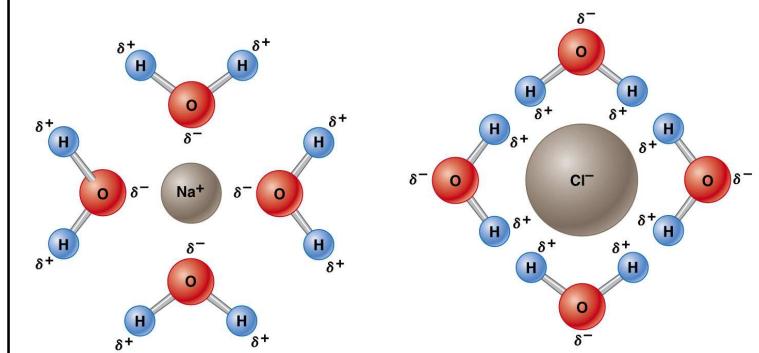


Ocean principles



(a) Hydration of sodium ion

(b) Hydration of chloride ion

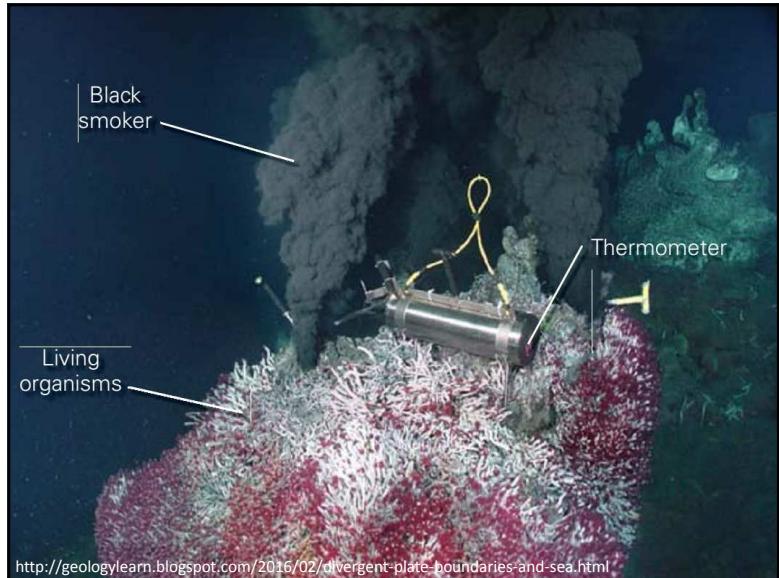
Seawater

- Most ions in seawater are produced by;
 - chemical weathering of rocks on land (mostly **cations**; Na^+ , K^+ , Mg^{2+})
 - from Earth's interior released through hydrothermal vents or volcanoes (mostly **anions**; HS^- , Cl^-).

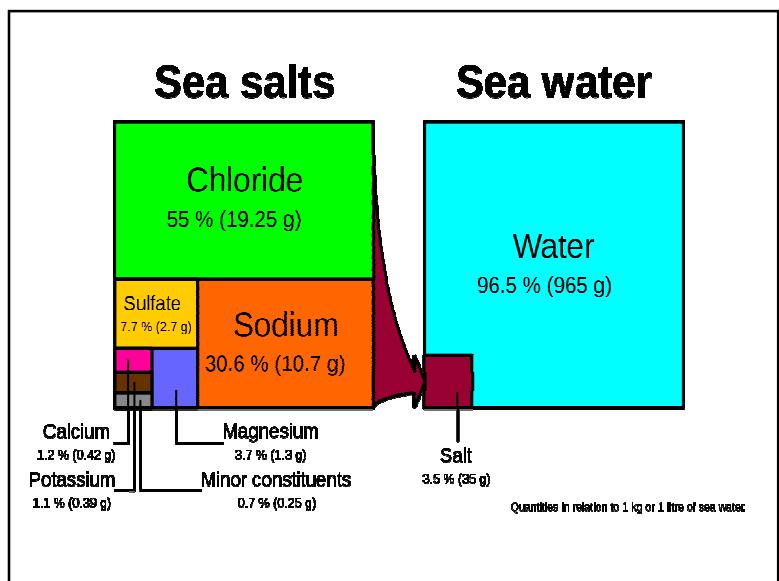


Hot smokers?





