TRAINING & EDUCATION

Course Code
GE01
Course Name
Structural Styles in Oil and Gas Exploration
Instructor
Dr. İbrahim Çemen

Professional Career

Dr. Çemen is the Chair of the Department of Geological Sciences at the University of Alabama since August 2009. He is also the director of southeastern region of the Petroleum Technology Transfer Center of the American Association of Petroleum Geologists. He received his Ph. D. in Geology from the Pennsylvania State University in 1983. After a oneyear visiting assistant professor position at Ohio University, he started as an Assistant Professor at Oklahoma State University in 1984. He was awarded an early tenure and promotion to Associate Professor in 1987 and become a full professor in 1993. He was at the Middle East Technical University from August 1989 to December 1991. He also served as the Department Head at Oklahoma State University Boone Pickens School of Geology from 2001 to 2005.Dr. Çemen is a petroleum structural geologist. His major research interests are a) oil and gas exploration in sedimentary basins; b) structural styles formed in contractional, extensional and strike-slip terranes. Since 1986, he has been conducting research in determining oil and gas potential of sedimentary basins in Oklahoma and in Turkey. Since 1999, his research group has been studying the extensional basins in Western Turkey. He has authored 47 archival referred articles; edited 2 books, wrote 19 technical reports and delivered 163 presentations (57 invited). His work has been cited over 500 times in geological journals scanned by the Science Citation Index. He has received various grants and contracts totaling to over $5,000,000 from major oil and gas companies, and from federal and state funding agencies including the National Science Foundation of the United States (NSF). He taught three summer courses with TOKTEN grants in Turkey. He also spent a sabbatical in Ankara University in 1999. He was awarded the Myron Sturgeon visiting scholar award of the Ohio University in 2006 when he was on sabbatical. He is a fellow of the Geological Society of America, active member of American Association of Petroleum Geologists and member of Turkish Petroleum Geologists Association.

Course Objective and Description

- The following concepts will be introduced in this course: Importance of identifying structural styles in oil and gas exploration
- Geometry and evolution of thrust systems in fold-thrust belts
- Hydrocarbons in fold-thrust belts
- Concept of cross-section balancing
- Cross-section balancing and hydrocarbon exploration
- Construction of balanced structural cross-sections in fold-thrust belts
- Geometry and evolution of structures in extended terrains
- Hydrocarbons in extended terrains
- Construction of balanced cross-sections in extended terrains
- Geometry and evolution of structures associated with strike-slip deformation
- Hydrocarbons in strike-slip basins
- Can strike-slip faults and associated structures be balanced?
- Identifying structural styles on maps, cross-sections, and seismic profiles
- Geometric characteristics of structural inversion
- Identifying inverted structures on seismic profiles

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Who Should Attend

Exploration geologist working in structurally complex areas, such as fold-thrust belts, foreland, extensional, rift and strike-slip basins

Prerequisite

Basic knowledge of structural geology

Learning Level

Post undergraduate

Duration

5 days

Course Material

Notes prepared by the instructor

Course Outline

Day One

- Introduction the course
- Importance of identifying structural styles in oil and gas exploration
- Overview of structural styles approach
- Structural geometry in fold-thrust belts
    - o Thrust system linkages
    - o Folds in thrust belts
    - o Folds in thrust belts
- Sand box and clay cake experiments
- Role of pore pressure in thrust faulting
    - o Structural zonation
    - o Imbricate thrust faults, duplexes and triangle zones
- Exercise
- Seismic expression of fold-thrust belts, examples from the Ouachita
- Mountains, southern Oklahoma and Arkansas

Day Two

Concept of cross-section balancing

- Section balancing and hydrocarbon exploration
- Assumptions of cross-section balancing
- Classical and modern methods of cross-section balancing
    - o Bed length balancing
    - o Area Balancing
    - o Key-bed balancing
    - o Suppe's fault-bend folding theory and kink bend balancing
- Exercise
    - o Construction of balanced cross-sections.
    - o Use of structural software to construct balanced structural cross-sections in fold-thrust belts

Day Three

- Thrust systems in three-dimensions
- Tear faults, lateral ramps and oblique ramps
- Oil and gas potential of fold-thrust belts
- Exercise
    - o Construction of balanced cross-sections (Continued)
    - o Use of structural software to construct balanced structural cross-sections in fold-thrust belts

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Day Four

- Extensional structures
- Geometry of extensional structures
- Classic clay cake experiments of crustal extension
- Listric (Curving) faults and rollover (Accommodation) folds
    - o Modern Experiments of crustal extension
    - o Growth faults
    - o Extensional faults in three dimensions
    - o Listric fans, transfer (Accommodation) faults, and polarity switches
    - o Oil and gas potential of extensional structures
- Exercise
    - o Seismic expression of extensional structures, examples from the Basin-Ranges southwestern U.S.A.
    - o Construction of balanced cross-sections in extended terrains.
    - o Use of structural software to construct balanced structural cross-sections in extended terrains

Day Five

- Strike-slip (Wrench) structures
- Strike -slip faulting and associated structures
- Strike-slip duplexes, pull-apart basins (Divergent zones)
- Push-ups (Convergent zones) and flower structures
- Classical and modern clay cake and sand box experiments of strike-slip
- Faulting and associated structures
- Strike-slip faults of the fold-thrust belts and extended terrains
- Can strike-slip faults and associated structures be balanced?
- Oil and gas potential of strike-slip faults and associated structures
- Exercise
    - o Examining strike-slip structures on seismic profiles, examples from
    - o California and southern Oklahoma, U.S.A
    - o Seismic expression of strike-slip faults and associated structures
    - o Identifying structural styles on seismic lines

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