Oceanography Chapter 7: Seawater Chemistry

Water is a great erosive tool.
It can dissolve more substances than almost any other liquid.
Why? It's Polar.

Solution- made up of a
1. Solvent – liquid, more abundant
2. Solute – dissolved solid or gas, less abundant

Solutions have uniform properties throughout.
Mixture- different substances are closely intermingled, but retain separate properties (Noodle Soup)

Dissolving Power – like Halite (or Salt) NaC1 – ionic bond
Gypsum ($CaSO_4$)

Mixture- oil & water
⇓
Non polar

Things like oil can diffuse (Diffusion) – movement through water
- Diffusion occurs from areas of high concentration to low
- Sharks & farts

Saturation – rule of dissolving = rate of precipitation of the solute.

Seawater – 5000 trillion kg of Salts
45 m thick (150 feet)

Seawater
96.5 % H20
3.5% Dissolved Stuff – Salinity

Most abundant – Sodium (Na+) and Chloride (Cl-)
Others: SO_4 =, Mg ++, Ca ++, K+, Bicarbonate ($HC0_3$-) - 99%

Trace Elements – less than 1 ppm

<u>Water's Colligative Properties</u>
1. Heat capacity of sw decreases with increasing salinity
2. Dissolved salts disrupt the web work of hydrogen bonds in water. Sort of acts as an antifreeze.
3. Because dissolved salts attract water molecules, seawater evaporates more slowly than freshwater (swimmers)
4. Osmotic pressure, the pressure exerted on a biological membrane when the salinity of the environment is different from that within the cells, rises with increasing salinity.

Source of Ocean Salts
1. Weathering & Erosion of crystalline rocks.
2. Excess Volatiles – CO_2, Cl^-, S, H, F, N, H_20)
   (below surface)

Forchhammer's Principle – The Principle of Constant Properties – the ratio of major salts is constant in seawater –from any location.

Determining Salinity
- Chloride is always 55.04%
- Chlorinity – all halogens
  - Salinity ‰ = 1.0865 x Chlorinity in ‰

Salinometer – measures electrical conductivity of seawater.

Chemical EQ
Most lakes appear to get saltier - ocean does not

Steady State ⇒ Input = Output
⇓ ⇓
from above Lithification of Sediments

Residence Time = $\frac{\text{Amount of Element}}{\text{Rate of Removal}}$ (Table 7.3)

Mixing Time = 1600 yrs (match's the constant proportion idea)

Conservative Constituents – occur in constant proportion and change very little.
- Long residence time
- Most abundant

Non conservative – tied to biological cycles or seasonal or to short geological cycles
- Dissolved 0_2, $C0_2$, Silent $CaC0_3$, Nitrates, Phosphates, Aluminum

Dissolved Gases
1. Nitrogen – 48% - concentrated & utilized in the photic zone
2. Oxygen – 36% from photosynthesis, anything with gills uses it.
3. CO_2-15%- make $CaC0_3$ – then moves slowly from 0_2 to atmosphere.

Figure 7.5: Processes that regulate the major constituents of seawater

Figure 7.8: Concentrations vary with depth

Figure 7.10: Carbon Dioxide

Figure 7.11: Abundance of Carbonic Acid

Figure 7.12: Variations in pH with depth