Petr 571 (3cr. Hrs.)
Reservoir Geology and Reserves/Resources Assessment
Spring 2009, TR 9:30-10:45am, MSEC 376

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Office Hrs: By appointment or DB

Course Description: Basic elements of Petroleum Geology, Basic Statistics for Reserves/Resources Assessment, and the new SPE/WPC/AAPG/SPEE reserves/resources terminology/definitions.

Course Objectives:

- Understand basic geologic terminology, symbols, and classification in relation to petroleum origination, migration, and accumulation.
- Become familiar with geologic methods in the exploration and production of hydrocarbons with emphasis on structural and stratigraphic map applications and well logging.
- Develop a confidence in the application of geologic data.

Materials: Course materials will be provided.

Grading:

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<td>Project</td>
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<td>Total*</td>
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*i.e., 50% of your total grade will be determined on the Reservoir Geology portion of this course.

Course Outline:

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I. Composition of the earth/Geologic Time/Plate tectonics

i. Core, Mantle, Asthenosphere, Lithosphere
   1. Behaviors, Properties, and Composition of each
      a. Lithosphere Rocks: igneous basement, metamorphic, sedimentary
   2. Lithostatic, Hydrostatic, Geothermal gradients

ii. Plate Tectonics
   1. Convergent, Divergent, and Transform margins
   2. Subduction zones and fore-arc basins, reservoir case example
   3. Spreading zones and continental basins, more reservoir case expls.

iii. Geologic Time Scale
   1. Absolute time scale/Relative time scale
      a. Radioactive isotope dating
      b. Flora, Fauna, Strata division
   2. Wilson Cycle or Earth’s face through time
   3. How old is Petroleum?

iv. Glossary

II. Weathering/Erosion/Deposition/Lithification

i. Process of weathering
   1. Mechanical, Chemical
   2. Origination of Sediments

ii. Process of erosion
   1. Transport: Aeolian (wind), alluvial (stream), gravity, etc.

iii. Deposition
   1. Depositional environments
      a. Continental
      b. Coastal
      c. Marine
   2. Strata and Stratigraphic Column

iv. Lithification
   1. Compaction
   2. Cementation
   3. Crystallization

v. Glossary

III. Reservoir rock types/Classification/Properties/Symbols

i. Sedimentary Rocks
   1. Shale, Sandstone, Limestone
      a. Grain shape, size, sorting and textures (e.g., cross-bedding); affect on formation properties, e.g., porosity, etc.
      b. Associated map symbols

ii. Aside: Transgressions and Regressions in sedimentary column
1. Indicator for potential local HC-containing-formation pinchouts
   iii. Carbonate Reservoirs
       1. Description, Classification, Properties, History, and Occurrence
       2. Case example
   iv. Sandstone Reservoirs
       1. Description, Classification, Properties, History, and Occurrence
       2. Case example
v. Glossary

IV. Traps -- Structural/Stratigraphic

i. Seals/Caps as barriers
   1. Shales, impermeable strata
ii. Structural traps
   1. Faults and Folds
      a. Normal faults
      b. Anticlines/Synclines
      c. Anticlinal domes/Synclinal domes
iii. Stratigraphic traps
   1. Angular unconformities
   2. Pinch-out
iv. Other
   1. Salt-dome traps
v. Glossary

V. Sedimentary Basins

i. Cratonic Basins
ii. Troughs
iii. Rift-zones
iv. Strike-slip basins

VI. Hydrocarbons -- Origination/Migration/Accumulation

i. Origin
   1. Biogenic material
   2. Burial
   3. Kerogens ⇒ Hydrocarbons ⇒ Oil and Gas
ii. Migration
   1. Mechanisms
   2. Preferential movement (?)
   3. The role of subsurface waters—and how they got there
iii. Accumulation
   1. Gas on Oil on Water
iv. Unconventional HC reserves
1. Tight-gas sands, coal-bed methane
v. Glossary

VII. Geological & Geophysical Exploration Techniques
i. Geological Exploration Techniques
   1. Outcrop data
ii. Geophysical Exploration Techniques
   1. Seismic data
iii. Glossary

VIII. Surface Maps, Subsurface Maps, Stratigraphic Sections and Cross-Sections
i. Surface Maps
   1. Constructing a Geologic Map—Elements of, e.g., Contours, Symbols
ii. Subsurface Maps
   1. Isopach maps
iii. Stratigraphic Sections
   1. Markers
   2. Correlations
iv. Cross-Sections
   1. How to make a Cross-Section
v. Inferring potential reserves using all of the above
vi. Glossary

IX. Well Logs
i. Types of well logs
   1. SP logs
   2. Gamma logs
   3. Etc.
ii. Glossary

References:
