Chapter 22

Landscape Evolution: Geomorphology

As mountains rise, the more they are subjected to erosion:
More precipitation, steeper gradients

Mountains have low-density roots:
The more they are eroded, the more they rise.

Topography is a Balance Between Erosion and Tectonic Uplift
Relief

- The relief in an area is the maximum difference between the highest and lowest elevation.
- We have about 7000 feet of relief between Boulder and the Continental divide.

Relief:
- Longs Peak is at 4346 m (14,259 ft).
- The elevation in Boulder is 1655 m.
- What is the relief between Boulder and Longs Peak?
  - A. 10,000 m
  - B. 6001 m
  - C. 2691 m
  - D. 269 m
  - E 14,259 ft

Relief:
- Mont Blanc is at 4810 m (15,781 ft).
- The elevation in Chamonix is 1036 m.
- What is the relief between Chamonix and Mont Blanc?
  - A. 6000 m
  - B. 3773 m
  - C. 2691 m
  - D. 269 m
  - E 15,781 ft

Relief:
- Mount Everest is at 8848 m (29,029 ft).
- The Challenger Deep is -10,971 m.
- What is the total relief on our planet?
  - A. 2133 m
  - B. 8848 m
  - C. 19,819 m
  - D. 30 km
  - E 29,029 ft

Mountains control weather and increase erosion: Erosion rate prop. to slope

Uplift stimulates erosion (negative feedback)
**Isostasy:**

Mountains Have Roots

Mountains are large masses of rock that project above surrounding terrain. A mountain range is a continuous area of high elevation and high relief. A valley is an area of low relief typically formed by and drained by a single stream. A basin is a large low-lying area of low relief. In arid areas basins commonly have closed topography (no river outlet to the sea).

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**Mountains and Valleys**

- Colorado has 52 peaks over 4267m (14,000 ft) and none over 4420m (14,500 ft).
- Why?
- 80 m years ago Colorado was at sea level.
- Regional uplift

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**Clicker Question**

Mountains tend to be close to gravitational equilibrium with surrounding terrain. Mountains typically have deep roots of lower density rocks. This is the principle of:
- A. Rebound
- B. Balance
- C. Isostacy
- D. Density
- E. Evolution

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**Clicker Question**

Mountains typically occur in ranges. (Why?)

- Glaciated forms
  - Horn
  - Arête
- Desert Mountains
  - Vertical Cliffs
  - Alluvial Fans
**Mountain Landforms:**
- **Horn**

**Deserts:**
- Vertical Cliffs and Alluvial Fans

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**Valleys and Basins**
- **River Valleys**
  - *U*-shape (Glacial)
  - *V*-shape (Active Water erosion)
  - Flat-floored (depositional flood plain)
- **Tectonic (Fault) Valleys (Basins)**
  - Tectonic origin
  - San Luis Valley
  - Jackson Hole
  - Great Basin

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**V-shaped Valley:**
- Active water erosion

**U-shaped Valley:**
- Glacial Erosion

**V-shaped Valley:**
- Active water erosion: Bedrock channel
**Flat-floored Valley: Depositional Flood Plain**

**Flat-floored Valley (Yampa)**

**Flat Floored Valley (Rhône)**

**Clicker Question**

- A flat-floored river valley indicates that the river
  - A. is actively eroding its valley
  - B. is actively depositing sediment
  - C. was recently glaciated
  - D. is tectonically active
  - E. has reached equilibrium

**Desert and Semi-arid (Sedimentary) Landforms**

- A *cuesta* is an asymmetric ridge in dipping sedimentary rocks such as the Flatirons.
- A *hogback* is ridge formed by near-vertical, resistant sedimentary rock. (Dakota Ridge)
- *Badlands* are areas of deeply gullied topography unsuitable for agriculture.
Cuesta

Hogback

Rock type:
A. Igneous
B. Metamorphic
C. Sedimentary

Colorado National Monument

Canyonlands
Landform Terms

- Relief
- Mountain
- Mountain Range
- Isostasy
- Valley
- Basin
- Horn
- Arête

- Alluvial Fan
- U-shaped Valley
- V-shaped Valley
- Cuesta
- Hogback
- Badlands

No Clicker Registered

- AlMehaimid, F.
- Anderson, R.
- Backus, N.
- Bardi, S.
- Berliner, L.
- Dalugdug, J.-M.
- Dordick, K.
- Duden, A.
- Jie-A-Fa, R.'
- Henesey, N.
- Huie, T.
- Ichikawa, D.
- Johnson, Brett
- Kim, D.
- Linton, R.
- Montague, W.
- Rempel, C.
- Rollins, K.
- Ruger, P.
- Slagle, C.
- Smith, R.
- Stahlman, A.
- Weinstein, J.

Unregs

- 0CA8B410
- 0CD98F9A
- 1D2596AE
- 2617C4F5
- 263F8D94
- 268143E4
- 26B264F0
- 34017A4F
- 3640A4D2
- 3641C3B4
- 38B672FC
- 38B976F7
- 39148BA6
- 395DDDB9
- 396B1644
- 39A646D9
- 39CECE39
- 3A083C0E
- 804A1CD6