5. OCEAN CURRENTS

Let's recall.

- When does any material flow?
- What happens exactly when it flows?
- Which anomalies in the material is responsible for the initiation of the flow?

Try this.

Materials required: A large metal tray, water, plastic sequins, spirit lamp, etc.

Note: The following activity should be carried out by students under supervision of teachers. Focus on observation.

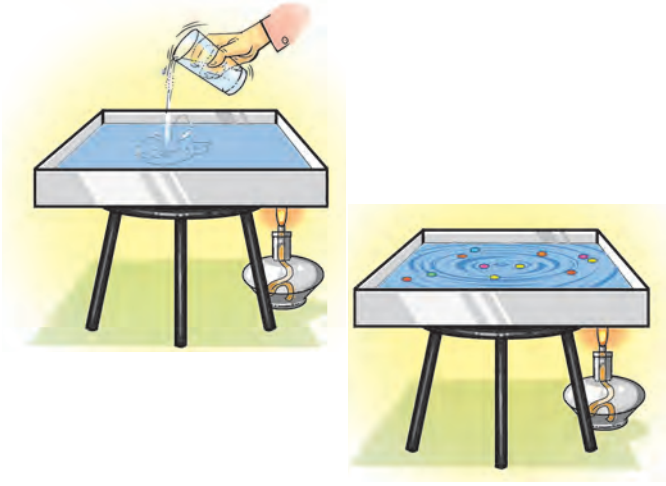

Figure 5.1

- ✓ Keep the large metal tray on a stand. Fill it with water. After the water becomes still, leave the sequins in them. After sometime, the sequins will start floating in the water and become still too.
- ✓ Observe all these things. After sometime, light the spirit lamp and place it below one corner of the tray. Observe what happens. See fig 5.1
- ✓ On the basis of observation, discuss in the class and put forth your opinions regarding the experiment. Consider the following questions for the same.
- What did you understand initially by observing the sequins?
- When the temperature of water started increasing, what changes did you see?
- Observe the movement of the sequins.
- What conclusion can be drawn from the same?
- Where can such processes take place on the earth's surface?
- What are those processes and why do they happen?

Note: In the experiment the heat is given by the spirit lamp. Please keep in mind that in reality, the source of heat for oceans is the sun.

Geographical explanation

It will occur to you that as the temperature of water increases, the plastic sequins move from one place to another. As the temperature rises, the density of water decreases and it becomes lighter. And, therefore, the water having lower temperature which is heavier replaces the water with higher temperatures. After sometime, the sequins start moving in a circular motion. There is movement of these sequins because of the flow of water.

Can you tell?

A very strange incident occurred in the Pacific Ocean in the year 1992. A cargo ship sailed towards America from Hong Kong. While travelling through the Pacific Ocean, near the Hawaii Islands, a container full of toys fell into the ocean and broke. Around 28000 rubber toys started floating on the ocean. This incident occurred on 10th January, 1992. Now a strange thing happened. After around 10 months, on 16th November, 1992, some of these toys reached the coast of Alaska. Some of them crossed the Bering Strait and moved upto the Arctic ocean by the year 2000. Some of

