Types of mass movement

Mass movement can be classified into four main types – creep, flow, slide and fall (Figure **4**). Each process represents a flow or transfer of material and can be considered to be an output from one store (land) and an input to another store (beach/sea). The type of movement at any one place depends upon a range of factors – angle of the slope or cliff; rock type and structure; vegetation cover; how wet the ground is.

Type of mass movement	Nature of movement	Rate of movement	Wet/dry
Soil creep Solifluction	Creep/flow	Imperceptible	Wet
Mudflow	Flow	Often quite rapid	Wet
Runoff	Flow	Rapid	Wet
Landslide/debris slide Slump/slip	Slide	Usually rapid	Dry Wet
Rockfall	Fall	Rapid	Dry

Figure 4 *Classifying different types of mass movement*

Soil creep

As the name implies, *soil creep* is an extremely slow form of movement of individual soil particles downhill. The precise mechanism of movement often involves particles rising towards the ground surface due to wetting or freezing and then returning vertically to the surface in response to gravity as the soil dries out or thaws (see 4.7). This zigzag movement is similar to that of longshore drift. Soil creep cannot be seen operation but its action can be implied by the formation of shallow terracettes, the build-up of soil on the upslope side of walls and the bending of tree trunks (Figure **5**).

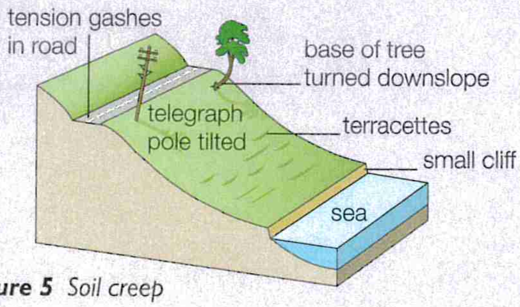


Figure 5 *Soil creep*

Mudflows

A *mudflow* involves earth and mud flowing downhill, usually over unconsolidated or weak bedrock such as clay, often after heavy rainfall. Water gets trapped within the rock, increasing pore water pressure, which forces rock particles apart and leads to slope failure. Pore water pressure is a form of energy within the slope system and it is an extremely important factor in determining slope instability. Mudflows are often sudden and fast-flowing so can represent a significant natural hazard.

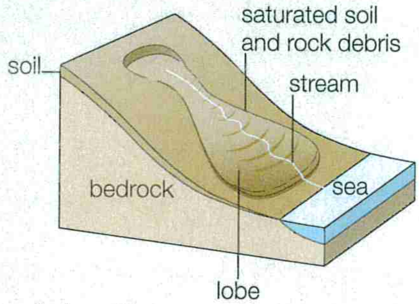


Figure 6 *A mudflow*

Landslide

A *landslide* involves a block of rock moving very rapidly downhill along a planar surface (a slide plane), often a bedding plane that is roughly parallel to the ground surface (Figure **7**). Unlike a mudflow, where the moving material becomes mixed, the moving block of material in a landslide remains largely intact.

Landslides are frequently triggered by earthquakes or very heavy rainfall, when the slip surface becomes lubricated and friction is reduced. Landslides tend to be very rapid and pose a considerable threat to people and property. In 1993, 60 m of cliff slid onto the beach near Scarborough in North Yorkshire, taking with it part of the Holbeck Hall Hotel (Figure **8**).

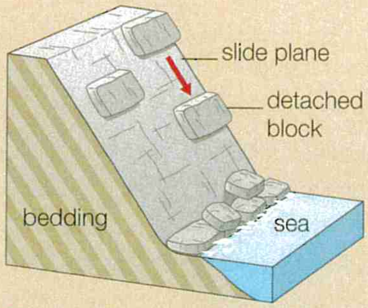
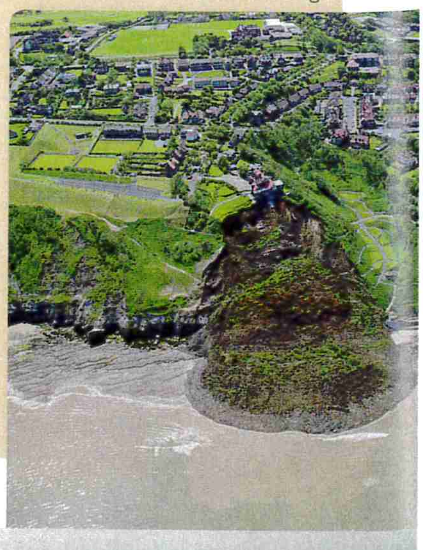


