

Mass Wasting

Mass Movement: the downslope transfer of material through the direct action of gravity.
Mass Movement can be fast, as in landslides, or slow, as in creep.

Angle of Repose

The steepest slope on which loose material such as talus, will remain at rest without rolling farther downslope (Average = 30°).

Factors influencing Mass Movement

- *Saturation of material with water
Lubricates and adds weight
- *Vibrations from earthquakes
1970 Peru Quake – 400m³ moved downslope 300km/hr, killing 40,000 at the base of Mount Huascaran.
1976 Guatemala – Quake resulted in 10,000 mass movements
- *Oversteepening of slopes by undercutting.
By nature (rivers) or humans (Highways, Malibu)
- *Alternating Freezing and Thawing
Cases: Madagascar, Vaiont Reservoir (1963) in Italy

Types of Mass Movement

Creep – Extremely slow, almost imperceptible downslope movement of soil and rock debris that results from the constant minor readjustments of the constituent particles.

Creep Evidence:

- 1) Hard to see it move, but evidence can be seen
- 2) Bulges or low, wave-like swells in the soil
- 3) Bending of steeply dipping strata
- 4) Tilted trees and posts
- 5) Deformed roads, fence lines
- 6) Tilted retaining walls

Includes Block Slides: caused by heaving process that results from the alternating expansion and contraction of loose rock fragments in the regolith.

Freeze/Thaw

Wetting/Drying

Other Factors that lead to Creep:

- Growing plants (or lack of)
- Undercutting by streams
- Increased loads by rainwater or snow
- Earthquakes
- Construction by humans

Rates of Creep

- 1-2 mm/yr in humid temperature regions
- 5-10 mm/yr in semi arid with cold winters
- Special Type: Solifluction (soil flowage)
 - Common in polar regions (permafrost)
 - Can occur in water drenched soils

Debris Flows

- No definite plane of slippage
- Medium to fast movement
- Consist of mixtures of rock fragments, mud and water that flows downslope as viscous fluids.
- Rate: Flowing concrete to running water, depending on the amount of water present.

Mudflow: Variety of debris flow that consists of a large percentage of silt and clay sized particles.

- Results from heavy rain or quick thaw
- Water content can be as high as 30%
- Common in arid or semi-arid regions (like here)
- Can float houses, barns or boulders
- Many are over 100m thick, and can be 80km long
- Glacial muds can create “quick-clays” like quicksand, only smaller particles with lots of water.

Slumgullion Mudflow Colorado

Landslides: Involves movement of a mass rock or regolith along a definite plane

- Usually fast moving
- A landslide differs from creep and debris flows in its mechanics of movement.
- Landslides move as a unit, or series of units, along a fracture or system fractures, with much of the material moving as a large slump block

Special Varieties of Mass Wasting**Rock Fall**

- From Steep Cliffs

Rockslide: Rapid downslope movement of rock material along a bedding plane, joint, or other plane of structural weakness.

Debris Slide: Rapid movement of soil and loose rock fragments.

Slump: A slow to rapid movement of a coherent body of rock along a curved rupture surface.

Debris flows often occur at the end of slumps

Subaqueous Sand Flow: Flow of water saturated sand or silt beneath the surface of a lake or ocean

Rock Glaciers

Looks and moves like a glacier

Has some ice in its pores which helps it to move
(5cm/day, 1 m/yr)

Subsidence

Downward movement of earth material essentially vertical.

Controlled by gravity

Karst Topography – collapse due to excavation of caves

Mining of ores, coals, gems

Pumping of groundwater for use in houses

Lava tunnels

Pumping oil

Lahars

Volcanic Mudflows

Loose pyroclastics and water from rain or melted snow due to heating up

Examples:

Mt. St. Helens

Vesuvius (79AD) 20m thick

Armero, Columbia (1985) Andean Volcano, buried 23,000 people
(Nevado Del Ruiz)

Mine Dumps

Loose, unconsolidated materials

1966, Wales, Town of Aberfan

Heavy rain caused mine refuse to overtake a school, killing 140.

Slope Systems

Open systems in which the effects of weathering, mass movement, and erosion of minor gully tributaries combine to transport rock material downslope to the main stream.

Be careful building your house on a slope, or have good insurance.