# Ice Core Data

NOVA Activity **Mountain of Ice**

### Chemicals in the Ice

**Sulfate ($SO_4^{2-}$)**

The sulfate ion has several sources in this Antarctic ice core. The most important of these are marine biological processes and volcanic activity.

• The sulfate ion produced by marine phytoplankton peaks in the spring. After the dark winter, the hours of daylight lengthen and the sea ice begins to melt and break up. This open ocean environment is ideal for marine phytoplankton growth. As the phytoplankton grow, they release sulfate-rich chemicals into the atmosphere, which in turn get transported by winds over the ice sheet.

• Another source of sulfate is volcanic eruptions. Volcanoes can spew millions of tons of sulfate into the atmosphere and concentrations can remain high for several years following a large volcanic eruption.

• The Tambora volcano in Sumbawa, Indonesia, erupted in 1815; acid from that event is believed to have settled in Antarctic ice about 1816–1817. Another unknown volcano erupted in late 1808 or early 1809.

### Sodium ($Na^+$) and Chloride ($Cl^-$)

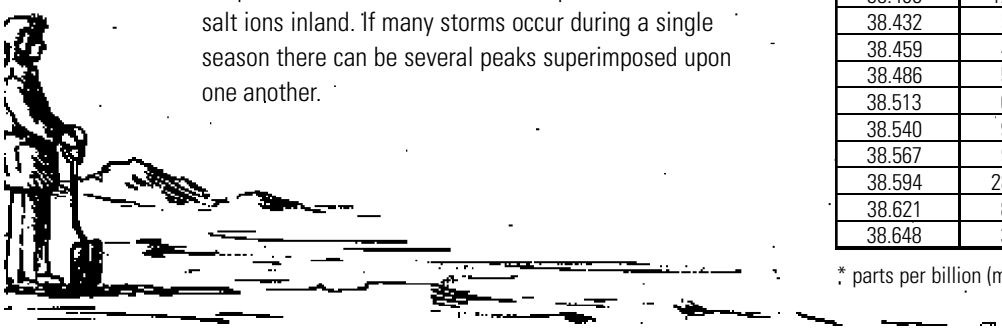
In this Antarctic ice core:

• Most of the sodium and chloride ion concentrations come from the ocean in the form of sea salt (NaCl).

• Sodium also has a terrestrial dust source but this only contributes a minute percentage in this core.

• Chlorine can be given off by volcanic eruptions in the form of hydrochloric acid (HCl).

• Sodium and chloride ion concentrations usually peak in the winter-spring season; during the winter–spring months the Antarctic wind strength increases and whips the ocean into foam and transports more sea salt ions inland. If many storms occur during a single season there can be several peaks superimposed upon one another.



### Ice Core Data

U.S. ITASE–99–1
Latitude: 80.62 S Longitude: 122.63 W

| Depth from top, in meters | Sodium ($Na^+$), in ppb* | Chloride ($Cl^-$), in ppb | Sulfate ($SO_4^{2-}$), in ppb |
|---|---|---|---|
| 37.270 | 16.40 | 42.63 | 91.48 |
| 37.297 | 53.14 | 99.46 | 96.71 |
| 37.324 | 81.74 | 140.71 | 107.92 |
| 37.351 | 50.10 | 93.78 | 129.02 |
| 37.378 | 27.99 | 46.85 | 203.13 |
| 37.405 | 43.38 | 69.35 | 225.60 |
| 37.432 | 82.17 | 109.37 | 266.19 |
| 37.459 | 43.40 | 83.46 | 264.96 |
| 37.486 | 71.32 | 115.21 | 554.33 |
| 37.513 | 54.79 | 180.34 | 479.90 |
| 37.540 | 209.26 | 294.90 | 768.02 |
| 37.567 | 241.75 | 328.83 | 679.31 |
| 37.594 | 68.56 | 160.46 | 243.69 |
| 37.621 | 53.20 | 98.16 | 280.67 |
| 37.648 | 51.00 | 93.63 | 308.64 |
| 37.675 | 37.96 | 60.38 | 314.44 |
| 37.702 | 32.42 | 46.35 | 295.36 |
| 37.729 | 10.64 | 20.25 | 219.09 |
| 37.756 | 16.08 | 34.28 | 164.09 |
| 37.783 | 57.75 | 85.50 | 162.82 |
| 37.810 | 52.45 | 85.74 | 79.41 |
| 37.837 | 30.88 | 51.17 | 68.91 |
| 37.864 | 32.45 | 53.67 | 61.68 |
| 37.891 | 12.64 | 32.39 | 57.15 |
| 37.918 | 44.91 | 82.84 | 67.82 |
| 37.945 | 97.03 | 152.79 | 87.95 |
| 37.972 | 83.86 | 136.20 | 34.01 |
| 38.000 | 22.83 | 37.84 | 97.92 |
| 38.027 | 22.96 | 36.86 | 95.10 |
| 38.054 | 43.24 | 63.62 | 51.29 |
| 38.081 | 54.78 | 83.29 | 38.04 |
| 38.108 | 44.26 | 75.44 | 31.44 |
| 38.135 | 5.55 | 13.52 | 17.32 |
| 38.162 | 5.06 | 12.37 | 24.90 |
| 38.189 | 14.81 | 26.11 | 41.81 |
| 38.216 | 42.10 | 64.93 | 46.09 |
| 38.243 | 40.71 | 66.41 | 36.44 |
| 38.270 | 53.17 | 90.35 | 59.36 |
| 38.297 | 16.64 | 46.90 | 62.55 |
| 38.324 | 39.48 | 72.02 | 82.38 |
| 38.351 | 48.87 | 93.15 | 69.49 |
| 38.378 | 45.34 | 82.35 | 62.39 |
| 38.405 | 122.19 | 173.73 | 101.22 |
| 38.432 | 52.43 | 90.37 | 74.20 |
| 38.459 | 44.61 | 69.06 | 101.28 |
| 38.486 | 54.40 | 84.59 | 205.43 |
| 38.513 | 69.42 | 114.81 | 273.03 |
| 38.540 | 98.30 | 142.69 | 296.44 |
| 38.567 | 98.73 | 159.80 | 218.24 |
| 38.594 | 283.47 | 439.44 | 225.51 |
| 38.621 | 83.32 | 166.07 | 90.38 |
| 38.648 | 33.31 | 72.26 | 101.46 |

* parts per billion (micrograms per liter)