Ion	Concentration (PSU)	% of total salinity
Chloride (Cl^-)	19.345	55.03
Sodium (Na^+)	10.752	30.59
Sulfate (SO_4^{2-})	2.701	7.68
Magnesium (Mg^{2+})	1.295	3.68
Calcium (Ca^{2+})	0.416	1.18
Potassium (K^+)	0.390	1.11
Bicarbonate (HCO_3^-)	0.145	0.41
Bromide (Br^-)	0.066	0.19
Borate (H_2BO_3^-)	0.027	0.08
Strontium (Sr^{2+})	0.013	0.04
Fluoride (F^-)	0.001	0.003
Other solutes	<0.001	<0.001

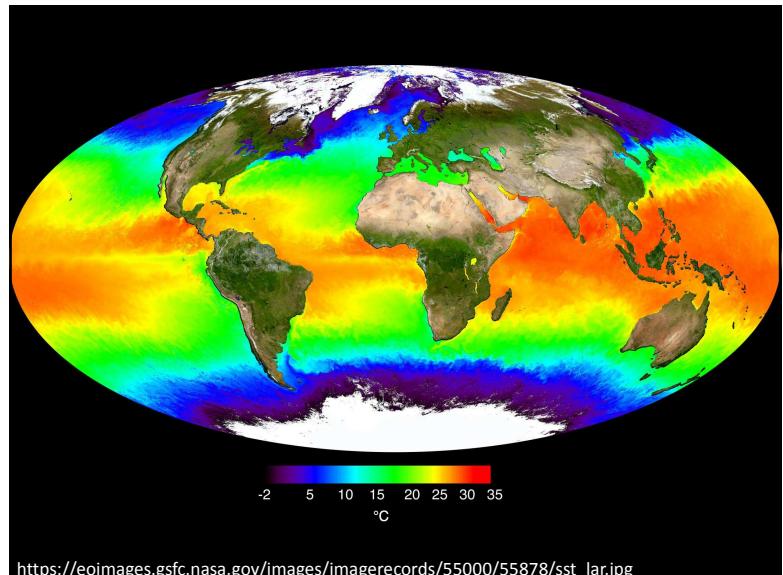
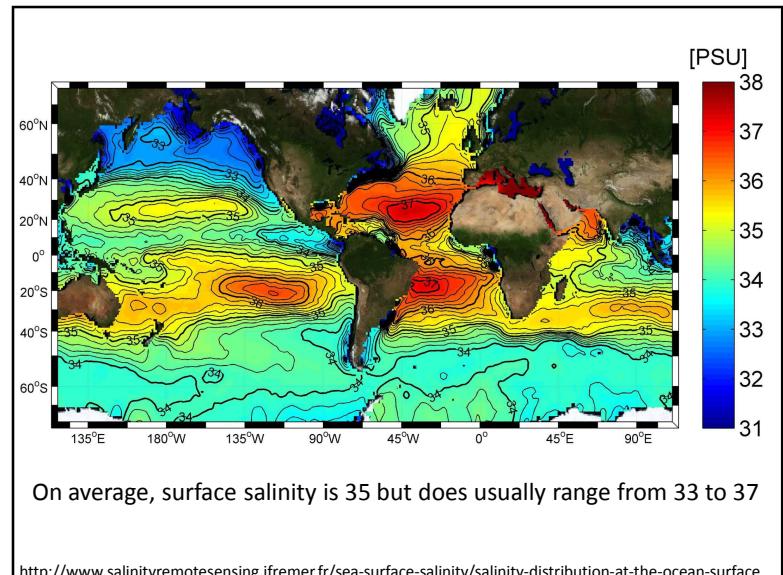


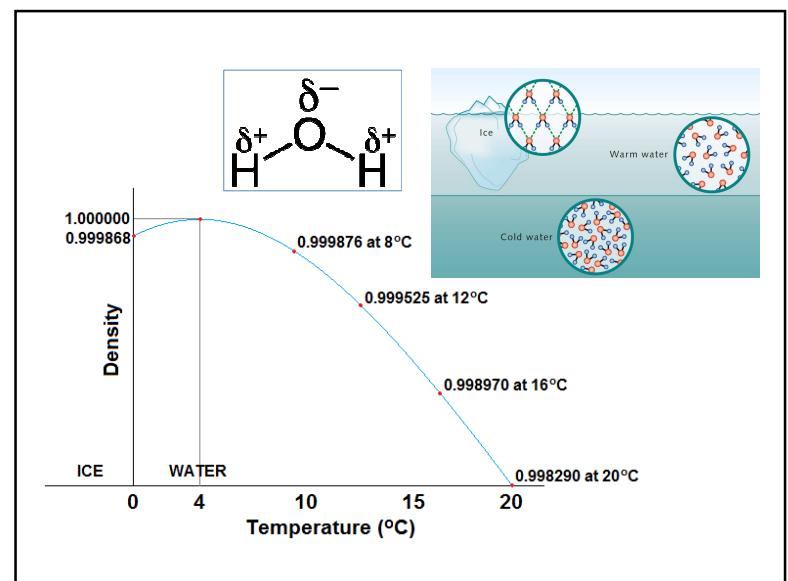
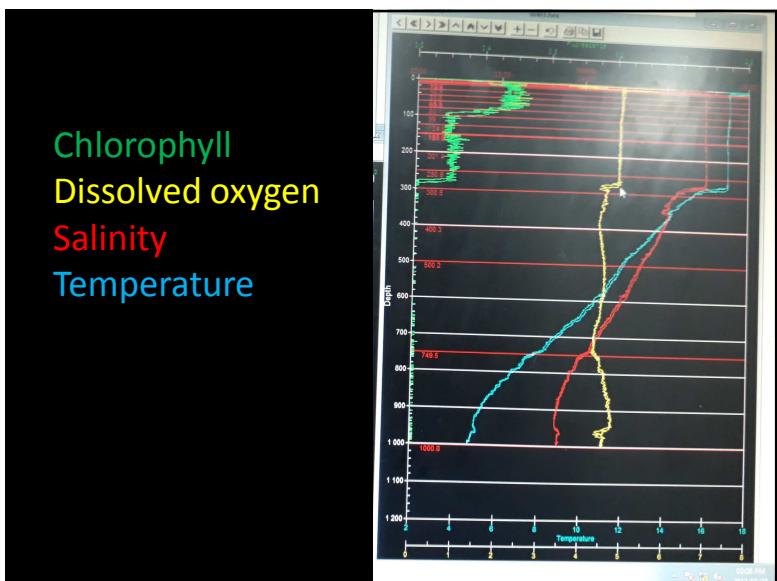
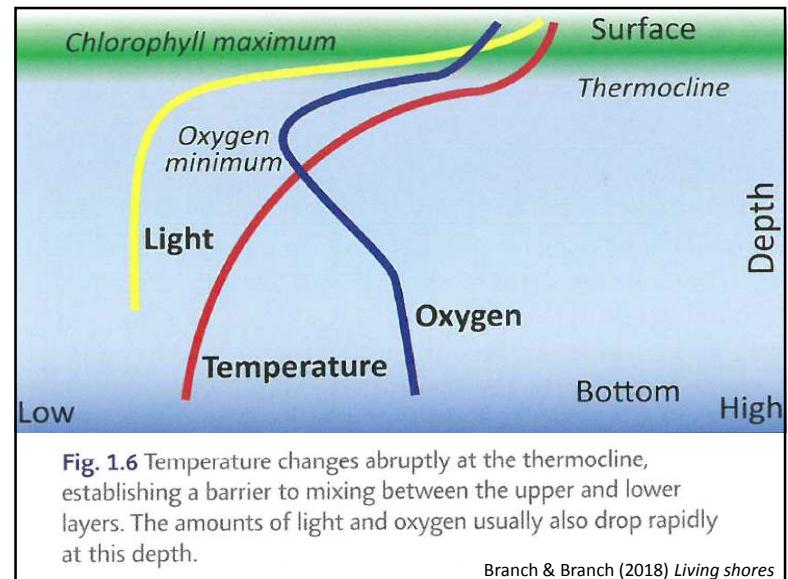
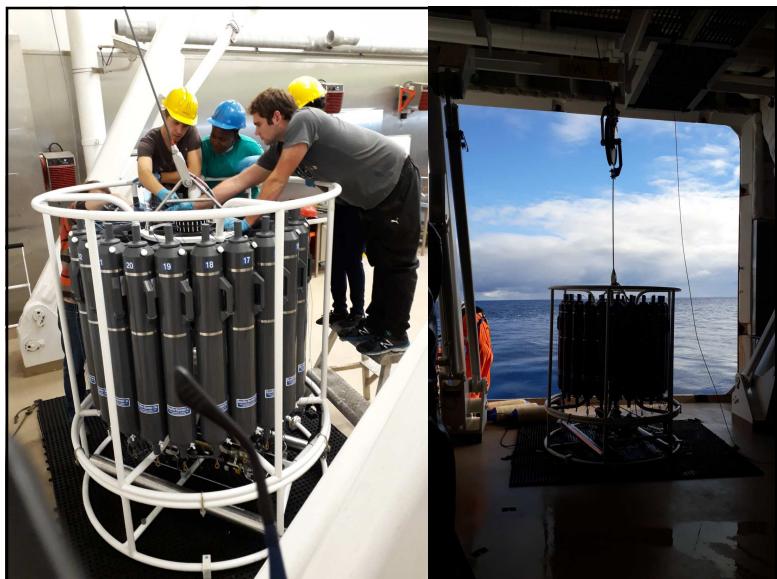
Sea water