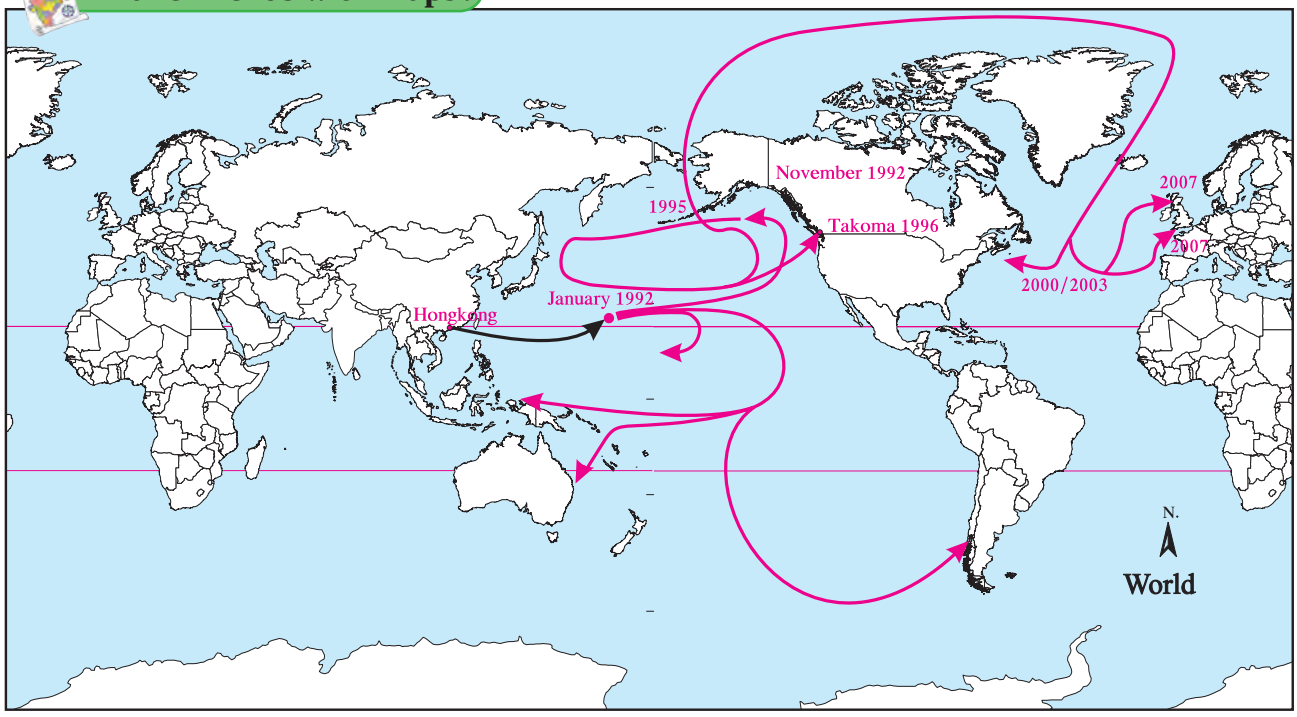

Figure 5.2 : Map showing the distribution of toys in the ocean

them also floated to Atlantic Ocean from the Arctic. Some of these reached the eastern coast of America in 2003 and some of the toys had even reached the European coast by 2007. From the Hawaii Islands, some toys took the route to Australia! See figure 5.2 and 5.3.

Why did the toys travel in this way?

Figure 5.3 : A toy duck

Geographical explanation

The ocean water can be divided into two parts based on depth-surface water and deep water.

(1) The upper layer extends upto 500 meters from the sea level.

(2) Below 500 m. depth.

The region from sea level to the depth of 500 m. is considered to be the surface water. Sunlight can reach till this depth. The movements in this layer occur mainly due to differences in temperature and salinity. The planetary winds give speed to the ocean currents.

Horizontal (Surface) Ocean Current :

The flow on the surface of the ocean moves only 10% of the oceanic water. The surface flow is considered up to 500 metres of depth. The discharge of water in the oceans is measured in Sverdrup unit. It is equivalent to 1 million cu.m./second discharge. The horizontal flow of ocean water occurs as warm and cold currents. These currents flow from the equator to the poles and from the poles to the equator. These currents are pushed to long distances by the planetary winds. As a result, the ocean waters flow from equator to both the poles and vice versa. You have studied the map given in figure 5.4 earlier. Study the map again and answer the following questions.

- What are the major types of ocean currents?
- What do you call the currents flowing from the equator to the poles?

Make friends with maps!

