

## **OVERVIEW OF THE SUBSURFACE PETROLEUM GEOLOGY OF NORTHERN SOUTH AMERICA: FROM MATURE ONLAND SUPERGIANTS TO OFFSHORE FRONTIERS**

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**Duration:** 16 hours (2 days)

### **Who should take this course?**

- 1) Higher- and mid-level management at major companies pondering the question of where future giant fields may be located in northern South America. Venezuela is the world's fifth largest reserve of hydrocarbon and the region
- 2) Entry-level explorationists at major or smaller companies and independent consultants faced with the task of quickly "getting up to speed" in this large and geologically complex region.

### **Course benefits**

This course will focus on the subsurface geology of Venezuela and Trinidad and their offshore areas. The fast pace of the oil industry makes it unlikely for many explorationists to have the time or inclination to think in global terms about common habitats and controlling factors for oil and gas in this region. This course will help participants understand the present distribution of oil and gas at basin- to continent-wide scales and to become aware of commonly recurring tectonic, structural and stratigraphic factors in their formation.

### **Course materials and products:**

1) Compiled notes by the instructors in hardcopy and digital 2) Materials for morning and afternoon exercises (seismic lines, wells, etc.)

#### 1) INTRODUCTION AND OBJECTIVES OF COURSE (PM)

- (a) Instructor and student introductions
- (b) Course objectives
- (c) Handouts and screensaver demos

#### 2) TECTONICS AND HYDROCARBONS IN THE CARIBBEAN AND GULF OF MEXICO REGION (PM)

- (a) Hydrocarbon significance of northern South America

- (b) Plate tectonic animation of the Gulf of Mexico-Caribbean from Jurassic to recent showing giant fields through time
- (c) Summary of main periods of Caribbean tectonic history: Pangea assembly, Jurassic rifting, Cretaceous passive margins, Cenozoic foreland basins, Cenozoic strike-slip margins
- (d) Alternative tectonic models for Gulf of Mexico and Caribbean evolution
- (e) Discussion and questions

3) **RECOGNIZING BASIN TYPES ALONG CARIBBEAN PLATE BOUNDARIES AND ASSESSING THEIR HYDROCARBON POTENTIAL**

- (a) Previous basin classifications
- (b) Classification we use
- (c) Hydrocarbon preservation potential of various basin types
- (d) Discussion and questions

**Exercise 1: Recognizing major basin types and their hydrocarbon potential**

4) **OVERVIEW OF TECTONICS AND BASIN GEOLOGY OF NORTHERN SOUTH AMERICA (AE)**

- (a) History of oil exploration in Venezuela and Trinidad
- (b) Summary of basin types and hydrocarbon reserves
- (b) History of oil exploration in Venezuela and Trinidad
- (c) Level of understanding of onshore vs. offshore basins
- (d) Data sources used for reconstructions and basin geology
- (e) Plate tectonic animation of northern South America
- (f) Paleogeographic evolution of northern South America

5) **MARACAIBO BASIN OF WESTERN VENEZUELA (AE)**

- (a) Basin framework
- (b) Jurassic rift structures
- (c) Passive margin history
- (d) Foreland basin history
- (e) Andean history
- (f) Quick summary of sources and reservoirs through time of major producing fields

**Exercise 2: Recognizing major tectonic events in the Maracaibo basin and understanding their implications for hydrocarbon trapping and secondary migration**

6) **BARINAS AND GUARUMEN FORELAND BASINS (AE)**

- (a) Basin framework
- (b) Passive margin history
- (c) Foreland basin history
- (d) Andean history
- (e) Quick summary of sources and reservoirs through time of major producing fields

7) EASTERN VENEZUELAN BASIN AND HEAVY OIL BELT (AE)

- (a) Basin framework
- (b) Jurassic rift structures
- (c) Passive margin history
- (d) Foreland basin history
- (e) Quick summary of sources and reservoirs through time of major producing fields including the Heavy Oil Belt

**Exercise 3: Recognizing major tectonic events in the Eastern Venezuelan basin and understanding their implications for hydrocarbon trapping and secondary migration**

8) TRINIDAD AND COLUMBUS BASIN (PM)

- (a) Basin framework
- (b) Passive margin history
- (c) Foreland basin history
- (d) Quick summary of sources and reservoirs through time of major producing fields

**Exercise 4: Intersection fault families in the Columbus basin and their controls on oil and gas fields**

9) ACTIVE STRIKE-SLIP MARGIN AND RELATED BASINS (PM)

- (a) Earthquakes
- (b) Onland fault traces and morphology
- (c) Bocono fault and Merida Andes
- (d) Venezuelan Andes and coastal faults
- (e) Cariaco pull-apart basin
- (f) El Pilar fault
- (g) Paria pull-apart basin
- (h) Active faults in Trinidad
- (i) Active faults in eastern offshore Trinidad

10) STRUCTURE AND STRATIGRAPHY OF ULTRADEEP AREAS OF OFFSHORE VENEZUELA (AE)

- (a) Venezuelan basin
- (b) South Caribbean deformed belt

11) STRUCTURE AND STRATIGRAPHY OF DEEPWATER AND COASTAL BASINS OF VENEZUELA (AE)

- (a) Dutch Antilles and Aves Ridges
- (b) Bonaire and Falcon basins

**Exercise 5: Recognizing offshore regions and hydrocarbon indicators on deepwater seismic data and their significance for offshore exploration**

- (c) Grenada and Tobago basins

12) THE BARBADOS ACCRETIONARY PRISM: IS IT PROSPECTIVE (PM)

- (a) Plate reconstructions
- (b) Main prism provinces
- (c) Barbados as a window into the prism geology
- (d) Hydrocarbons on Barbados
- (e) The Shady Lane well near Barbados

13) EFFECTS OF STRIKE-SLIP OFFSETS BETWEEN THE CARIBBEAN AND SOUTH AMERICAN PLATES AND THE DISTRIBUTION OF CENOZOIC FLUVIAL-DELTAIC AND DEEPWATER CLASTIC SEDIMENTS (AE)

- (a) Isochron maps
- (b) Plate reconstructions
- (c) Grenada-Tobago link to the Maracaibo basin
- (d) Discussions, questions, demo of flyover

14) MAJOR CONTROLS ON SOURCE AND RESERVOIR ROCKS (AE)

- (a) Onland foreland basins: Maracaibo, Barinas, Guarico, EVB
- (c) Coastal and onshore basins: Bonaire, Falcon,

15) MAJOR CONTROLS ON SOURCE AND RESERVOIR ROCKS (PM and AE)

- (a) Offshore foreland basin: Columbus
- (b) Strike-slip basins: Cariaco, Paria, Darien Ridge
- (c) Barbados accretionary prism
- (d) Arc-related basins: Grenada, Tobago

**Exercise 6: Finding creative yet constrained solutions to explain the possible occurrence of widespread hydrocarbons in the Barbados prism. Recognition of exploratory targets offshore northern South America.**

16) REVIEW OF MAIN POINTS OF COURSE AND WRAPUP DISCUSSION SESSION

COURSE EVALUATIONS