

Mass Wasting

Down slope movement of Rock, regolith, and soil under the direct influence of gravity, it does not need transporting agents like other ~~erosion~~ erosional processes.

* Factors control mass wasting :

a) Internal Factors : tends to reduce the shearing strength of the soil and R.

① water content : a Reduce the shear strength.

* Add additional weight \rightarrow st. st. (st. st.)

* lubricating agent

a long a plane of weakness


Freezing and thawing of R.

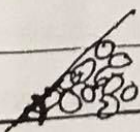
② nature of the slope :

Angle of repose : The steepest angle at which

unconsolidated mat. remain stable,

it depends on the size and shape of particle (25° - 40°).

ex. coarse  or fine sand.



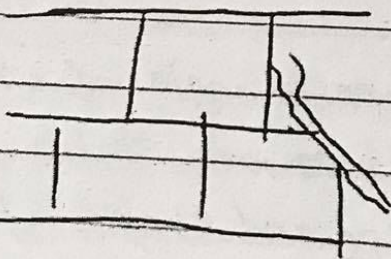
③ composition of the mass:

- + silicious sand stone is highly stable silica ^{ذراته}
- + clay and calcareous sand stone may suffer failure. ^{ذراته} calcite
- Gypsum, clay ^{بتسليم الماء}
- ويتشكل فجوات.

Also texture of R. (packing of grains or crystals) affect the porosity (n) and percolating water (permeability) ^{النفاذية}

مسامية المسامية porosity (n) = $\frac{V_{voids}}{V_{total}}$ ^{تكررة عن كمية الفراغات الموجودة.}

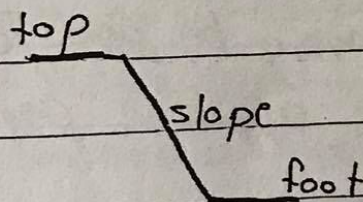
4) Geological structure: inclination of the strata (dip) presence of shear and fault zone and joints.



الميل ^{دip} أكبر
mass wasting
أكبر

b) External Factors :

- 1) Vibration : Repeated vibrations as due to heavy traffic on hill roads may be greatly contributing factors towards causing of the failure, also vibration may be due to earthquake.
- 2) Removal of support at the foot of the slope.
- 3) Loading at the top of the slope
- 4) Removal of vegetation cover.



* Types of Mat. in mass wasting :

a) if soil and regolith $\xrightarrow{\text{Process}}$ debris, mud, earth

b) if mass of bed rock breaks loose $\xrightarrow{\text{Process}}$ Rock.

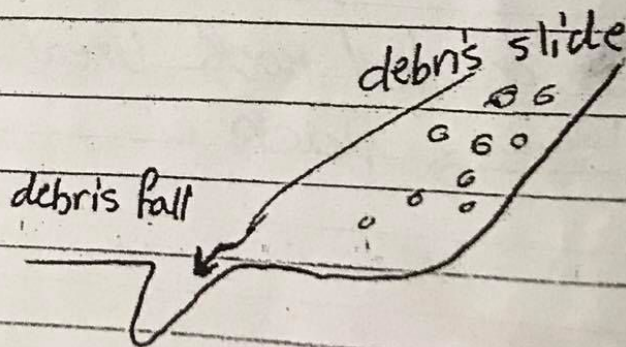
* Types of Motion :

The way in which Mat. moves can be described as :

a) Fall : when the movement involves free-fall of pieces of any size.
→ Common on steep slope.

b) Slides : Mat. remains coherent and move along a well-defined surface the surface may be ~~for~~ joint, fault or bedding plane approx. parallel to the slope.

c) Flow : when the Mat. moves downslope as a viscous fluid.
Most flows are saturated ^{with} water.



* Rate of Movement :

1) Rock avalanches : Rock and debris can move downslope at speed exceed 200 km/hr.

2) Slump : downward sliding of a mass of Rock or unconsolidated mat. moving as a unit along a curved surface, the mat. does not travel fast nor very far. This type of motion especially in thick accumulations of cohesive mat. (clay), the surface of rupture is spoon shape.

Slumps commonly occurs because:

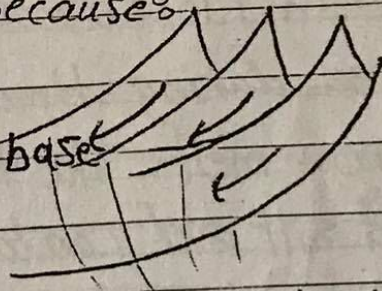
+ the slope is oversteepened

by removing the mat at the base

+ the slope is overloaded

"when weak-clay underlies

Layers of stronger layers"



3) Rock slides : occur when blocks of bedrocks break down loose and slide down slope. If the Mat. is largely unconsolidated the term debris is used.

It is occur where the rock-strata are inclined or where joints and fractures parallel to the slope.

4) Mud Flow: is relatively rapid type of mass wasting that involves a flowage of debris containing a large amount of water.

It is characteristic of semiarid mountain regions, (infrequent raining but heavy)

Mud flow occur on slopes of some volcanoes. Is termed Lahars when highly unstable layer of ash and debris become saturated with water and flow down slope.

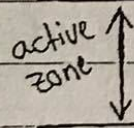
5) Earth Flow: mostly occur on hill side in humid area during times of heavy precipitation or snow melt. The Mat. involved are rich in clay and silt and contain only small proportions of sand and coarse particles.

Earth flow are quite viscous, they move at slower rates than mud flows movement, and may stay active for a period ranging from days to years, velocity may be less than 1mm/day up to several meters/day
(steepness, mat. consistency).

6) Creep: type of mass wasting that involves gradual downhill movement of soil and regolith, creep can take place on gentle slope so it is the most widespread form of mass wasting. The primary cause of creep is the alternate expansion and contraction of surface mat. caused by freezing and thawing or wetting & drying.

7) Solifluction: Form of mass wasting → common in regions of permafrost → frozen ground. Solifluction occur in a zone above the permafrost called the active zone.

إذا كان في ميل ودخلت الماء :
تتحرك الماء باتجاه الميل
وتجرف معها التراب .



تراب ركنه متحرك

* Control of land slides:

تجفيف الماء

a) Drainage: (surface and subsurface)
[drainage tunnels, ditches, trenches]

b) retaining structure:

retaining walls, Gabions, Riprap

الاسكال

← حوائط حديدية بوالها حجار

منارة ساكنها قليلة

لتثبيت الأساس المتزعزع عندها m.w.

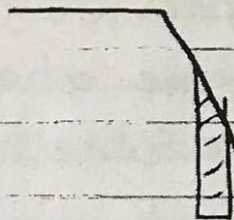
c) oiling the surfaces

من المناطق الصحراوية - ترش أسطح مسطحة البترول
على الرمل مما يجعل على تثبيتها ومنع انتقاله.

d) treatment of the slope :

- * flattening the slope
- * removal of load
- * using pile foundations

بتحفر حفرة بالأرض وتحميها بأطون



- * increasing vegetation cover.