

CLASSIFICATION OF MASS WASTING PROCESSES (24)

I Main Topics: Varnes classification scheme (Fig. 2.1 of SR 176)

<http://www.em.gov.bc.ca/Mining/Geosurv/Surficial/landslid/ls2.htm>

A Style of slope movements

B Types of geologic materials

C Landslide nomenclature

Varnes classification scheme

Process⇒ Material	Sliding	Toppling	Fall	Flow	Avalanche (complex)
Rock					
“Coarse soil” (Debris)					
“Fine soil” (Earth)					
Ice analog	Glaciers			Glaciers	

II Style of slope movements

A Falls

- 1 Movement largely a free fall through air; accompanied by leaping, bounding, bouncing, or rolling of material
- 2 Maximum rate of movement: $\sim 10^2$ m/sec
- 3 Example: rock falls from cliffs

B Topples

- 1 Movement is initially a rigid body tilting or overturning; generally requires steep fractures parallel to free face
- 2 Maximum rate of movement: $\sim 10^2$ m/sec
- 3 Example: topples along banks of Mississippi River

C Slides

- 1 Material moves parallel to (and maintains contact with) one or more surfaces or narrow zones of failure
- 2 Rate of movement: Highly variable (10^{-9} m/sec - 10^1 m/sec)
- 3 Two many types of slides
 - a Rotational slide (slump): slip surface curved in cross section
Pure rotational slides usually in uniform engineering material
 - b Translational slide: slip surface is roughly planar
- 4 Example: Manoa Valley slides; small failures along highway cuts

D Lateral spreads

- 1 Material on a shallow slope is extended; there may or may not be a well-defined failure surface
- 2 Rate of movement: Highly variable (10^{-9} m/sec - 10^0 m/sec)
- 3 Commonly triggered by shock to young quick clays
- 4 Example: G street "slide" in Anchorage, 1964

E Flows

- 1 Deformation is spread throughout the displaced material in a relatively continuous fashion
- 2 Rate of movement: Highly variable (10^{-9} m/sec - 10^2 m/sec)
- 3 Enormous variety of phenomena (e.g. bedrock flows, soil creep, silt flows, dry sand flows, debris flows, debris avalanches)
- 4 Similarity between earthflows, lava flows, glaciers

F Complex

- 1 Movement is by a combination of the above main styles; this implies gradations between styles
- 2 Rate of movement: Highly variable (10^{-9} m/sec - 10^2 m/sec)
- 3 Examples: Elm, Switzerland event; Nevados Huascarán, Blackhawk
- 4 Includes many phenomena termed avalanches

III Types of geologic materials

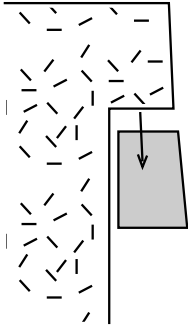
- 1 Rock: material that requires blasting or heavy equipment to move
- 2 Debris: loose material that contains a significant portion of coarse material (20%-80% > 2mm)
- 3 Earth: loose material that primarily consists of fine material (80+% < 2mm)

IV Landslide nomenclature (see handout)

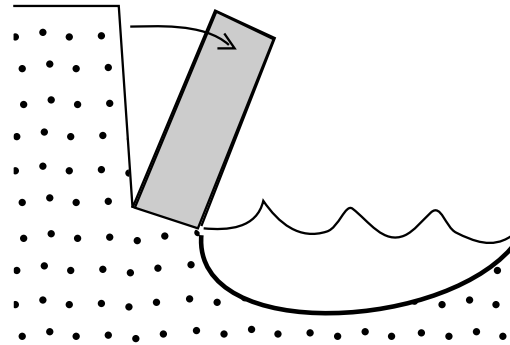
TYPES OF SLOPE MOVEMENT PROCESSES

Cross-section views

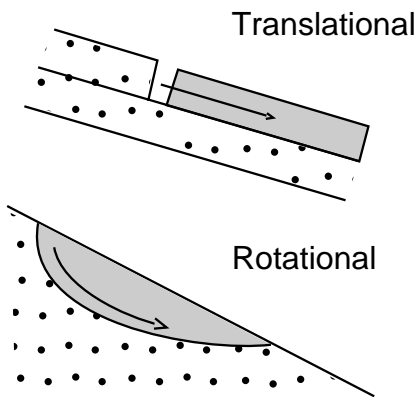
Falls



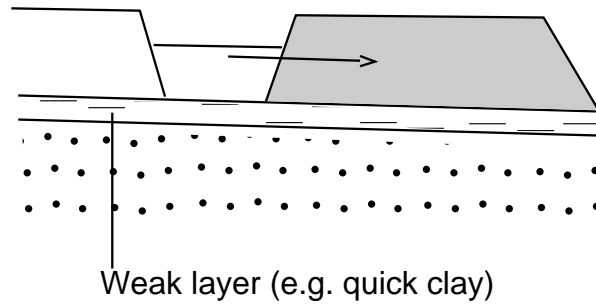
Topples



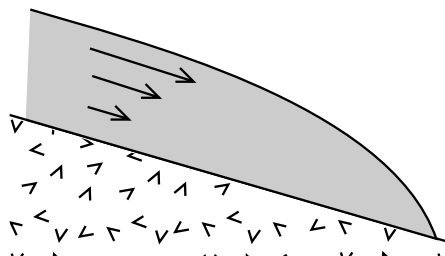
Slides



Lateral spreads



Flows



Complex

