Instructor: James Kellogg (7-4501), kellogg@sc.edu

Course Schedule: There will be 2 hours of lecture and supervised laboratory per week arranged to fit student schedules. Part of course may be taught as a two day weekend workshop.

Course Objectives:

This Seminar in Structural Geology course is useful for exploration geologists and geophysicists. The conservation of rock volume can be an important constraint in evaluating the feasibility of a geological interpretation. Volume-balanced cross sections are especially useful in structurally complex areas. Learn to evaluate common mistakes in structural interpretations. Construct balanced cross sections in a “hands on” workshop emphasizing the kink-bend model, fault-bend folding, and fault-propagation folding. Exercises will involve the use of Paradigm GeoSec computer software for forward modeling.

Learning Outcomes:

1. learn to evaluate the feasibility of geologic models.
2. Predict fault orientations and permeability and fracture directions.
3. Learn how to construct models of fault-bend
4. construct “volume-balanced” cross sections.
5. apply kink method to seismic interpretation.
6. Exercises will involve the use of GeoSec geologic modeling software.

Grades: Based on class participation and laboratory exercises.

Readings: Students will read selected journal articles.

Schedule of Course Topics:

1. Introduction. Regional geodynamics and petroleum systems
   a. Mountain building, space geodesy results, elastic and permanent strain
   b. Petroleum system, source, reservoir, seal, basin modeling, events chart
2. Rheology – principles of rock deformation, strain ellipsoid, principal stresses, elastic and plastic rheology, Hooke’s law, brittle and ductile deformation.
3. Fault mechanics –
   a. basic principles, Anderson’s classification, Mohr circle, Coulomb failure,
   b. fault seals and permeability
   c. fracture directionality and relation to large structures
4. **Geometric Methods**
   a. Evaluation of balanced cross sections
      i. Kink-bend method
      ii. Fault-bend folds
   b. Evaluation of balanced cross sections
      i. Fault propagation folds
      ii. Imbricate duplex structures

5. **Balanced Cross Sections**
   a. Construction of balanced cross section
   b. Regional tectonic evolution
   c. Evaluation of balanced cross sections
   d. Construction of retrodeformed section

6. **Seismic Structural Interpretation**
   a. Seismic interpretation with kink method
   b. Growth structures

7. **Case Study**
   a. Volume balancing.
      i. Apply kink method to individual data
      ii. Wrap up