Acid Mine Drainage: Acid mine drainages are negative by-products of metal or coal mining. They **form** when previously covered, **sub-surface minerals are exposed to air and water** (normally as a result of human activity). Weathering reactions with these minerals **cause the release of metals and acidic compounds** into the environment. The **pH** of acid mine drainages can be as low as **-3.6** and they can have temperatures of over **100°F**. Often, these acid mine areas have **very high concentration of metals** such as iron or copper.

For reference:

pH < 7 is acidic

The pH of soft drinks range from 2.5-3.5 and the pH of orange juice is about 4.2

High concentration of metals such as iron, copper and nickel are toxic to most organisms

Yellowstone Hot Springs: There are 3 main types of hot springs in Yellowstone. Some general characteristics of two of them are listed in the table below.

	Volcanic: alkaline	**Volcanic: acid**
Source Water temp (°C)	93	87
pH	9.6	2.4
Sulfide (as in hydrogen sulfide or sulfuric acid)	1	35
Carbonate	70	0

For reference:

pH < 7 is acidic

The pH of soft drinks range from 2.5-3.5 and the pH of orange juice is about 4.2

pH > 7 is basic

The pH of bleach is 12.6 and ammonia is 11.5

water boiling point: 100°C

hydrogen sulfide is toxic to many organisms

Tums and other antacids (to settle your stomach) are high in carbonate

Hydrothermal Vents: **Seafloor hot springs** located at mid-ocean ridges and hot spots where seawater has circulated through the oceanic crust and **exits the seafloor at temperatures up to 750°F**. The fluids coming out of the vents are **very mineral-rich** but are toxic **to *most* life**. These vents, however, support one of the few ecosystems on Earth whose primary producers are **chemosynthetic** (derive energy from chemicals and chemical reactions rather than sunlight) rather photosynthetic.

Dead Sea: This **hypersaline** (meaning really salty) lake is the deepest hypersaline lake in the world (1,083 ft). The salinity of the Dead Sea ranges from 26-35% salt while ocean salinities generally range from 3.2-3.7% salt, meaning that **salt concentrations in the Dead Sea** are nearly **10x that of the surface ocean**.

Mono Lake: Mono Lake is a **hypersaline lake**, meaning it is really salty. **Salt concentrations are about 50 grams per liter**. Most **ocean water** has only about **30-35 grams of salt per liter**.

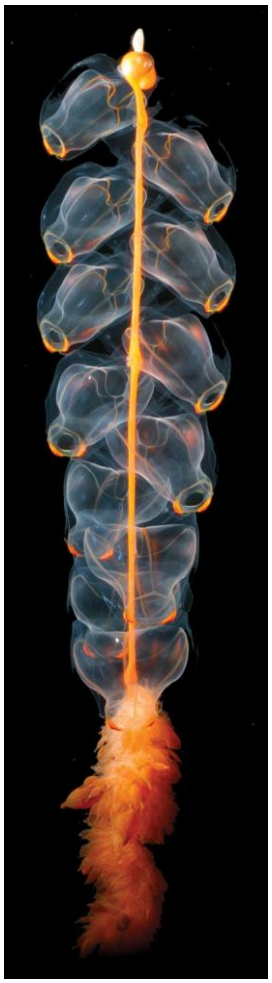
In case you were curious:
The pillars in this picture are called tufa and are made of limestone. Tufa form at the bottom of the lake as a result of chemical reactions between lake water and water coming out of springs at the lake floor. Limestone precipitates (comes out of solution) from this reaction, forming these structures. Tufa grow slowly over time and eventually pop out of the lake surface, as pictured here.

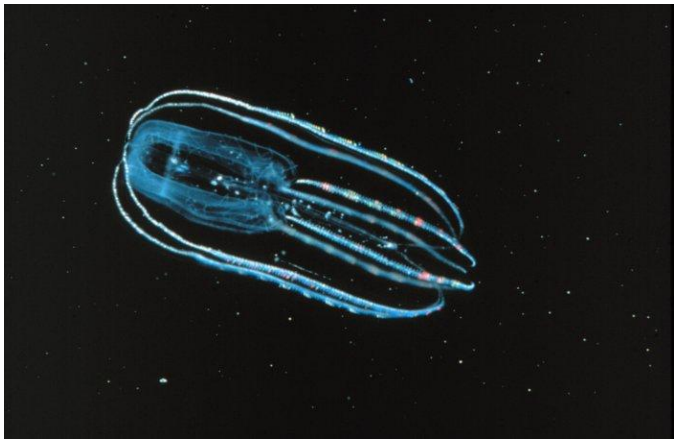
Polar regions (Arctic and Antarctic):

	Antarctica	**Arctic Ocean**
Average summer temperature	20°F*	29°F
Average winter temperature	-30°F	-29°F

*Temperatures vary widely in Antarctica because it is a continent. Even in the summer, the interior of Antarctica has temperatures < 0°F. The average for the interior is -50°F. On the coast, temperatures are much warmer (but still pretty cold!).

Both the **Arctic and the Antarctic** (on the ocean…not on the continent) **have sea ice**. Salt is concentrated into little pockets of liquid water in sea ice called brine pockets. **Concentration of salt** in these **pockets** can get up to **6 times the concentration of sea water**.





Left: Siphonophore. Upper right: Dumbo octopus. Lower right: Ctenophore.

Deep sea: Every **33 feet** you go down in the ocean there is **an increase in pressure by 1 atmosphere** (**atm**; an atmosphere is a unit of measure for pressure – equivalent to 14.7 pounds per square inch). So, at a depth of 3300 ft in the ocean the pressure is roughly 100 atm. Here at sea level, we experience an air pressure of 1 atm. Imagine living at 100 times the pressure you normally experience. **More than half of the world's ocean is deeper that 9800 ft (pressure: 297 atm)**. Some organisms travel to great depths from the surface in short periods of time. For instance, Sperm whales make hour-long dives down to 7,380 feet. This means that this whale experiences a change in pressure from 1 atm to 223 atm in the course of 1 hour!!