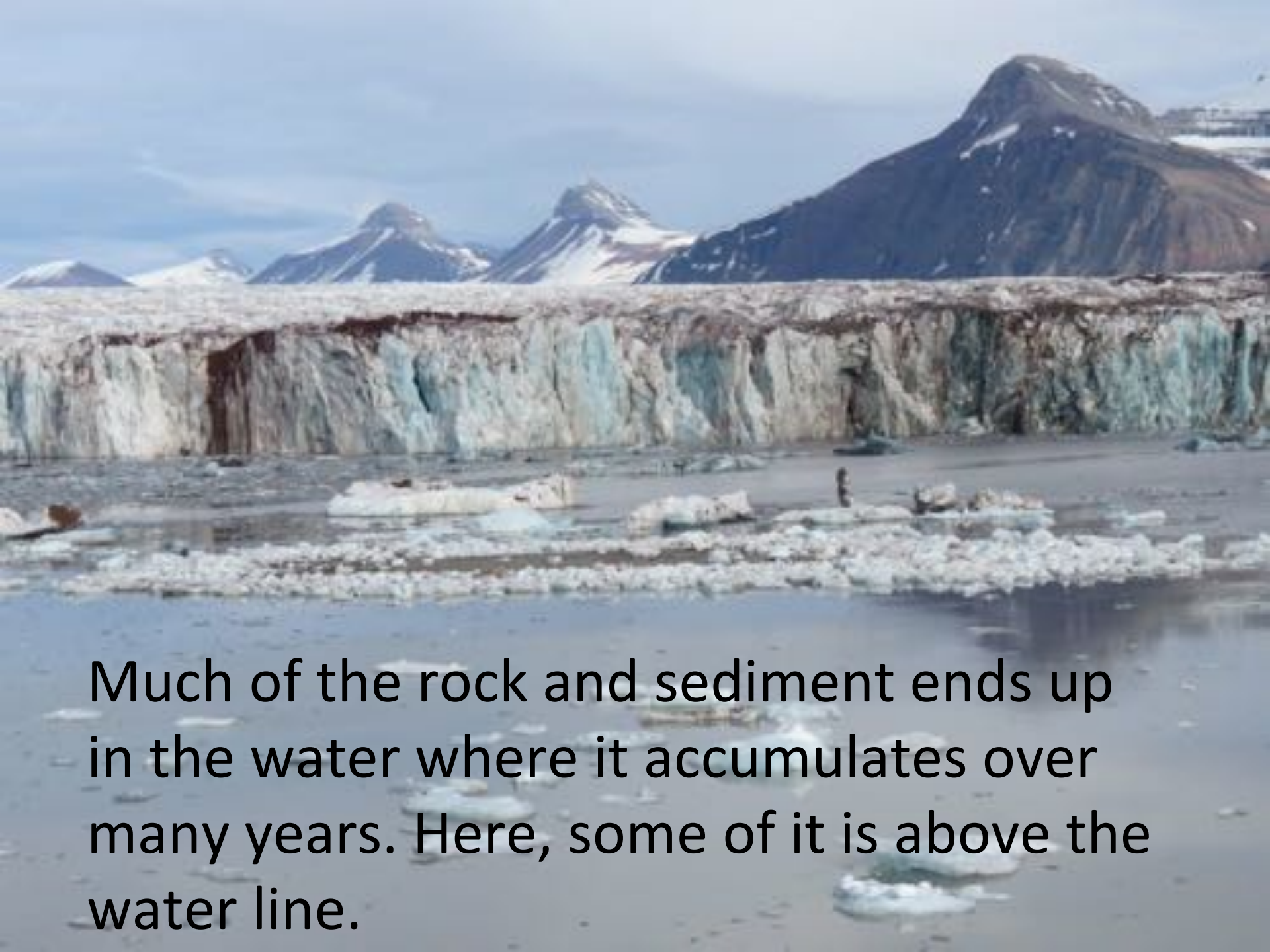




Tidewater glaciers are rivers of ice. They are like giant bulldozers, scraping rock and sediment from the Earth.

The glaciers carves out large valleys and shape mountain peaks.

Where does all that rock and sediment go?



Much of the rock and sediment ends up in the water where it accumulates over many years. Here, some of it is above the water line.

Glaciers, like wind and water, constantly sculpt the Earth's surface into new forms, bringing land down to sea level. The formation of volcanoes and movements in the Earth's crust work opposite of this tendency by thrusting the Earth up.

We can learn more about this process by going out into the water.