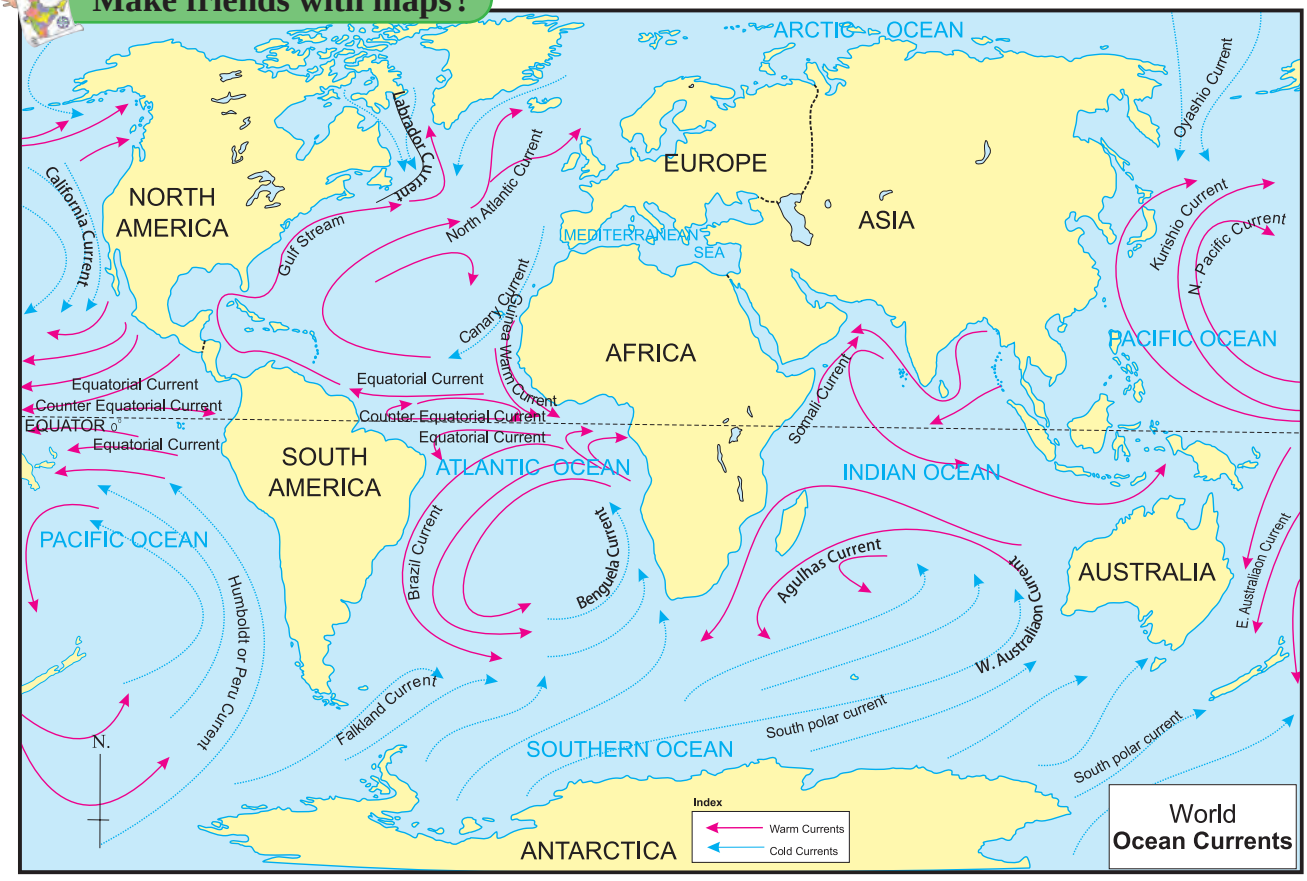

Figure 5.4 : Ocean Currents

- What do you call the currents flowing from the poles to the equator?
- When the currents are moving in a circular manner, what difference is visible in their direction in Northern and Southern Hemisphere respectively?
- What might happen at the places where these currents meet?
- When two different types of currents meet along the coast then what type of human settlements and occupations are seen.

Geographical explanation

We have studied that ocean currents are formed due to differences in temperature, density and planetary winds. In addition, the following reasons are also responsible for the direction of flow of ocean currents and their velocity.

Rotation of the Earth : Because of the rotation of the earth, the ocean currents move in

Do you know?

THE OCEAN CURRENTS OF THE INDIAN OCEAN :

There is similarity between the patterns of the ocean currents of the Pacific and Atlantic Ocean but the flow of the ocean currents of the Indian Ocean are different.

The Indian Ocean is land-locked in the north. The equator divides this ocean into two parts- northern and southern. The Monsoon winds influence this ocean tremendously. These winds change their direction according to the season. In the northern part of the Indian Ocean, currents flow in clockwise direction in summer while in winter they flow in the opposite direction due to reversal of Monsoon Winds.

clockwise direction in the Northern Hemisphere and in anti-clockwise direction in the Southern Hemisphere.

Continental structure : According to the alignment of the coastline, the direction of the ocean current changes. The velocity of the ocean currents is around 2 to 10 km per hour. The ocean currents are divided into two types- cold currents and warm currents.

Effects of Ocean Surface Currents on Human life :

Ocean currents especially affect the climate of the regions having proximity to the sea. In cold regions where warm ocean currents flow, climate becomes warmer. In some regions, the amount of precipitation increases. For example, the warm ocean currents flowing near Western Europe, Southern Alaska, and Japanese coast, reduce the intensity of the winters there and make them warmer. As a result, these ports do not freeze in winters.

