

'...I gain the cove with pushing prow,  
And quench its speed in the slushy sand.  
Then a mile of warm sea-scented beach;'

From *Meeting at Night* by Robert Browning.

For most people, the word 'beach' means simply that stretch of sand or shingle above low tide level where they can lay out their sun beds, erect the deckchairs and keep a wary eye on the rising tide while the children paddle or build sandcastles. In other words, their interest lies only in those mainly sandy areas of the shoreline which are exposed at some stage in the tidal cycle. Coastal oceanographers have a wider interest because processes involving water and sediment movement occur below low tide level, and these must be considered if the beach zone is to be understood. In this Chapter, therefore, we shall examine the much broader **littoral zone** which stretches between the seawards limit of land plants and the region below sea-level where sediment is not disturbed by wave action during fair weather conditions—i.e. around 10m to 20m water depth at low tide\*. Where cliffs are developed, they (rather than vegetation) limit the landwards extent of the coastal zone. Seawards of the littoral zone is the **offshore zone**.

As beaches are accumulations of loose sand or pebbles, they change shape rapidly in response to changes in wave energy, and the movement of beach sediment dissipates some of the energy of a wave breaking on the shore (Section 1.4.6).

## 5.1 THE DIVISIONS OF THE LITTORAL ZONE

Rather a large amount of terminology exists to describe the features of the littoral zone. The terminology used depends on whether oceanographers are concerned with the influence on the littoral zone of tidal currents, the effects of waves, or the sediment profile. Figure 5.1 draws all the terms together and shows how they are related.

The part of the littoral zone that is exposed at low water when the tide is out, but covered at high water when the tide is in, is known as the **foreshore** or **intertidal zone**. The **backshore** is above mean high tide and is only influenced by the sea when there are storm waves, or during exceptionally high tides. Sediment on the backshore dries out rapidly and, where the coastline is flat, it is easily worked by the wind into a series of coastal sand dunes. Seawards of the foreshore is the **shoreface** which is permanently covered by water, except at exceptionally low tides.

\*Note that marine ecologists use 'littoral' in a different sense, to mean only the intertidal zone.

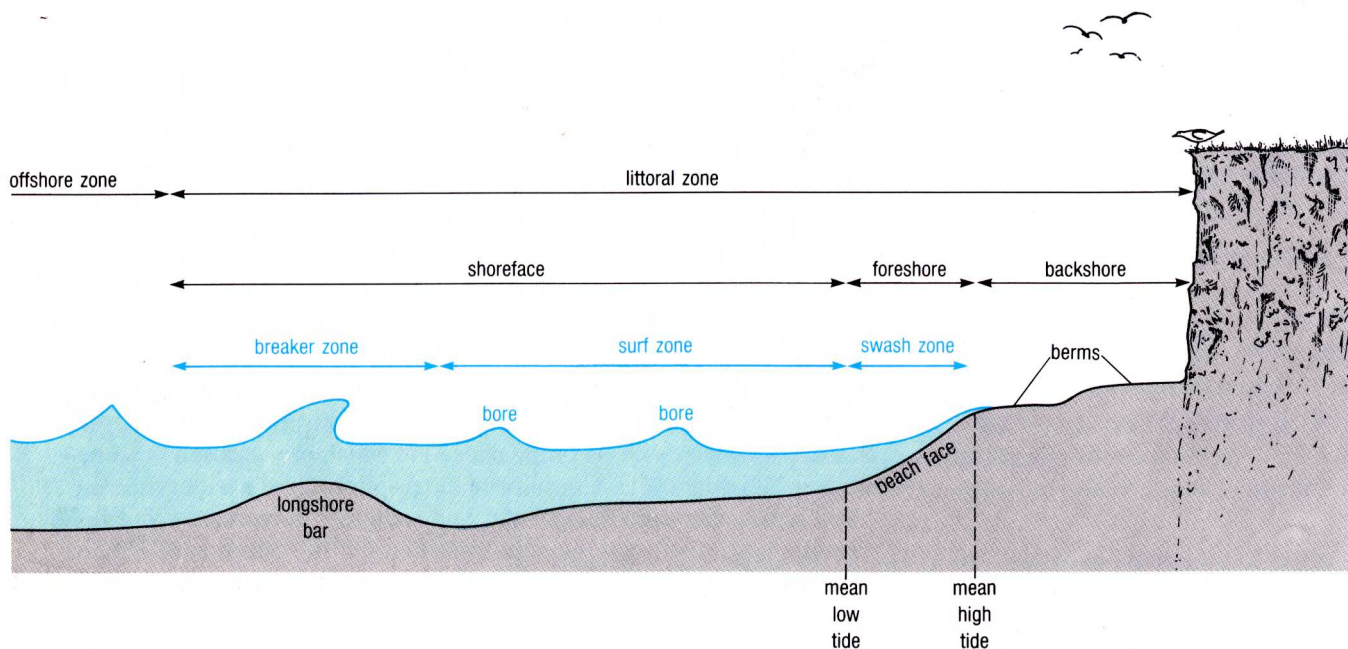


Figure 5.1 Zones of tidal influence, wave action and the sediment profile within the littoral zone.

### 5.1.1 ZONES OF WAVE ACTION

On the basis of wave action, the littoral zone is divided into breaker, surf and swash zones. The **breaker zone** is where waves become unstable and break, generating a **surf zone** in which much shallower waves (or bores) are projected up the beach face to the **swash zone**. The swash zone is alternately covered by the upsurge of water (the swash) and exposed as the backwash retreats.

**QUESTION 5.1** Are the wave zones constant in position along a stretch of coastline, during a tidal cycle?

### 5.1.2 THE SEDIMENT PROFILE

Figure 5.1 shows that the sediment in the littoral zone does not form a smooth landwards slope, but is interrupted by a number of ridges or sediment bars. The **berm** of the backshore is a flat-topped ridge which develops at the limit of the wave swash on steeply sloping beaches (Figure 5.2(a)). By contrast, shallow sloping beaches of the foreshore are often characterized by a series of low broad sandy bars separated by linear depressions or **runnels** (Figure 5.2(b)) running parallel to the shoreline. These bars, sometimes known as **swash bars**, form by sediment movement in the surf and swash zones and so a whole series of swash bars and runnels may develop as the tide migrates across the beach. As Figure 5.1 shows a steep beach profile, no swash bars or runnels are drawn. It may be quite dangerous to walk down to the sea's edge on the incoming tide across a beach with well-defined swash bars and runnels, unless you are a strong swimmer. The runnels fill with water first and it is easy to find yourself stranded on a swash bar, separated from the next bar or the shore by a stretch of often relatively deep, fast-flowing water.

Seawards, beneath the breaker zone, a **longshore bar** may develop. It is a characteristic feature of some beach profiles in the winter season, when



(a)



(b)

Figure 5.2 (a) A beach berm. (b) A swash bar and runnel exposed on the foreshore.

berms are generally absent. We shall discuss the reasons for the formation of longshore bars when beach profiles are examined in more detail in Section 5.3.

The sloping portion of the beach, below the berm shown in Figure 5.1, is the **beach face**.

**QUESTION 5.2** Examine the extent of the beach face on Figure 5.1 and describe (a) the relationship between the beach face and the intertidal zone, (b) the relationship between the beach face and zones of wave action.