# I. Structures

## *A. What are structures?*

## *B. Primary and secondary structures*

1. Primary structures
2. Secondary structures
    a) Brittle structures: fractures
    b) Ductile structures: flow

## *C. Scales of structure*

1. Microscopic
2. Mesoscopic / Outcrop scale
3. Macroscopic / Map scale
    a) Topographic and geologic maps
    b) Map scales and representative fractions
    c) Topographic profiles and cross sections
    d) Vertical exaggeration

## *D. Levels of structural analysis*

1. Descriptive/Geometric
2. Kinematic
3. Dynamic

# II. Orientation of lines and planes

## *A. Measuring orientation*

1. Basic angles
    a) Relative to north: azimuths
    b) Relative to horizontal: inclination
2. Lines
    a) Trend
    b) Plunge
    c) Recording the data
3. Planes
    a) Dip
    b) Strike
    c) Dip direction
    d) Recording the data
4. Line in a plane
    a) Rake or pitch
    b) Recording the data

## *B. Contour representations of lines and planes*

1. Topographic contours
2. Structure contours
3. Linear features on contour maps
4. Topography and structure
    a) Map patterns
    b) Cross-sections
        *Constructing a cross-section*
        *True and apparent dip*
5. Time-structure contours

## *C. Stereographic representation of lines and planes*

1. Principles
    a) Principle of stereographic (equal-angle) projection
    b) Wulff net
    c) Primitive, great and small circles
2. Basic plotting operations
    a) Plot of a line
    b) Plot of a plane and its pole
    c) Plot of a line in a plane
3. Calculations

a) **Plane common to two lines**
b) **Angle between two lines**
c) **Line perpendicular to two lines**
d) **Intersection of two planes**
e) **Plane perpendicular to two planes**
f) **Angle between two planes**

## III. Primary structures

### *A. Primary structures in sedimentary rocks*

1. **Stratification**
   a) **Map-scale units: formations, groups, members**
   b) **Outcrop-scale: bedding, lamination**
   c) **Thickness calculations**
2. **Structures generated by currents, way-up indicators**
   a) **Bedforms and cross-stratification**
   b) **Sole markings**
3. **Structures generated by soft-sediment deformation**

### *B. Primary structures in igneous rocks*

1. **Intrusions**
2. **Volcanic rocks**

### *C. Unconformities*

1. **Disconformity**
2. **Angular unconformity**
3. **Nonconformity**