Figure 7 *A landslide*

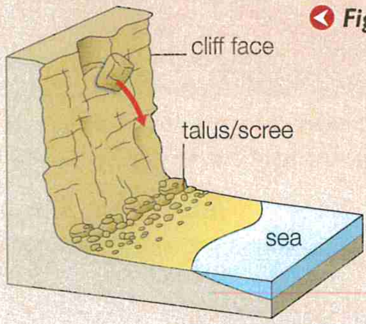
Figure 8 *Landslide in 1993 at Holbeck Hall, Scarborough*



Rockfall

A *rockfall* involves the sudden collapse or breaking away of individual rock fragments (or a block of rock) at a cliff face. They are most commonly associated with steep or vertical cliffs in heavily jointed and often quite resistant rock. A rockfall is often triggered by mechanical weathering (particularly freeze-thaw) or an earthquake. Once broken away from the source, rocks fall or bounce down the slope to form scree (also known as talus) at the foot of the slope (Figure **9**). Scree often forms a temporary store within the coastal system, with material gradually being removed and transported elsewhere by the sea. When this occurs the scree forms an input into the sediment cell.

Figure 9 *A rockfall*



Runoff

Runoff is a good illustration of the link between the water cycle and the coastal system. When overland flow occurs down a slope or cliff face, small particles are moved downslope to enter the littoral zone, potentially forming an input into the sediment cell. Runoff can be considered a type of flow that transfers both water and sediment from one store (the rock face) to another (a beach/the sea).

Toxic chemicals can contaminate stormwater and cause threats to coastal ecosystems, illustrating yet another link between natural systems (see 6.10).

Solifluction

Essentially, *solifluction* is similar to soil creep but specific to cold periglacial environments (see 4.7 and 4.11). In the summer, the surface layer of soil thaws out and beco mes extremely saturated because it lies on top of impermeable frozen ground (permafrost). Known as the active layer, this sodden soil with its blanket of vegetation slowly moves downhill by a combination of heave and flow. Solifluction characteristically forms features called *solifluction lobes* (see 4.11).

Landslip or slump

A *landslip* or *slump* differs from a landslide in that its slide surface is curved rather than flat. Landslips commonly occur in weak and unconsolidated clays and sands, often when permeable rock overlies impermeable rock, which causes a build-up of pore water pressure. Landslips or slumps are characterised by a sharp break of slope and the formation of a scar (Figures **10** and **11**). Multiple landslips can result in a terraced appearance on the cliff face.

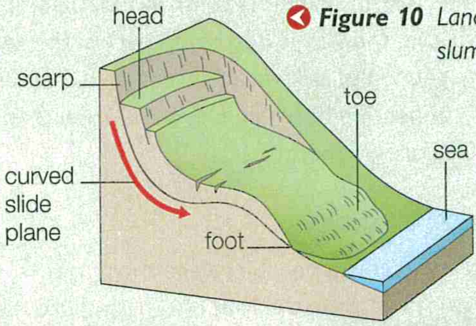


Figure 10 *Landslip or slump*

Figure 11 *A rotational scar at Christchurch Bay, Barton-on-Sea, Dorset*

ACTIVITIES

1. In pairs, discuss and decide (**a**) the part played by weathering and its influence on the rate of coastal retreat, (**b**) which forms of weathering are likely to have the greatest impact in different parts of the UK.
2. Explain why evidence of past solifluction can be seen in some parts of the UK.
3. Explain the significance of weathering and mass movement in relation to the coastal system. Use the correct systems terminology in your answer and consider drawing a simple diagram to support your answer.
4. Explain how the methods by which sediment is supplied to the coastal system are likely to vary between areas of resistant and weak geology.
5. Distinguish between the following pairs of terms: (**a**) weathering and mass movement; (**b**) flows and slides; (**c**) landslides and landslips; (**d**) soil creep and solifluction; (**e**) rockfalls and slumping.

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6. In pairs, discuss and devise two flow diagrams to outline the sequence of processes that probably led to the rockfall at Dover (Figure **1**) and the landslip at Lyme Regis (Figure **3**).