Comparing and contrasting by graphs and tables

Properties of Ocean Water - AW Section 2

Salinity

The words *saline [seilain] - salty* and *salinity [sə'liniti] - saltiness are* from Latin *sal*
Salinity is a measure of the amount of total dissolved materials in water defined as grams per kilogram of water – parts per thousand. *Do you happen to know the salinity of average ocean water? –*
As shown in Table 8-2 on p.386, six elements make up over 99% of the salinity of ocean water. *Write their names*:
In which form are they found in water? -
Compare the percentage of dissolved materials and note that two of them are by far the most abundant and they make up common table salt – what are they?

Compare environmental changes that affect the salinity of the Mediterranean Sea and the Black Sea – AW page 387. Prepare a table.

	The Mediterranean Sea	*The Black Sea*
River inflow		
Evaporation		
Mixing		
Salinity		
Parts per thousand		

In the major oceans, three fourths of the water is below one kilometer depth, where the salinity is nearly constant at 34.5 to 34.9 parts per thousand. Along the center of the mid-ocean ridges, however, isolated spots have hot springs which often contain concentrated amounts of dissolved solids. When deep water circulation is restricted, these hot waters can form **brine pools** (=solanky se silně mineralizovanou vodou). The bottom of the Red Sea has brine pools with salinities as high as 257 parts per thousand.

Temperature

Temperature is one of the most frequently measured properties of ocean water. The surface of the open ocean ranges from very cold in the polar regions to room temperature in tropical areas. This difference is caused by the variation in solar radiation at different latitudes. (Fig. 8-14 on page 389)
Fig. 8-15 on p.390 shows the distribution of water temperature with **depth** from north to south through the Pacific Ocean. As you can see, the most rapid temperature changes take place within one km of the surface in the equatorial and temperate regions. (Be careful of the similarity between the words **temperature** and **temperate!)** Water layer in which temperature changes rapidly in the vertical direction is referred to as **thermocline.** Also note that deep ocean water at the equator is about the same temperature as the surface water near the poles.

Density

The density of ocean water depends on the temperature and the salinity. As the salinity of ocean water increases, the density also increases, but if the temperature increases, the density drops – water is less dense. The density of river water will therefore be less than the density of ocean water.
Ocean water moves in large volumes of water called **water masses.** By determining temperature, salinity, and density, scientists are able to identify large water masses and to trace their movement from place to place.

Sea ice

One of the consequences of the temperature, salinity, and density relationship is the lack of sea ice in most of the world's oceans. Salinity affects the **freezing point** of water. The saltier the water is, the colder it must be before it freezes. How cold must average ocean water be in order to start freezing? Find the answer in the graph in Fig. 8-17 on p. 393.

Cooling of ocean water occurs at the surface because of cold winter winds. The spray from winter waves can coat the decks and rails of a ship with ice. And yet, the surface of the ocean has no ice. This is because of the relationship between temperature and density. As the surface water gets colder, it becomes denser than the water beneath it and sinks being replaced by less dense water, which is not as cold. This sinking can be stopped only by the bottom or by a denser water mass.
In the Arctic Ocean, the middle and lower levels have a high salinity water mass that forms a barrier to the downward mixing of the cold surface waters, that become cold enough to freeze and form **sea ice.** Because of the length of the cold season and the extreme cold, the sea ice eventually forms very thick masses called **pack ice** (=pole ker). See Fig. 8-18 on p.394.

The water in the open Atlantic, Pacific and Indian Oceans never gets cold enough from top to bottom to freeze, but sea ice might form around the margins where the bottom is shallow and horizontal mixing is restricted. It might also form in **bays** and **estuaries** that have salinity of less than 24.7 parts per thousand. Such bodies form ice fairly easily during winter months because such water does not become continuously denser as it is cooled. The water will reach a maximum density at some temperature above the freezing point. Then, as the water gets colder, it becomes less dense and floats on the surface, becoming colder and colder until it freezes.This is the same way that freshwater ponds and lakes freeze.
When you think of ice in the ocean, you might also think of icebergs. What are **icebergs?** Are they special type of sea ice? – NO!!! They are not frozen ocean water. Icebergs are masses of ice that broke off freshwater glaciers that form on the land.

Check yourself

1. *Where in the world's oceans does sea ice form?*
2. *How do icebergs differ from sea ice?*
3. *How cold must average ocean water be in order to start freezing?*

Water absorbs light

Pictures taken underwater frequently look blue because blue color is absorbed less rapidly than the other colors of the spectrum. The ocean environment can be divided into three zones, depending on the amount of light that has penetrated to that zone.
Photic zone (from Greek phós = light) extends to a depth of 200m. The light is strong enough for the frowth of algae (one-celled plants) and basic food source for many animals.
Disphotic zone (dis = reduced, half) ranges between 200 and 1000 m
Only a very tiny, almost immeasurable amount of light - no more algae, only some organisms with extremely sensitive eyes, bioluminescent animals – e.g. the angler fish
Aphotic zone – the bulk of the ocean
Total darkness except for bioluminescence and underwater eruptions of lava. Some scavengers and "pockets" of life based on a food chain beginning with sulfur-eating bacteria (no photosynthesis involved).
Give the meanings of these expressions: algae [dži:]- angler fish [g]-
fireflies - bulk – scavanger [dž] -

Reading for specific information

Task A: *Read about* ***water pressure*** *on page 394 and answer the following questions:*

1. *What is the rate of pressure change with ocean depth?*
2. *What is the approximate atmospheric pressure (in bars) at sea level?*
3. *How are divers with air tanks able to breathe at depths of twenty meters?*
4. *What would happen to a swimmer if he extended his snorkel tube to 1 m?*
5. *Can other organisms live in any depth?*

Task B: *Read about* ***resources of ocean water*** *on page 398 and write the list* ***of*** *them:*

Discussion Topic

Pollution of the ocean – key words: wells, wastes, sewage, disasters / catastrophe