

Mass Wasting

Mass Wasting

The downslope movement of rock, regolith, and soil under the direct influence of gravity

Gravity is the controlling force

Mass Wasting

Important triggering factors

- Saturation
- Oversteepening
- Removal of vegetation
- Ground vibrations

Important triggering factors

Saturation of the material with water

- Destroys particle cohesion
- Water adds weight

Important triggering factors

Oversteepened slopes

- Unconsolidated granular particles assume a stable slope called the angle of repose
- Stable slope angle is different for various materials
- Oversteepened slopes are unstable

Important triggering factors

Oversteepened slopes

- Undercutting by streams
- Undercutting by human interference
- Addition of material to top of slope
 - Natural—deposition
 - Human-caused—construction

Important triggering factors

- Removal of anchoring vegetation
 - Wildfires
 - Drought
 - Development, logging
- Ground vibrations
 - from earthquakes

Mass Wasting

Types of mass wasting processes

Defined by

- The material involved
- The movement of the material

Types of mass wasting processes

Defined by the material involved

- Debris
- Mud
- Earth
- Rock

Types of mass wasting processes

Defined by the movement of the material
The character of the movement

- Fall
- Slide
- Flow

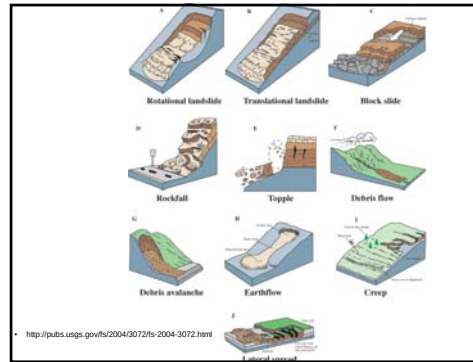
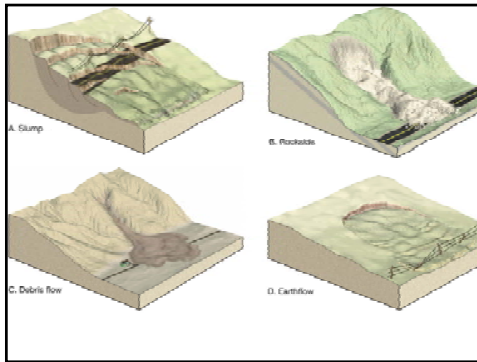
Types of mass wasting processes

Defined by the movement of the material
The rate of the movement

- Fast
- Slow

Forms of mass wasting

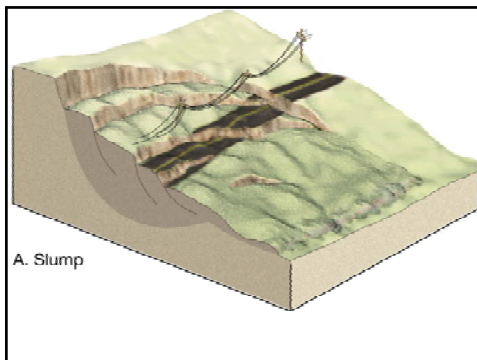
- Slump
- Rockslide
- Debris flow
- Earth flow
- Creep
- Solifluction



