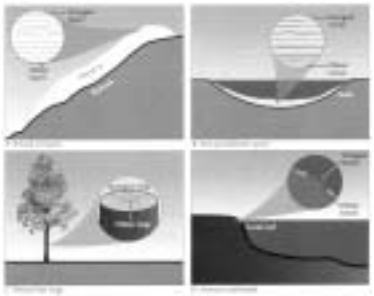
Discussion 4: How Do We Know Climate In The Past?

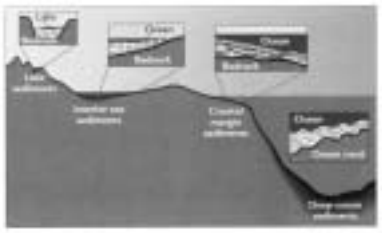
Climate Archives



(from *Earth's Climate: Past and Future*)

- Much of climate history is recorded in four climate archives:
  (1) Sediments
  (2) Ice
  (3) Corals
  (4) Trees
- How are those records dated?
- Hoe much of Earth's history each archive spans?
- What is the resolution of climate history yielded by each?

Sediments

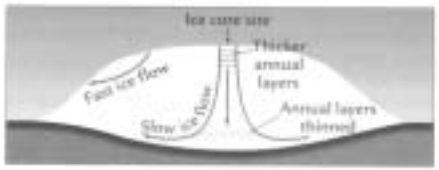


(from *Earth's Climate: Past and Future*)

- Sediments are the major climate archive on Earth for over 99% of geological time (and on all time scales), primarily as continuous sequences deposited by water.
- Rainfall and the runoff it produces erode rocks exposed on the continents and transport the eroded sediments in streams and rivers.
- The sediments are deposited in quieter waters where layer upon layer of sediments can be laid down in undisturbed succession.
- For intervals before the last 170 million years, all surviving sedimentary records come from continents.

Glacial Ice

(from *Earth's Climate: Past and Future*)



- Ice cores retrieve climate records extending back thousands of years in small mountain glaciers to as much as hundreds of thousands of years in continental sized ice sheets.
- The antarctic ice sheet has layers that extend back over 400,000 years.
- The Greenland ice sheet has layers that extended back 100,000 years.

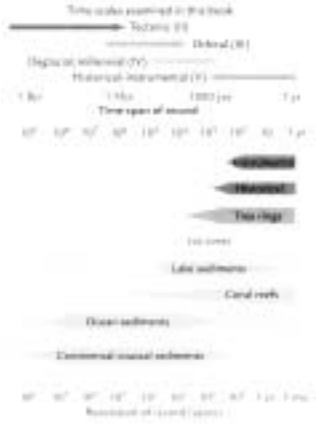
Trees

- Trees are climate archives for the interval of the last few tens and hundreds of years.
- The outer softwood layers of many kinds of trees are deposited in millimeter-thick layers that turn into hardwood.
- These annual layers are best developed in middle and high latitudes, where seasonal climate changes are larger.

Corals

- Corals form annual bands of CaCO3 that hold several kinds of geochemical information about climate.
- Individual corals may live for time spans of years to tens or hundreds of years.
- Coral archives are located at tropical and subtropical latitudes.

Resolution of Climate Records



(from *Earth's Climate: Past and Future*)