

Week 12

Section 3 - The Marine Environment

Functional aspects – Part 2

2. Zonation of the marine environment

2.1 Introduction

Organisms are not evenly distributed in the global ecosystem but follow many different abiotic and biotic features that govern their distribution and zonation. **Figure. 22** presents a diagrammatic representation of the terms which are used to describe different parts of the sea bed as well as the corresponding approximate depths.

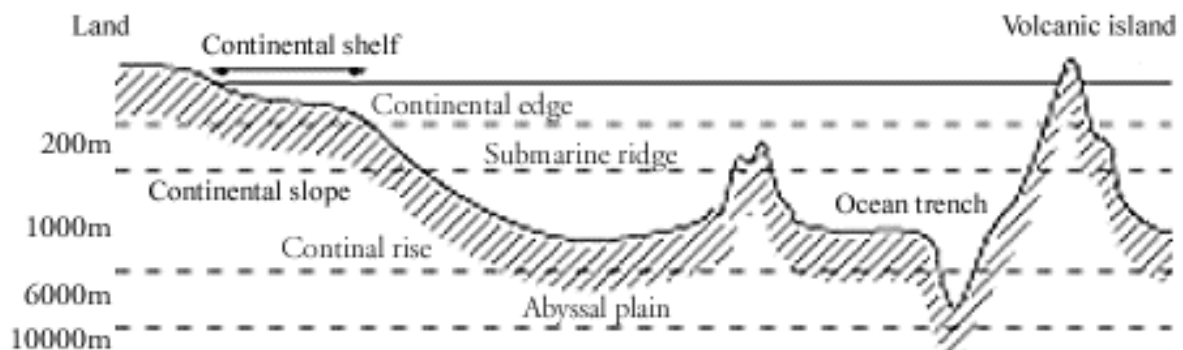


Figure 22. Terms applied to parts of the sea bottom.

2.1.1

It is interesting here to observe the globally common pattern concerning continental shelf and continental slope. The continental shelf formation is due to a series of causes such as:

- wave erosion and accumulation of the eroded material in the deeper areas during the earth's geological history with resulting fluctuations in the water level;
- the tectonic sinking of extensive areas which are flooded with water (i.e. the North Sea)

2.1.2

Beyond the continental shelf which usually reaches down to 200 metres the sea bottom presents a much steeper incline called the continental slope which extends down to the bottom of the ocean basins to a depth of 3000-6000 metres.

2.2.

2.2.1

This morphology pattern of the sea bottom has various consequences as far as its physical and chemical characteristics are concerned and therefore also in respect of the organisms which live there. Thus a specific terminology is used to denote the zonation of the marine environment (**Figure 23**) both for the pelagic and the benthic categories.

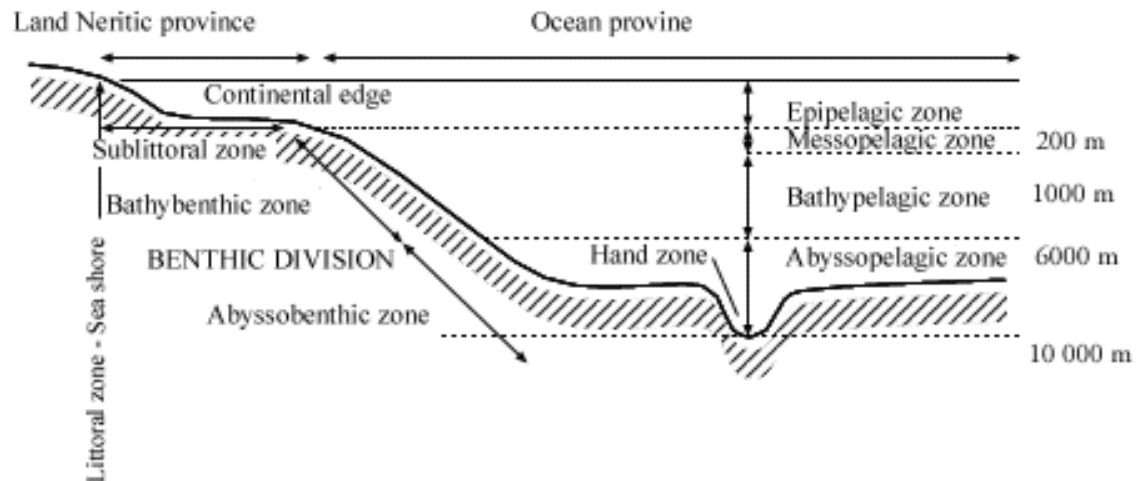


Figure 23. Main division of the marine environment.

2.2.2

The pelagic division occurs horizontally (i.e. in relation to the distance from the coast) and is divided into two categories:-

- a) the **Neritic province** which is located above the continental shelf and
- b) the **Oceanic province** which is located beyond the continental shelf.

2.2.3

It is described vertically (i.e., in terms of depth) as falling into the following zones:-

- a) the **epipelagic zone** where intense gradients of most of the environmental parameters exist (light, temperature, organic material, nutrients etc.), significant diurnal and seasonal variations as well as a pronounced influence of the wave action
- b) the mesopelagic zone** where almost no seasonal variation exists, there are very low light levels and the temperature is fairly constant;
- c) the bathypelagic zone** where there is total darkness, temperatures are constantly low and there is high pressure;
- d) the abyssopelagic zone** which is equally dark, has even lower temperatures and very limited food availability.

2.3 Depth gradient

2.3.1

One of the most important gradients of the marine environment is the depth gradient. Most

environmental parameters change in relation to depth though the most significant changes occur in relation to the availability of food.

2.3.2

Those organisms which live in shallow areas must cope with intense fluctuations of temperature, salinity and oxygen but in return they have the advantage of high food availability. This is why shallow and mainly coastal areas which, although occupying a small proportion of the marine environment contribute around 90% of its total production.

2.3.3

This increased productivity is used by most marine faunal organisms in the development of their larval stages. Consequently disturbance of these areas, a not unlikely event, since they are easily affected by human activities, could prove fatal for some species, especially the endemic and those with low populations.

2.3.4

In the deep sea there is not much fluctuation in the environmental parameters, but of course, the food availability is rather limited. This is why the populations of those species which live there are very low. They have thus developed a series of adaptations enabling them to cope with the special problems imposed by such an environment.

These adaptations are:-

a low metabolic rate, intensified by the low temperatures, in order to avoid waste of energy

a large mouth, in order to increase the ability to retain the prey (which is not easy to find in any case)

luminescent organs which serve to attract prey (and mating partners)

well-developed sensory organs in order to locate prey

a variety of reproduction mechanisms since mating is rather difficult when the population is so sparse.