CLASSIFICATION OF MASS WASTING PROCESSES (24)

I Main Topics

A Mass wasting classification scheme

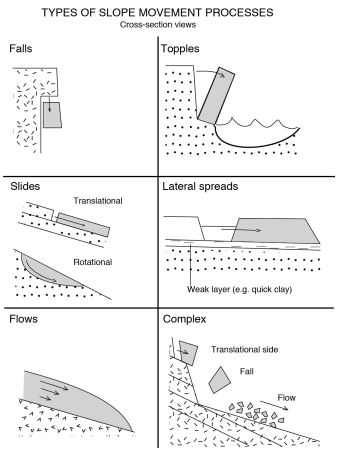
B Types of geologic materials

C Styles of mass wasting

II Mass wasting classification scheme

Varnes classification scheme (simplified)

Process/ Material	Fall	Topple	Slide	Spread	Flow	Avalanche (complex)
Rock						
"Coarse soil" (Debris)						
"Fine soil" (Earth)						
Ice/snow analog	Glacier	Ice fall	Start of avalanche		Glacier	Avalanche



III Types of geologic materials

A Rock: material that requires blasting or heavy equipment to move

B Debris: loose material that contains a significant portion of coarse material (20%-80% > 2mm)

C Earth: loose material that primarily consists of fine material (80+% < 2mm)

IV Styles of mass wasting

A Falls

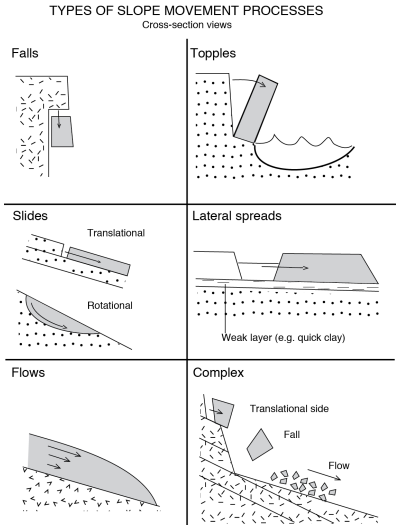
B Topples

C Slides

D Lateral spreads

E Flows

F Complex



A Falls

1 Free fall through air; with bouncing or rolling
2 Maximum speed: ~10^2 m/sec
3 Example: rock falls from cliffs

Rockfall at Yosemite National Park, CA

https://www.youtube.com/watch?v=H0YhlqP1BgE

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Rockfall, South Tyrol, Italy

https://www.youtube.com/watch?v=-5SiQqSroIw

B Topples

1. Initiates as a tilting or overturning;
2. Generally requires steep fractures parallel to free face
3. Maximum speed: ~10^2 m/sec
4. Example: topples along banks of Mississippi River

Toppling Failure, Coast of France

https://www.youtube.com/watch?v=gvSe27Ht-NY

C Slides

1. Material moves parallel to (and maintains contact with) one or more surfaces or narrow zones of failure
2. Speed: Highly variable (10^{-9} m/sec - 10^1 m/sec)
3. Main types
   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. Examples
   a. Manoa Valley slides;
   b. Small failures along highway cuts

Landslide, Jackson, Wyoming

https://www.youtube.com/watch?v=_zcjbF6omWI

C Slides

1. Material moves parallel to (and maintains contact with) one or more surfaces or narrow zones of failure
2. Speed: 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. Examples
   a. Manoa Valley slides;
   b. Small failures along highway cuts

Polk County Rockslide, Tennessee
(Sheeting joint failure)

https://www.youtube.com/watch?v=39LCzBS8yOM

D Lateral spreads

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

Lateral spread, Hegben Lake, Montana

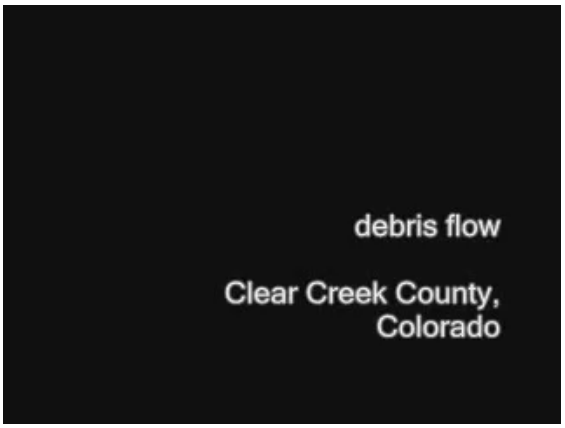
http://www.idahogeology.org/DrawOnePage.asp?PageID=83

http://www.idahogeology.org/uploads/Hazards/Landslides/Image_5_dlg8.jpg

E Flows

1. Deformation distributed through material in a relatively continuous fashion
2. Speed: 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

Debris Flow, Clear Creek, Colorado



https://www.youtube.com/watch?v=8mKC3eID074

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Debris Flow, South Korea

https://www.youtube.com/watch?v=ghAzOE6xxnE

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Earth Flow, northern Italy

https://www.youtube.com/watch?v=Dct3JQn2m0o

F Complex

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

Rock Avalanche, Mount Rainier

https://www.youtube.com/watch?v=fK_3AneOujQ