Sequence Stratigraphy of Sandstone Reservoirs
(Using Logs, Seismic, Core and Outcrop Data)

Instructor: Riyadh Rahmani Ph.D

4 - 8 September 2017

Bandung

WHO SHOULD ATTEND
The course is aimed at exploration and development geologists, geophysicists, petrophysicists, log analysts and reservoir engineers.

COURSE OBJECTIVE
The course provides attendees with detailed knowledge and a thorough coverage of the basic and advanced principles, practices and applications of Clastic Sequence Stratigraphy. The lectures and practicals covered in this course should help earth scientists develop their own sound models for the stratigraphic correlation and prediction of reservoir distribution.

WHAT PARTICIPANTS EXPECT TO LEARN
Coming out of this course you should be able to place sandstone reservoirs in chronologic perspective within the spectrum of genetically related facies (i.e. a sequence stratigraphic context) and develop predictive models for the exploration and characterization of the reservoir under study. By the conclusion of the course it is expected that all participants should:

- At least have acquired a working knowledge of basic principles and practices of clastic sequence stratigraphy.
- With the aid of regional high resolution seismic and application of sound sequence stratigraphic principles arrive at a general picture of the type and style of basin sedimentary fill and tectonic history.
- Using wireline logs, and with help from detailed sedimentological core descriptions be able to recognize facies tracts, parasequences and their stacking patterns.
- Construct detailed stratigraphic cross sections, using log and core facies descriptions with the aid of sound sequence stratigraphic practices. With the aid of sedimentological core descriptions, you should be able to recognize sequence boundaries, flooding surfaces and the various systems tracts. When correlating these entities from well to well a clear and logical picture should emerge concerning the depositional history of the area concerned.
- Be able to breakdown a complex stratigraphy into its genetically related units; the sequences.
- Map the spatial distribution of the genetic units and understand their temporal succession.
- Predict distribution of source, seal and reservoir rocks in frontier and mature basins.
- Understand the architecture and plumbing of the reservoir rocks by following sound concepts of sequence stratigraphy.

COURSE OUTLINE
SECTION I: PRINCIPLES & CONCEPTS
What is Sequence Stratigraphy?
Power of Sequence Stratigraphy
Introduction & Historical Perspective
Major Controls on Depositional Sequences
- Sediment Accommodation
- Sediment Supply
- Effects of Basin Type & Physiography
Effects of Other Controls on Depositional Sequences
- Influence of Climate
- Influence of Tectonics
Sediment Volumetric Partitioning
Concept of Base Level
Transgression & Regression
- Transgression
- Regression
  - Normal Regression
  - Forced Regression
Concept of Shoreline Trajectory
Lithostratigraphy vs Sequence Stratigraphy
Stratal Terminations
Stratigraphic Contacts & Surfaces
- Base Level Rise Surfaces
  1. Maximum Regressive Surface (MRS)
  2. Ravinement Surface (Transgressive Surface)
  3. Maximum Flooding Surface (MFS)
- Base Level Fall Surfaces
  1. Subaerial Unconformity & Its Correlative Conformity (CC)
  2. Basal Surface of Forced Regression
Sequence Boundaries (SBs)
- Recognition
  1. Type I Sequence Boundary
  2. Type II Sequence Boundary
Parasequences
- Definition & Parasequence Development
- Stacking Patterns
Parasequence Sets & Boundaries

**Sequences**
- Definitions
- Type I Sequence
- Type II Sequence

**Systems Tracts**
- Falling Stage Systems Tract - Forced Regression (FSST)
- Lowstand Systems Tract (LST)
- Transgressive Systems Tract (TST)
- Highstand Systems Tract (HST)

**Sequence Models**
- Exxon Model
- Posamentier Model
- Hunt & Tucker Model
- Genetic Sequence Model (Galloway)
- T-R Sequence Model (Embry)

**Sequence Duration & Driving Mechanism**

**Sequence Hierarchy**

**Sequence Stratigraphic Tools**
- Seismic Data
- Well Log Data
- Core Data
- Outcrop Data

**Log Suites Used In Sequence Stratigraphy**
- GR Logs, SP Logs, Density-Neutron, Sonic, Resistivity
- Interpreting Parasequence Stacking Patterns from Well Logs
- Recognizing Significant Stratigraphic Surfaces from Logs
- Systems Tracts Recognition from Well Log Patterns

