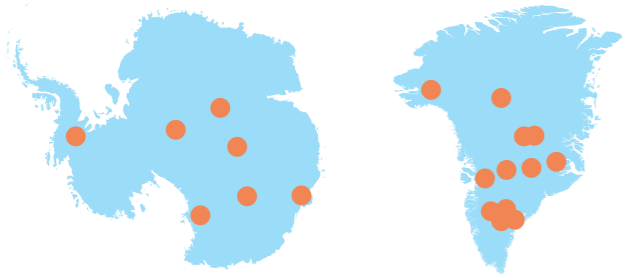


# ICE CORES & ATMOSPHERIC HISTORY

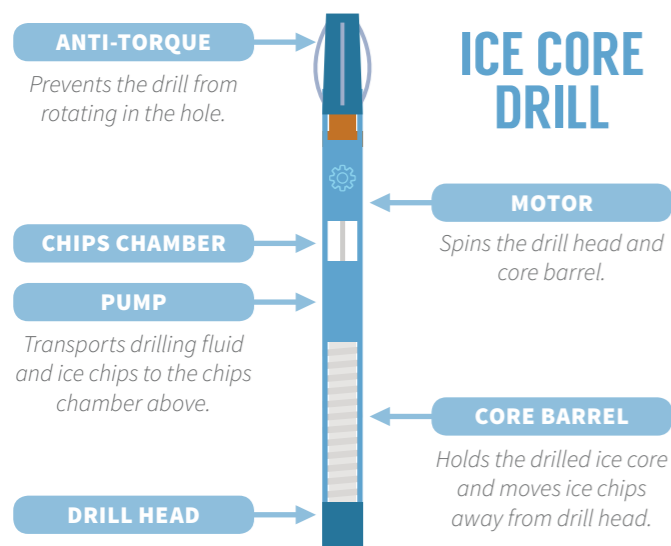
Ice cores from Antarctica and Greenland can tell us a lot about the past of our planet's atmosphere and climate. Here's a look at how!

## DRILLING ICE CORES



Ice core drilling stations in Antarctica (L) and Greenland (R)

Most ice cores are drilled in Antarctica and Greenland. The oldest continuous ice core record extends to 130,000 years in Greenland and 800,000 years in Antarctica. The deepest are over 3 km (2 miles) in depth.



Cores are drilled and brought to the surface, typically in 4 metre sections. The ice cuttings are collected to keep the borehole clear, and an ester-based drilling fluid is pumped into the hole to stop ice pressure collapsing it.