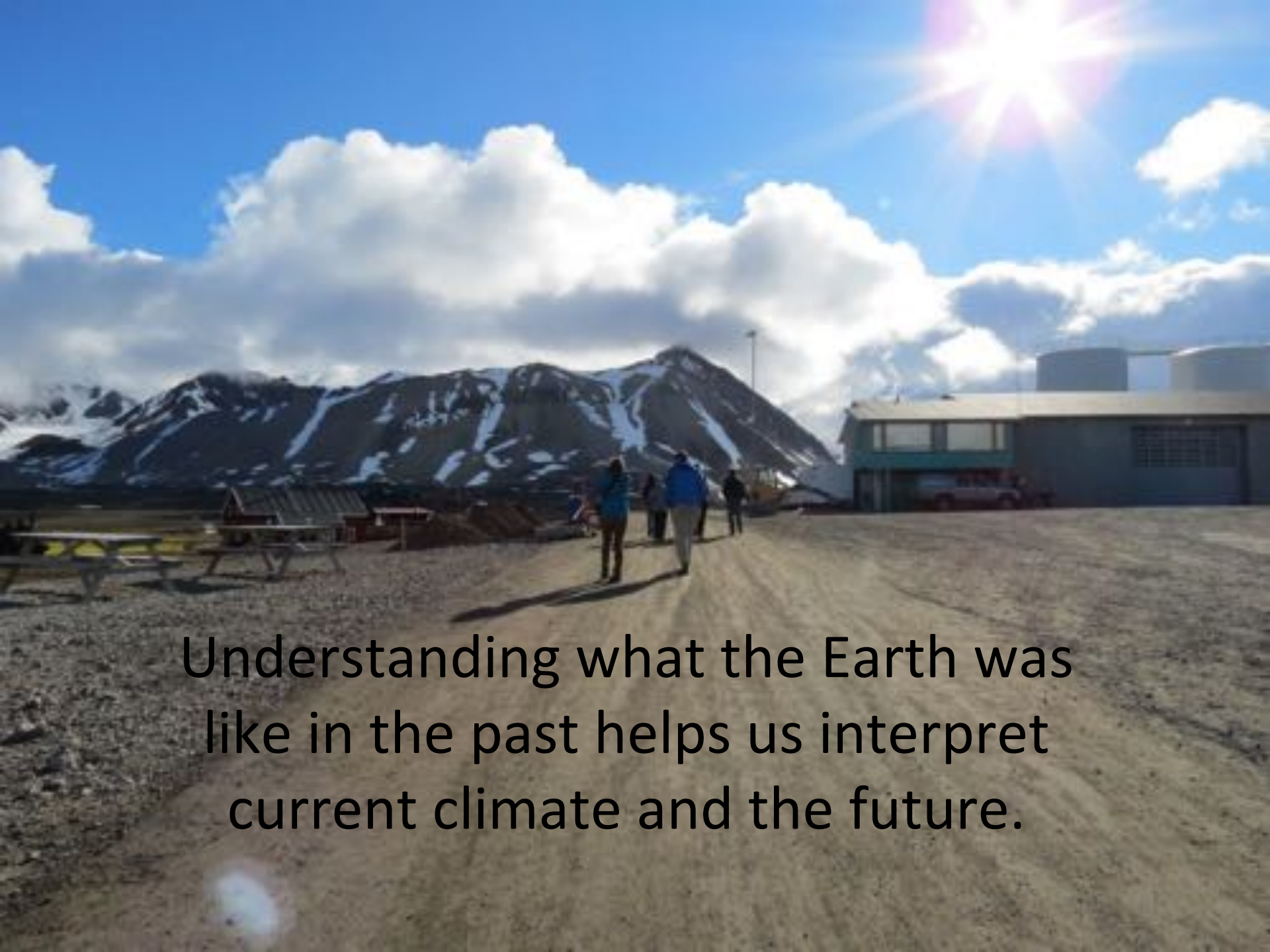
And bringing up some of the mud (sediment).

Here is a sediment sample that was deposited by a glacier. Look carefully. What do you see? What do you think this tells us?

By analyzing sediment samples we can learn:

- How long ago the sediment was deposited
- What kind of rocks and minerals eroded
- How fast the glacier was flowing
- What kinds of plants and animals existed
- If the glacier changed its course
- What the climate was like in the past
- How the land has changed


Why do we want to know this?



Understanding what the Earth was like in the past helps us interpret current climate and the future.