**Sequence Stratigraphic Correlation Techniques**

**Checklist for Sequence Stratigraphic Interpretation of Well Logs**

**Pitfalls & Ambiguities in Sequence Analysis of Log Data**

**SECTION II: APPLICATIONS TO DEPOSITIONAL SYSTEMS**

**Definition**

**Walther’s Law**

**Fluvial Systems**
- Fluvial processes & Channel Types
- Key parameters of Channel Types
- Allogenic Control on Fluvial Processes
- Fluvial Response to Base Level Fluctuation
- Vertical Changes in Fluvial Architecture in Response to Base Level Fluctuation
- Fluvial vs Shoreface Architecture in Response to Base Level Fluctuation
- Vertical Changes in Fluvial Channel Architecture through a Full Sea Level Cycle
Defining Features of Low & High Accommodation Fluvial Systems Tracts

**Coastal & Shallow Marine Systems**
- Deltas & Strandplains Depositional Systems
- Estuaries, Incised Valley Fills & Transgressive Barrier Systems
- Tidal Depositional Systems
- Wave-Storm Dominated Coastal Shallow Marine and Shelf Systems

**Deep Marine Systems**

**CASE STUDIES**
Principles and applications discussed above will be reviewed using worked-out case studies conducted by the instructor and from published literature.

**PRACTICAL EXERCISES**
Sets of basic exercises will be handed out to course participants after each major topic to be worked out (solved) by groups of twos or threes, depending on the size of the class. These practical exercises range from geophysical log correlations supported by rock data to using 2D and 3D seismic sections to interpret general and detailed correlation and sequence stratigraphic interpretation of reservoir, source and seal rocks.

**REFERENCE MATERIAL**
An exhaustive and complete list of published research papers on practical aspects of seismic and sequence Stratigraphy of sandstone reservoirs will be handed to course participants on a DVD or a USB storage device. The articles are in a PDF format ad total about 2GB.

**INSTRUCTOR BIOGRAPHY**
Riyadh (Ray) A. Rahmani is a consulting petroleum geologist and President of **RRC Petroleum Geological Consulting** in Victoria, Canada. He holds a PhD in Geology (1973) from the University of Alberta, Edmonton, Canada. Riyadh has 39 years of worldwide experience with the petroleum industry (Canada, USA, North & East Africa, and the Middle East) and government geological surveys. He has previously worked with RAK Gas (Ras Alkhaimah, UAE), Crescent Petroleum (Sharjah, UAE), Saudi Aramco (Saudi Arabia), Sirte Oil (Libya), Canadian Hunter Exploration, Alberta Geological Survey, Kuwait Institute for Scientific Research, Geological Survey of Canada, and Shell Canada. He is a member of the AAPG, IAS and SEPM.

Dr. Rahmani has conducted numerous outcrop and subsurface-based regional and field scale sequence stratigraphic and facies studies of clastic reservoirs in petroleum basins of a variety of tectono-stratigraphic settings that span the entire Phanerozoic. His fields of interests are clastic reservoir characterization, sedimentology, sequence stratigraphy and basin analysis.

Dr Rahmani has taught sedimentology and sequence Stratigraphy of sandstone reservoirs since 1973 both in the classroom and in field seminars to his employers' staff.
and society conferences and meetings, in Canada and worldwide. As a consultant, for the past eight years, he has taught these subjects both as public courses & private in house seminars to petroleum professionals in Indonesia, Egypt and Canada.

ENROLLMENT
In order to allow sufficient time for arranging travel plans, early enrollment is recommended. Registration will be closed on 2 August 2017. Late enrollment may result in course cancellation.

CANCELLATION, SUBSTITUTION & REFUND
The tuition fee will be refunded (less US$ 100 registration fee) only if notification of cancellation is received at least 10 days prior to the commencement. Non payment of tuition fee does not constitute automatic cancellation of participation. Substitution may be made at any time for those enrolled.

CERTIFICATE
A certificate of participation will be awarded to each person completing the course.

TUITION FEE
Tuition fee at Rp. 39,000,000 + 10% VAT per delegate (the tuition fee will be adjusted based on the prevailing rate) is due and payable upon confirmation of enrollment. The fee is excluded accommodation. Payment should be settled at the latest on 2 August 2017. Any bank charges connected with payment in Rupiah must be added to tuition fee payment. Tuition fee includes admittance to the course, course materials, daily refreshments and full lunch.

Payment can be transferred to PT. Geoservices
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