The Rock Cycle: Intrusive Igneous Rock

BI201 Natural History of Guam

Class Presentation 10

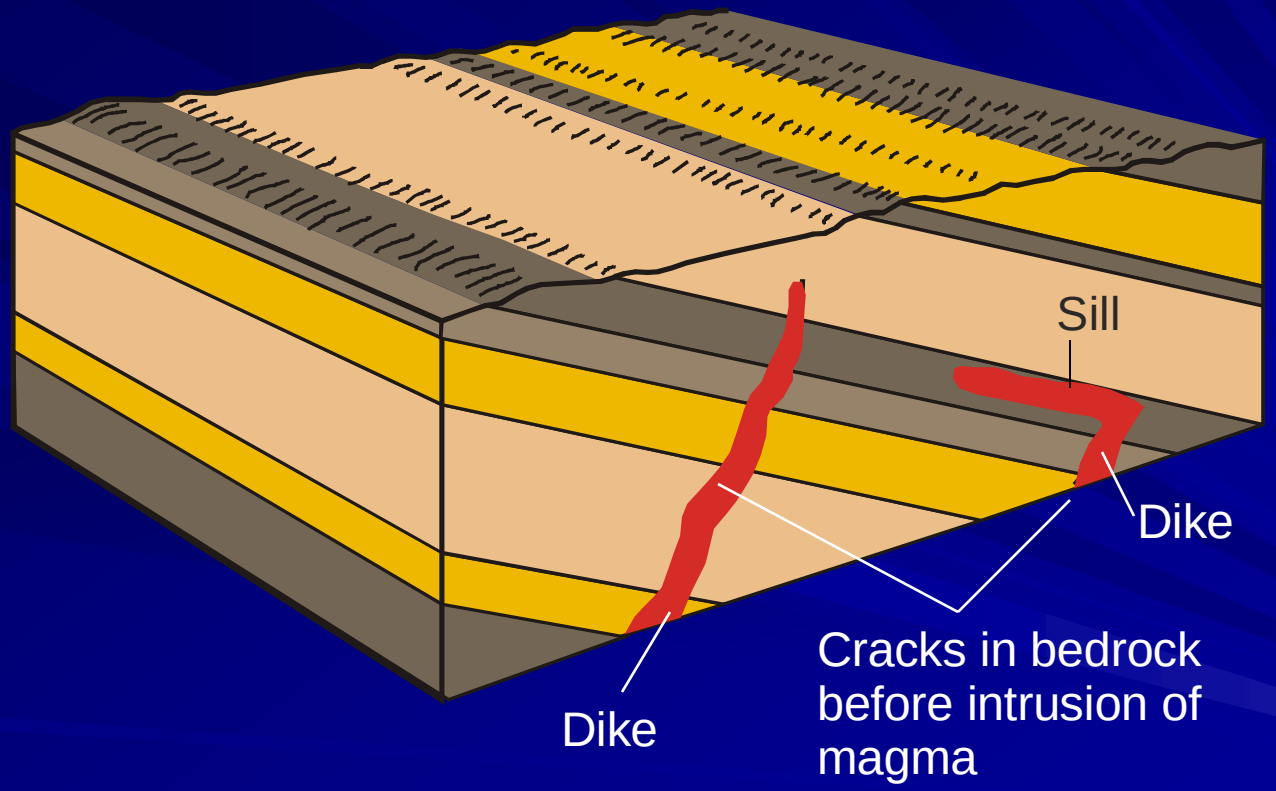
- Intrusive Igneous Rock
  - Intrusive rock is formed by magma that cooled and crystallized within the lithosphere
  - Intrusive rock is exposed only after erosion that is usually preceded by tectonic uplift

- **Intrusions**, or **intrusive structures**
  - Intrusions, also called plutons, are masses of intrusive rock
  - For example, a **volcanic neck** or **plug**
    - Volcanic necks are intrusive structures formed from magma that solidified within the throat of a volcano
    - Volcanic necks are exposed to surface when the surrounding volcanic cone is eroded away
    - They are not common in Guam

Mt. Tibrogarga near Brisbane, Australia is an example of a volcanic neck.

Devil's Tower, Wyoming probably is a volcanic neck.

- Intrusions that are more likely to be encountered in Guam are dikes and sills
  - A dike is a **tabular** [i.e., shaped like a table-top], **discordant** [i.e., not parallel to any layering in the surrounding rock] intrusive structure
  - A sill is a tabular, **concordant** [i.e., formed parallel to any planes or layering in the surrounding rock] intrusive structure


Sill
Dike
Cracks in bedrock before intrusion of magma
Dike

– A series of dikes and sills reach the surface at Facpi Point

Classification of Igneous Rocks

- **Chemical Composition:**
  - Classification of igneous rock by chemical composition is based mostly upon the total percent of silica present
  - Classification may include texture descriptions based on crystal size, but tuffs have no crystals because they cool very rapidly
  - Therefore, we usually use *light* vs. *dark* coloration for local rocks

Light → Dark → Very Dark to Green

= felsic rocks
gen. of continental origin
silica-rich
rich in potassium feldspars
not common in Guam

= mafic rocks
oceanic in origin
silica-poor
have Ca feldspars
have Mg feldspars
have Fe-bearing minerals
most common volcanics of Guam

= ultramafic rocks
originate from mantle, where magma is cooled
very silica-poor
usually deeply buried; thus, not often seen in Guam

- **Texture:**
  - Texture usually refers to the size of the grains in rock
  - In igneous rock, texture is generally noted as crystallization

- Scale of Crystallization
  - If ***cooling time*** is ***very slow***, then large crystals form in rock
    - For example, a large mass of magma under a continent may require 10s of millions of years to solidify, whereas magma under the thin crust of an island may cool and solidify within hours or days
    - Large crystals are characteristic of intrusive rocks formed in the lithosphere, and they would most likely be found in volcanic dikes or sills if found on an island
    - By definition, these would be intrusive rocks, e.g., granites, pegmatite, mica

- If cooling time is ***slow***, then very small crystals form in rock
  - Generally, these crystals are too small to see with the unaided eye
  - These small crystals do not include phenocrysts, which are formed deep in the lithosphere or upper mantle before being transported to the surface in magma
    - Therefore, you must examine the matrix of the rock, which cooled at the surface, to determine the scale of crystallization
  - These rocks are mostly extrusive rocks and volcanic flows, e.g., flow basalts and andesite

- If cooling time is fast, then there is no time for crystals to form
  - Rocks lacking crystals are called amorphic
    - Amorphic rocks have a glassy appearance
  - Amorphic rocks include volcanic tuffs, e.g., obsidian