Had ocean currents been absent, the ocean water would have remained still. In such waters, the biotic components would have been devoid of food. Consequently, marine life and its ecosystems would have been limited in its extent. In regions where cold and warm currents meet, plankton, vegetation, algae, etc. grow. This is food for the fish. Therefore, fish come here in large numbers and breed. This has, in turn, led to formation of large fishing grounds. Grand Bank near the North American coast in Atlantic Ocean and Dogger Bank near the European coast are some of the examples.

With respect to the water transport too, the ocean currents are very important. If the transportation is done according to the flow of ocean currents, the speed of the ships increase and the fuel is saved too.

Near the coasts where cold currents flow, the amount of precipitation is low. For example, in Peru, Chile and the arid desert of South-West Africa.

At places where the cold and the warm currents meet, thick fog is formed. Such fogs create problems for transportation. The warm Gulf Stream and the cold Labrador currents meet near the Newfoundland island. This leads to dense fog. Because of the cold currents, icebergs are carried away from the polar areas. If such icebergs come along the marine routes, they are hazardous to the ships.

Make friends with maps !

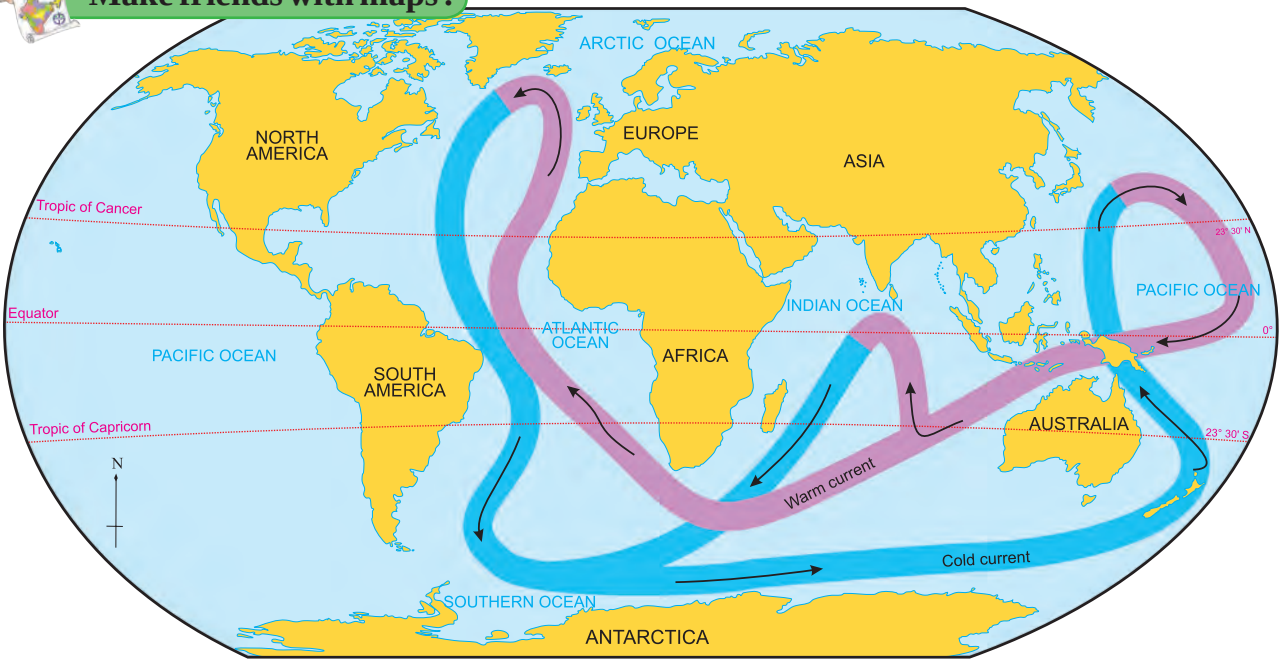

Figure 5.5 : Deep ocean currents

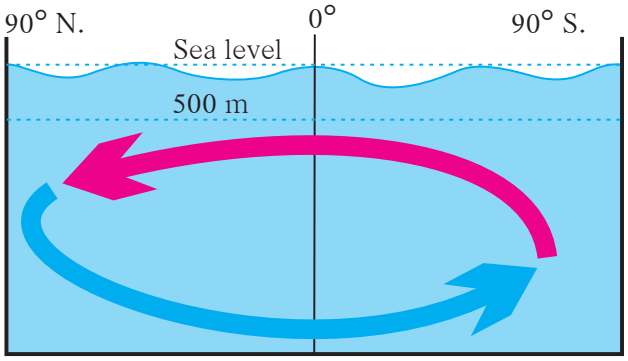

Figure 5.6 : Deep ocean currents

Deep Ocean Currents :

Water currents beyond the depth of 500 metres are known as deep water/ocean currents. These currents are formed due to the differences in temperature and density of the water in different parts of the ocean. This is known as thermohaline circulation. These currents flow till the sea-bed of the ocean. They flow like rivers continuously below the surface of the sea. See Figure 5.5.