Forms of mass wasting

Slump

- Rapid movement along a curved surface
- Occur along oversteepened slopes

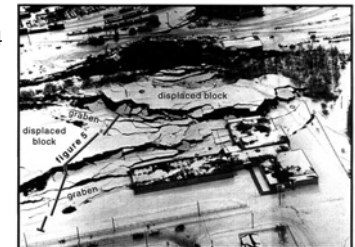


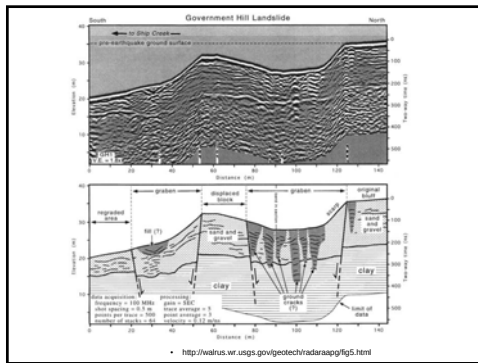
Slump



Government Hill, AK

- 1964



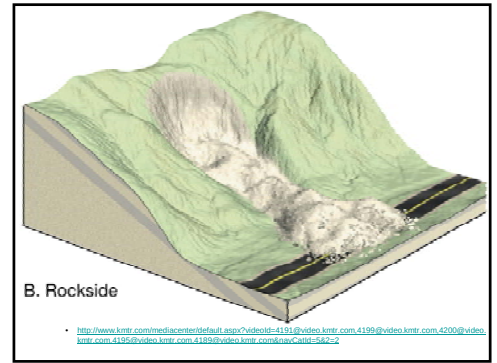


Forms of mass wasting

Rockslide

- Rapid
- Blocks of bedrock move down a slope

Cousin to Rockfall

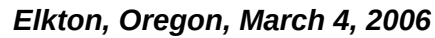


Elkton, Oregon, March 4, 2006



ODOT Photo

• http://www.kmtr.com/news/local/story.aspx?content_id=010798AE-AF2F-41D5-93F5-120A64493D45

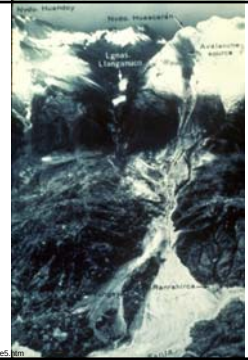


ODOT Photo

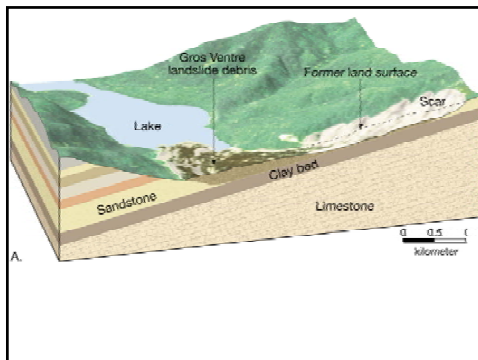
• http://www.kmtr.com/news/local/story.aspx?content_id=010798AE-AF2F-41D5-93F5-120A64493D45

**Nevado
Huascarán**

- Peru 1970
- Buried two towns
- 18,000 killed
- Geologists warned government of potential



http://landslides.usgs.gov/html_files/landslides/slides/slide5_vtm

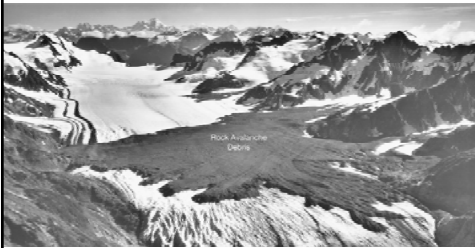


Slide Lake, Wyoming



- <http://www.uwsp.edu/geo/projects/geoweb/participants/dutchVTrips/GrosVentre.HTM>

Sherman Glacier Rock Avalanche, March 1964



Rock Fall

- July 1996
- Yosemite



• http://landslides.usgs.gov/hot/_files/landslides/slides/slide9.htm

Rock Fall

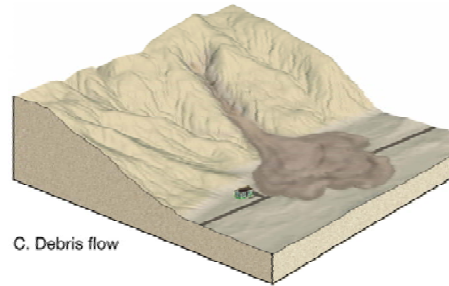


• <http://itsa.gsc.nrcan.gc.ca/geoscience/vancouver/graphics/mountain1.gif>

Forms of mass wasting

Debris flow (mudflow)

- Rapid flow of debris with water
- Confined to channels
- Dry areas with heavy rains
- Lahar composed of volcanic materials