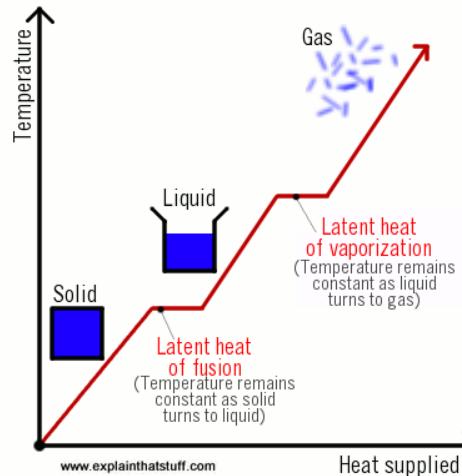
Salt cycle

- Salts added to/removed from seawater in five ways;
 - Rock erosion
 - Undersea volcanoes
 - Mid-ocean ridges; underwater hot springs
 - Subduction of ocean crusts
 - Uptake by plants and animals









Dissolved gases

- Three most biologically important gases are oxygen (O_2), carbon dioxide (CO_2) and nitrogen (N_2).
- All are found in atmosphere and can dissolve in seawater; reverse is possible so we refer to **gas exchange**.
- Gases dissolve better in cold water (higher saturation coefficient).

- O_2 isn't very soluble: surface seawater typically contains 0.4-0.6% dissolved oxygen (the atmosphere 21%).
- CO_2 reacts chemically when dissolved making it much more soluble. CO_2 makes up >80% of dissolved gas in ocean (0.04% in atmosphere).
- Oceans store >50x as much total CO_2 as atmosphere; critical when considering climate change.

Transparency

- Transparency of seawater is essential for sunlight to penetrate into the ocean.
- Primary producers require light to grow and transfer energy to higher trophic levels.
- Sunlight contains all colours of the rainbow but these don't all penetrate seawater as well.
- Red is filtered out earliest and blue penetrates deepest.