The difference in temperatures of various parts of the ocean is the major reason behind the deep-sea currents. Warm water has lower salinity and density. Such water comes to the surface of the sea. Cold water with high density goes down. This movement causes the deep sea water currents. See figure 5.6. Generally, the surface water near Greenland and Europe moves to more depths. This water moves to the Antarctica at these depths. Later the water moves to the surface. Thus, the redistribution of the ocean water keeps occurring. This redistribution takes around 500 years to complete. This type of movement is also known as conveyor belt.

Importance of deep ocean currents :

Due to thermohaline circulation, movement of sea water occurs on a large scale. Because of this circulation, ocean water moves from the surface to the bottom and from the bottom to the surface. Warm water is transferred to the bottom from the surface and the nutrient-rich cold water is circulated to the surface.

Do you know ?

These circular pattern of the movements of the ocean currents, give rise to certain peculiar features in the ocean. They are called gyres. The Sargasso Sea in the Atlantic Ocean is such an example. It is marked by the circular patterns of ocean currents . It does not have land boundaries and is only surrounded by ocean currents. It gets its name from the Sargassum seaweed. The water is still here. This sea is 1100 km wide and 3200km long.

Always remember -

- The ocean currents do not flow very close to the coast. They flow near the lower limit of the continental shelf.
- Even though the velocity of the ocean currents is less, the water carried by them is immense.
- Under the influence of the Westerlies, in the mid-latitudes, the ocean currents flow from west to east, but near the equator they flow from east to west. This leads to a circular pattern. See figure 5.4.

Exercises

Q 1. Choose the correct option :

(a) In which ocean does the Labrador current flow?

(i) Pacific

(ii) South Atlantic

(iii) North Atlantic

(iv) Indian

(b) Which current out of the following flows in the Indian Ocean?

(i) East Australian Current
(ii) Peru current
(iii) South Polar current
(iv) Somali current

(c) Which factor out of the following does not affect the region along the coast?
(i) Precipitation
(ii) Temperature
(iii) Land breezes
(iv) Salinity

(d) Which of the following occurs in the area where the cold and warm currents meet?
(i) High temperature
(ii) Snow
(iii) Low temperature
(iv) Thick fog

(e) Which of these following currents flows from the northern polar region upto Antarctica?
(i) Warm ocean currents
(ii) Surface ocean currents
(iii) Cold ocean currents
(iv) Deep ocean currents

Q 2. Examine the given statements and correct the wrong ones.

(a) Ocean currents give specific direction and velocity to the water

(b) The deep ocean currents flow with high velocity

(c) Generally, surface ocean currents are formed in the equatorial regions.

(d) Ocean currents hold great importance for human life.

(e) The movement of icebergs is not dangerous for water transport.

(f) Water becomes warm near Brazil due to ocean currents. On the other hand, it becomes cold near African coast.

Q 3. Explain the effect of -

(a) Warm ocean currents on climate

(b) Cold ocean currents on the movement of icebergs

(c) The shape of the coast line on ocean currents

(d) Meeting of warm and cold ocean currents

(e) The transportational capacity of ocean currents

(f) Deep ocean currents

Q 4. Look at the map of ocean currents and answer the following :

(a) How does the Humboldt current affect the climate of the South American coast?

(b) In which oceans are counter equatorial currents not observed and why?

(c) Which currents are absent in northern part of the Indian Ocean and why?

(d) In which regions do the cold and warm ocean currents meet?

Q 5. Answer the following questions:

(a) What are the reasons responsible for the formation of deep ocean currents?

b) What is the reason behind the dynamics of the ocean water?

(c) How do winds give direction to the ocean currents?

d) Why do the ports in the eastern coast of Canada freeze in winter?

ACTIVITY :

Look for more funny and interesting information related to ocean currents.

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