Geoscience Careers in The Petroleum Industry
Who Am I?

- **My Work History:**
  - ExxonMobil Research Geoscientist – 32 years
  - Contractor/Visiting Lecturer – 2 years
  - Noble Energy Sr. Geological Advisor – 3½ years

- **My Education:**
  - B.S. in Engineering Physics – Lehigh U, Bethlehem PA
  - M Phil & Ph.D. in Marine Geology – Columbia U, NYC, NY

- **Today’s Goal:**
  - Give you an Overview of how we use Geoscience to answer critical questions in the Petroleum Industry
Your Career Path

Course Work
MS or PhD Thesis
GRADUATION

Academia
Government
Industry

• Oil & Gas
• Coal
• Mining
• Water
• Environmental
• Etc.
A Major Geoscientist Employer

The Petroleum Industry

- O&G Companies
  - Mega Internationals
  - Small Independents
- Service Companies
- Private Consultants
A Petroleum Industry’s Asset

- An ASSET is a useful or valuable thing, person, or quality

- For an oil & gas company, an asset is an oil field or gas field that is capable of making money

- An asset has a life cycle, just as I do
  - Beginning of life
  - Youth
  - Middle age
  - Retirement
A Field’s Lifecycle

Obtain a License to Explore

Discover HCs

Bring Field Online

Deplete the HCs

Abandon the Field
Our Work in a Nutshell

Geoscientists help management make good business decisions:

– Collect & analyze data
– Develop an understanding of the subsurface
– Determine the implications for oil/gas

Much of our work is about making predictions:

– Which blocks hold the greatest HC potential?
– Will I find an economic amount of oil at location X?
– How much oil will I recover with 5 wells?
– Can I increase production with 2 injector wells?
Some Key Questions

In the EXPLORATION phase
- Which basins should we work?
- Which blocks should we bid on?
- Where should we drill on our blocks?
- What might we find?

In the DEVELOPMENT phase
- Should we develop this field?
- Where are the sweet spots?
- How can we get the most HCs out?
- Will we make money?

In the PRODUCTION phase
- What still remains?
- How can we get maximum production?
- How can we save money?
- When should we walk away?
A Look at Exploration

Identify Opportunities

Acquire More Data

Capture Prime Areas

Process Seismic Data

Assess Prospects

Drill a Wildcat Well

Success

Delineation Well(s)

Failure

Uneconomic

Success

To Development Or Production

Drop Prospect
What We Need for a Success

A Rube Goldberg View of a Hydrocarbon System

“A Kitchen” Where Organic Material Is Cooked

“Plumbing” To Connect the Container to the Kitchen

Correctly Placed Wells

A “Container” From Which Oil & Gas Can Be Produced

Reservoir Trap Seal

Migration

Source

FWSchroeder
**Source of Oil & Gas**

Plant or Animal Remains + Time + Temperature + Pressure = Oil & Gas Molecules

- Sugar: $C_6H_{22}O_{11}$
- Methane Gas: $CH_4$

**Source of Oil & Gas**
Questions?

- Which sediment layers have a lot of organic matter – plant or animal remains?
- Have these layers been “cooked” enough so we have generated oil or gas molecules?
- If they have, in which direction did the oil or gas molecules move?
Are There Any Traps?

- Are there any porous layers – like a sponge – to hold the HCs?
- Do the porous layers have a geometry such that they can “pool” enough oil and gas to form a field?
- Is there a sealing rock layer to act as a “ceiling” keeping the oil or gas trapped in the “pool?”
Some Examples of Traps

Sandstones “bend” into a fault; oil is trapped in the highpoint of the “bend”

A large salt body has “squeezed” up at this location and “dragged” sandstones with it; oil & gas are trapped against the salt body
Migration – Oil Movement

- Traps
- Seal
- Reservoirs
- Source
If Everything Works!

✅ Source
✅ Migration
✅ Reservoir
✅ Trap
✅ Seal

A Discovery

Guyana oil jackpot: ExxonMobil has made its 13th discovery offshore

Geoscience in Petroleum Industry

• Regional Geology
  – Provides an understanding of which areas are productive, why they are productive, and where else we should look.

• Geology
  – Analysis of cores, logs, analogues and databases to understand the geology where we operate.

• Basin Modeling
  – Quantitative integrated models of the petroleum system.

• Geophysics
  – Provides an image of the subsurface and data useful for predicting rock type and the occurrence of petroleum.

• Structural Geology
  – Provides an understanding of the process of deformation of the subsurface due to external forces.

• Stratigraphy
  – Provides an understanding of processes creating sedimentary units.

• Geochemistry
  – Chemistry of petroleum and its sources to characterize the type, history and origin of petroleum.

• Reservoir Characterization
  – Describes the flow characteristics and attributes of subsurface reservoirs for enhanced exploitation.

PLUS a whole lot more
What Industry Is Looking For

- Love For Challenges
- Ability To Integrate Knowledge Across Technical Areas
- Good Communication Skills
- Leadership Abilities
- Good Interpersonal Skills
- Ability To See The “Big Picture”
- Can Assimilate And Embrace New Technology
- Can Apply Geoscience Skills Across The Business
- Can Develop Into A Technical Expert

Courtesy of ExxonMobil
Career Path

Ongoing Experience

Technical Breadth / Depth / Experience / Responsibility Impact

Courtesy of ExxonMobil
**OBJECTIVE**: Walk through the exploration process to illustrate the exploration process starting prior to a lease sale, simulating a bidding round, maturing a prospect, and showing how a wildcat well would be presented to management.

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Send an e-mail to Heather Hodge to register at hhodges@aapg.org
Questions?