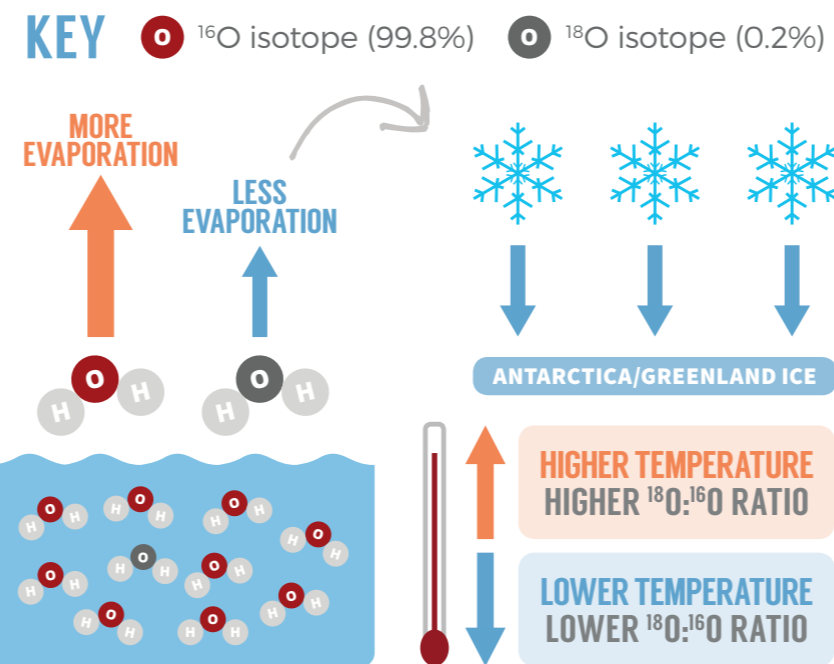
## DATING, TEMPERATURE, & ISOTOPES

Cores can be dated visually by counting layers, or by using electrical conductivity measurements. Variations in snowfall density give lighter layers for summer snowfall and darker layers in winter. Variations in summer and winter snowfall acidity affect the electrical conductivity of the ice.

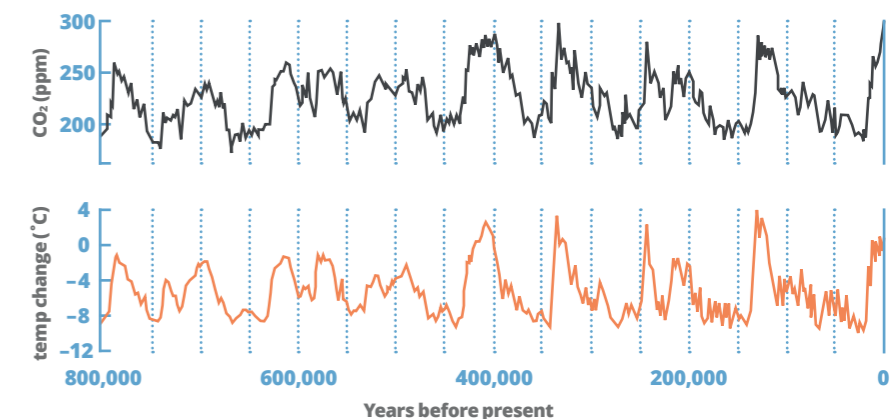


● Summer layers ● Winter layers

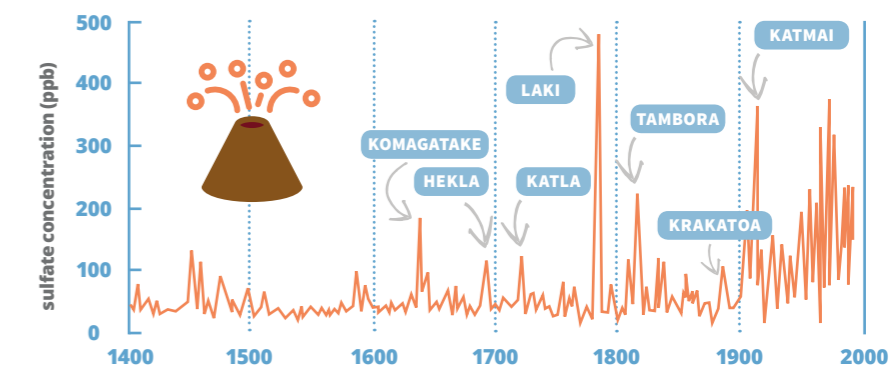
Isotopes can also be used to date ice cores, and gauge the temperature at the time the snow fell. Water molecules containing heavier isotopes don't evaporate as easily as water molecules with lighter isotopes. Therefore the ratio of isotopes in ice core layers links to temperature at the time – higher temperatures are indicated by more heavy isotopes.



## CO<sub>2</sub> AND POLLUTANTS



CO<sub>2</sub> concentration in the atmosphere can be obtained from gas chromatography of ice core samples. Ice core records from the past 800,000 years show pre-industrial levels of CO<sub>2</sub> did not reach higher than 300 parts per million. This year, we reached 412 parts per million. Records of CO<sub>2</sub> concentration correlate with ice core temperature records.



Yearly levels of other substances in the atmosphere can also be determined from ice cores. Sulfate ion peaks in ice core layers result from volcanic eruptions; they also increased due to the burning of fossil fuels, but slightly decreased in recent years due to clean air legislation. Atmospheric lead levels due to industry and leaded petrol can also be tracked.