C. Debris flow

Snohomish County, WA January 2006



• <http://www.komtv.com/stories/41527.htm>

US 50, Sierra Nevadas, California 1997



• <http://landslides.usgs.gov/monitoring/hwy50/index.php>

La Conchita, California

- Spring 1995
- No one injured or killed

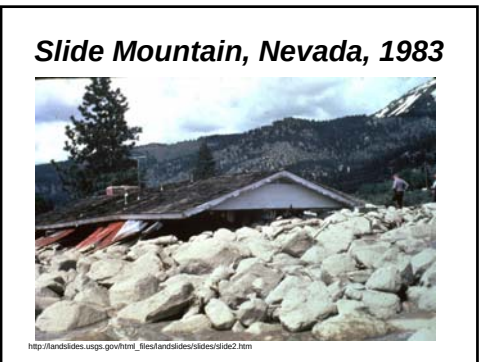


• http://landslides.usgs.gov/hot/_files/landslides/slides/slide21.htm

La Conchita, California



- February 2005





• <http://www.alertnet.org/thenews/pictures/MAN62D.htm>

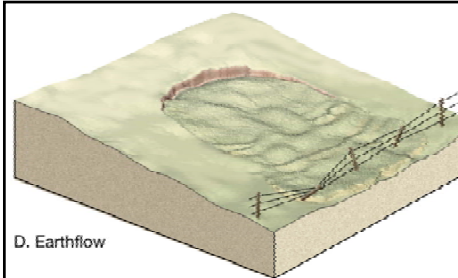


• <http://news.yahoo.com/news?tmpl=story&u=/060219481/bm10202190643>

Forms of mass wasting

Earthflow

- Rapid or slow
- Typically occur on hillsides in humid regions
- Water saturates the soil
- Liquefaction: associated with earthquakes and clay soils



D. Earthflow

Hollywood Hills, CA

- January 2005



• <http://www.cnn.com/interactive/weather/0501/gallery.storms/frame01.exclude.html>

Niigata, Japan, 1964



• <http://www.ce.washington.edu/~liquefaction/selectpic/lique/nigata64/tbedbuilding.jpg>

Anchorage, AK

1964



• http://www.onlinet.rice.edu/~sehr/AlaskaEQ/Alaska_SciEQScience



• <http://wahrus.wr.usgs.gov/geotech/radar/aagfig5.html>

Alaska, 1964



- <http://www.ce.washington.edu/~liquefaction/selectpic/lique/alaska64/lands/deinowater.jpg>
- Hyperlink to sand boil liquefaction <http://wahrus.wr.usgs.gov/geotech/images/TIsandboils.mpeg>

Sheffield Dam, 1925

Santa Barbara County

Earth-quake caused flow

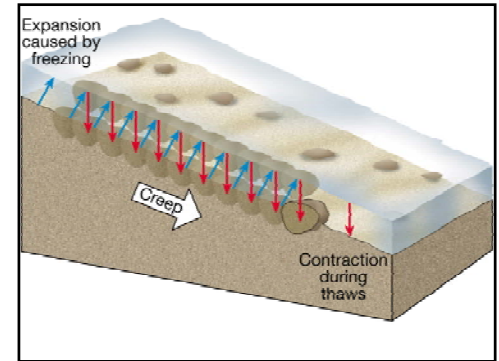


• <http://www.ce.washington.edu/~liquefaction/selectedpics/dams/sheffielddam1.jpg>

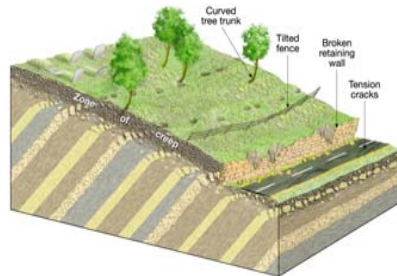
Forms of mass wasting

Creep

- Slow movement of soil and regolith downhill
- Causes fences and utility poles to tilt



Some visible effects of creep



Creep

- Bedrock curled due to creep mass wasting



• http://www.ngdc.noaa.gov/seghazard/slideset/06_140_slide.shtml

Creep

- Curved trunks due to soil creep

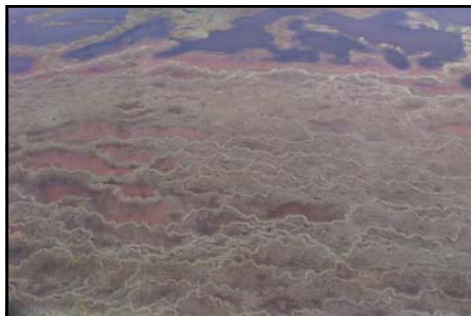


• <http://classes.colgate.edu/geol/geol101/massw/mimages/creep1.jpg>

Forms of mass wasting

Solifluction

- Slow movement in areas underlain by permafrost
- Upper (active) soil layer becomes saturated and slowly flows over a frozen surface below



• http://pru.alexandria.ucsb.edu/collections/geography/30/misc/solifluction_lobes.jpg/601%5d.jpg

Ground subsidence in Alaska due to solifluction





Mass Wasting

The downslope movement of rock, regolith, and soil under the direct influence of gravity

Gravity is the controlling force

Important triggering factors

- Saturation of the material with water
- Oversteepening
- Devegetation
- Vibration