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Name_____
Date_____Period_____

Playing With Mud: Sediment Deposition by Tidewater Glaciers

Examine the sediment core sample provided. The sediment was deposited by a glacier. An area labeled "1 year" displays the sediment that was deposited within a year. The "W" stands for winter and the "S" stands for the summer season of that year. The most recently deposited sediments are at the top and the oldest sediment is at the bottom.

1. About how many years are represented by this sediment sample?_____

2. In the space below describe what you observe about the section of sample labeled "1 year". Include things like color, texture, size, how these characteristics vary and differences observed within the section.

3. Using the *enlarged* centimeter ruler on the left, measure the sediment layers representing each year. (Approximations are ok.) Record the thickness of the largest and smallest yearly layer. (Hint: Use a piece of scrap paper to copy the "centimeters" and then line this up with the layers. Do not use your own centimeter ruler- the picture is not to scale.)
Thickest layer = _____cm. Thinnest layer = _____cm.

4. What do you think caused the seasonal variations (summer and winter) described in #2? (Refer to handout.)

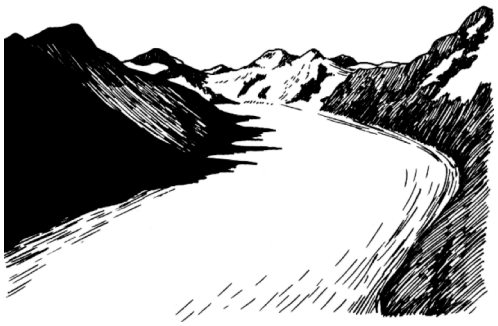
5. What do you think caused the annual variations (different years) described in #4? (Refer to handout.)

6. On the back, write a paragraph that describes a possible scenario for this glacial environment. Include:

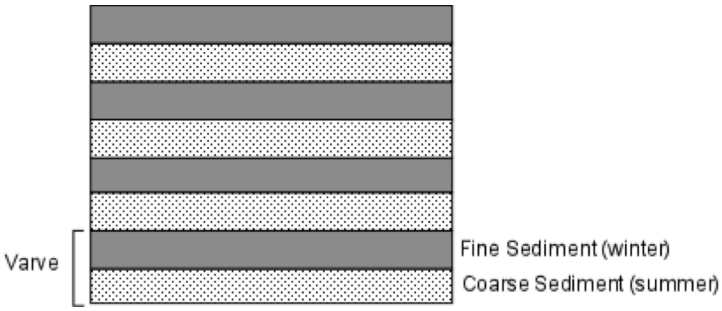
- Introduce the glacier: behavior, what does it do?
- How many years are you describing?
- What is your evidence (what are you using to make this description)?
- Describe seasonal variations and why you think they occurred.
- Describe annual variations and why you think they occurred.
- Describe any overall trends and relate to possible changes in temperature or environment.
- Conclude with a statement that explains why we are interested in studying glacial sediment/mud from glaciers.

Sediment Deposition by Tidewater Glaciers

A tidewater glacier is a type of glacier that begins on land and flows all of the way down to a fjord, bay or ocean. At their end, tidewater glaciers break off and form icebergs in a process called calving.

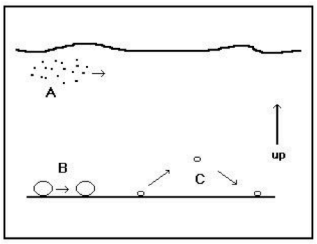


As a glacier flows, it scrapes, grinds and pushes sediment ahead of it and under it then deposits it in the water. Examination of the layers of deposited sediment gives clues about the behavior of the glacier and its environment.



A sediment core sample is like a timeline. The oldest sediment is at the bottom and the most recently deposited sediment is at the top. A sediment layer representing one year is called a varve and is identified as one dark colored and one light colored layer together.

Summer is a time of heavy melting of snow on and around the glacier. The surface of the glacier also melts and contributes high volumes of water that are thick with sediment. This disturbs the base of the water column with coarse sediment moving along the floor and fine particles rising up in a layer of fresh water over the salt water. Thin layers, known as laminations are evidence of varying rates and types of sediment deposition resulting from these currents.



During the winter, surface melting of the glacier and surrounding land stops and the water may freeze over. As a result, sediment deposition is greatly diminished. The only running water may come from underneath the glacier. This allows very fine sediment particles, known as clay to settle out and form a thinner, darker layer that does not exhibit laminations due to a lack of energetic currents.

Vigorous currents can move heavier sediment loads. Therefore the finest sediment is deposited in calmer water. The most vigorous currents coincide with abundant melt and precipitation, which often happens in the spring or with heavy precipitation events. The degree to which this occurs varies in different years.

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