

## I. Introduction

A. Rock Fabric = secondary planar and linear penetrative structures associated with strain.

B. Foliation: homogeneously distributed planar structure in rock

1. examples

- a. sedimentary bedding
- b. imbricate pebbles in conglomerate
- c. schistose foliation with parallel alignment of platy phyllosilicates
- d. slaty cleavage
- e. gneissic banding

C. Lineation: homogeneously distributed linear structure

1. surficial lineations: linear features on discrete surfaces only
  - a. slickenlines on fault
  - b. groove marks on sedimentary bedding plane
2. penetrative: linear features occur throughout the body of rock
  - a. hinge lines of crenulations in foliation
  - b. preferred alignment of elongate minerals

D. Primary vs. secondary features

1. primary: occur as result of sedimentary or igneous process of rock formation
2. secondary: originate as result of tectonic deformation or metamorphism

E. Other terms

1. S-surfaces: penetrative planar features designated as S1, S2, etc.
2. Rock cleavage: tendency for rock to break along surfaces of weakness
  - a. cleavage is a type of foliation in terms of rocks
3. banding: compositional zonation in rocks
4. Structural domains: units of rock with similar structural characteristics
  
5. Foliation morphology
  - a. spaced - foliations spaced at 10 um or more
  - b. continuous - fine, closely spaced foliation, < 10 um spacing.

## II. Foliation

A. Compositional Foliations

1. Defined: banding = mineralogic zonation in rock
2. Types

- a. Diffuse foliations: weakly zone mineral concentrations
- b. Banded foliations: strong compositional layering  
(1) e.g. gneisses

## B. Disjunctive Foliations

- 1. Defined: disjoined or detached foliations characterized by seams of minerals
  - a. microlithons: localized, seam-like accumulations of minerals of differing composition from rest of rock
- 2. Types
  - a. Stylolitic foliation: toothed, jagged cleavage common in limestones, and marbles
  - b. Anastomosing foliation: wavy cleavage
  - c. Rough foliation: blocky foliation
  - d. smooth foliation: e.g. slaty cleavage

## C. Crenulation Cleavage

- 1. crenulations: harmonic, small-scale chevron folds that develops in a pre-existing foliation
  - a. e.g. crenulated cleavage on a schistose foliation

## D. Continuous Foliations

- 1. continuous foliation of mineral grains at microscopic level

## E. Relationship of Foliation to Other Structures

- 1. Fold-related foliation
  - a. axial plane cleavage: foliation oriented parallel to axial surfaces of folds

## F. Nomenclature of Foliations

- 1. Slaty cleavage: fine continuous foliations characteristic of slates (comprised of finely crystalline phyllosilicates)
- 2. Phyllitic cleavage: similar to slaty, only in coarser grained phyllites
- 3. Schistosity: foliation in coarse-grained mica-rich schist
- 4. Gneissic foliation: compositional banding in gneisses

## III. Lineations

### A. Introduction

- 1. Structural lineations: preferred orientation of linear structure in rock

- a. discrete lineations: deformation of pre-existing features  
(1) e.g. lineation of pebbles, fossils etc.
      - b. Constructed lineations: lineations formed as result of deformation itself
    - 2. Mineral Lineations: preferred alignment of mineral grains in rock
  - B. Structural - Discrete Lineations (stretching of pre-existing materials)
    - 1. Examples
      - a. stretched pebbles
      - b. distorted ooids, fossils
  - C. Structural - constructed lineations (originate during deformation)
    - 1. Intersection lineation: linear fabric formed by intersection of two planar features
      - a. e.g. intersection of bedding plane ( $S_0$ ) with foliation plane ( $S_1$ )
      - b. Pencil cleavage: common in shales, breaks rock into elongate prisms
    - 2. fold-hinge lineations: microfold hinges in crenulations
    - 3. Boudins (boudinage) = "sausage"
      - a. pinching and squeezing of planar layer, may separate or remain attached by neck
      - b. common: stretching of shale layer
    - 4. Structural slicken lines
      - a. grooved striae found on slicken sides (the surface)
    - 5. Mullions: fluted elliptical columns
  - D. Mineral Lineations
    - 1. Polycrystalline Mineral Lineations
      - a. mineral streaks and alignments
    - 2. Mineral grain lineations
      - a. fibrous vein fillings
      - b. slicken-fibers (at microscopic level)
- IV. Formation of foliations and lineations

A. Primary Processes

1. Ductile flattening and elongation of rock
  - a. rock squeezing complimented by stretching at 90 degrees
    - (1) e.g. result in boudinage (pinch and swell structure)
2. Mechanical rotation
  - a. shear mechanisms rotate minerals into alignment
3. solution and precipitation
  - a. foliation via mineral mobility in rock
    - (1) mobilization of mineral components by breakdown into solutions
    - (2) e.g. stylolization
      - (a) common in limestones
        - i) comprised of calcite plus insoluble impurities (e.g. clay, carbonaceous matter)
        - ii) Riecke's principle (pressure solution)
          - a) calcite will go into solution at points of maximum compressive stress
          - b) pressure-point solution
          - c) remineralize at minimum compressive stress points
      - (b) stylolites
        - i) lines where calcite dissolved and mobilized out of system (volume loss)
        - ii) insoluble residuum accumulates along pressure-solution boundary
4. recrystallization
  - a. process of mineral transformation, recrystallization during metamorphism
    - (1) associated with attendant change in shape
      - (a) development of foliation
5. Slickensides and mineral fabric alignment
  - a. process: microscopic alignment of mineral fibers in shear-fracture

zones

- b. asprites: irregularities or rough bumps on fault surface that give rise to slickenlines via scratching.

B. Developmental stages of Foliation (with increasing tectonic pressure)

1. cleavage stage=volume loss by porosity reduction (bedding fissility) and pressure solution)
2. pencil cleavage
3. rough to moderate cleavage (handcock stage)
4. strong cleavage stage = well dev. bedding-cleavage lineations and crenulations
5. passive folding (axial planar foliation)
6. transposition (rotation of layers into parallelism with cleavage)
7. Recrystallization
  - a. preferred orientation of deformation and new minerals