

AV Transcending Geoscience Paradigms for Exploration Opportunity Growth*

Carlos A. Dengo¹

Search and Discovery Article #110171 (2014)**

Posted May 19, 2014

*Adapted from oral presentation at Discovery Thinking Forum, AAPG Annual Convention and Exhibition, Houston, Texas, April 6-9, 2014

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Key Points

Opportunities grow as the circumference of knowledge.

Examples of change of paradigm

- Pre-salt play

- Continental carbonate reservoirs

Fundamental questions

- Identification of new HC sources

- Basin formation, filling, and evolution

- Rock properties

- Fluids present

- Optimal fluid production

Human creativity and technology

Selected References

Beasley, C.J., J.C. Fiduk, E. Bize, A. Boyd, M. Frydman, A. Zerilli, J.R. Dribus, J.L.P. Moreira, and A.C. Capeleiro Pinto, 2010, Brazil's presalt play: Oilfield Review, Schlumberger, v. 22, p. 28-37.

http://www.slb.com/~media/Files/resources/oilfield_review/ors10/aut10/03_presalt.pdf (website accessed May 2, 2014).

Blenkinsop, T., and A. Moore, 2013, Tectonic geomorphology of passive margins and continental hinterlands: Treatise on Geomorphology, Elsevier, v. 5, p. 71-92.

Donovan, A. D., T. S. Staerker, A. Pramudito, W. Li, M. J. Corbett, C. M. Lowery, A. M. Romero, and R. D. Gardner, 2012, The Eagle Ford outcrops of West Texas: A laboratory for understanding heterogeneities within unconventional mudstone reservoirs: GCAGS Journal, v. 1, p. 162–185.

Gardner, R.D., M. C. Pope, M.P. Wehner, and A.D. Donovan, 2013, Comparative stratigraphy of the Eagle Ford Group strata in Lozier canyon and antonio creek, Terrell County, Texas: GCAGS Journal, v. 2, p. 42-52.

Harris, P.M., J. Ellis, and S.J. Purkis, 2013, Assessing the extent of carbonate deposition in early rift settings: AAPG Bulletin, v. 97, p. 27-60.

Péron-Pinvidic, G., and G. Manatschal, 2009, The final rifting evolution at deep magma-poor passive margins from Iberia-Newfoundland: A new point of view : International Journal of Earth Science, v. 98/7, p. 1581-1597.

Péron-Pinvidic G., G. Manatschal, S.M. Dean, and T.A. Minshull, 2008, Compressional structures on the west Iberia rifted margin: Controls on their distribution : Geological Society, London, Special Publications 306, p. 169-183.

Pratt, W.E., 1952, Toward a philosophy of oil-finding AAPG Bulletin, v. 36, p. 2231-2236.

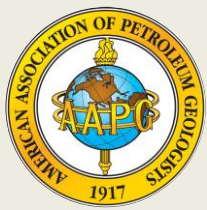
Halbouty, M.T., 1980, Methods used, and experience gained, in exploration for new oil and gas fields in highly explored (mature) areas: AAPG Bulletin, v. 64, p. 1210-1222.

Wright, V.P., 2012, Lacustrine carbonates in rift settings: The interaction of volcanic and microbial processes on carbonate deposition: Geological Society of London, Special Publications, v. 370, p. 39-47.

Website

EIA, 2011, North American shale plays,

https://www.google.com/search?q=eia+unconventional+gas+basins+map&biw=1280&bih=915&tbm=isch&imgil=RdV7tB4JFfg0kM%253A%253Bhttps%253A%252F%252Fencrypted-tbn3.gstatic.com%252Fimages%253Fq%253Dtbn%253AANd9GcRjoWiTnKw7IYwiiB-bO2vqf6guQblZnXlwZr2yymCmbUsw4y6ZIA%253B2200%253B1300%253BF4dJCO-f7kxeXM%253Bhttp%25253A%25252F%25252Fwww.rigzone.com%25252Ftraining%25252Finsight.asp%25253Finsight_id%2525253D346%25252526c_id%2525253D4&source=iu&usq= WL7a3jcn5ac64ytSE9NsXm59Ieo%3D&sa=X&ei=m2BkU9i_N-Xy8QHL_4CoAg&ved=0CCwQ9QEwAg#facrc=_&imgdii=_&imgrc=D0DaGWuqOZGGYM%253A%3Bss0CAwAn-upLAM%3Bhttp%253A%252F%252Fwww.eia.gov%252Foil_gas%252Frpdp%252Fnorthamer_gas.jpg%3Bhttp%253A%252F%252Fwww.eia.gov%252Fnaturalgas%252F%3B1650%3B1275 (website accessed May 2, 2014).



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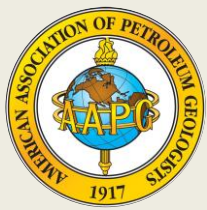
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College of Geosciences





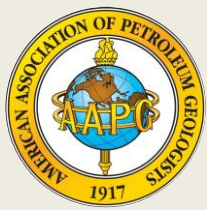
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UNIVERSITY

The Michel T. Halbouty Geosciences Building

GEOLOGY

GEOPHYSICS

ExxonMobil

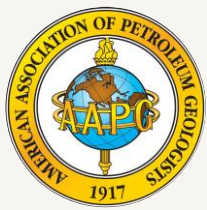


“Fundamentally the human brain is the most powerful tool in exploration” (D. Lawrence, 2011)

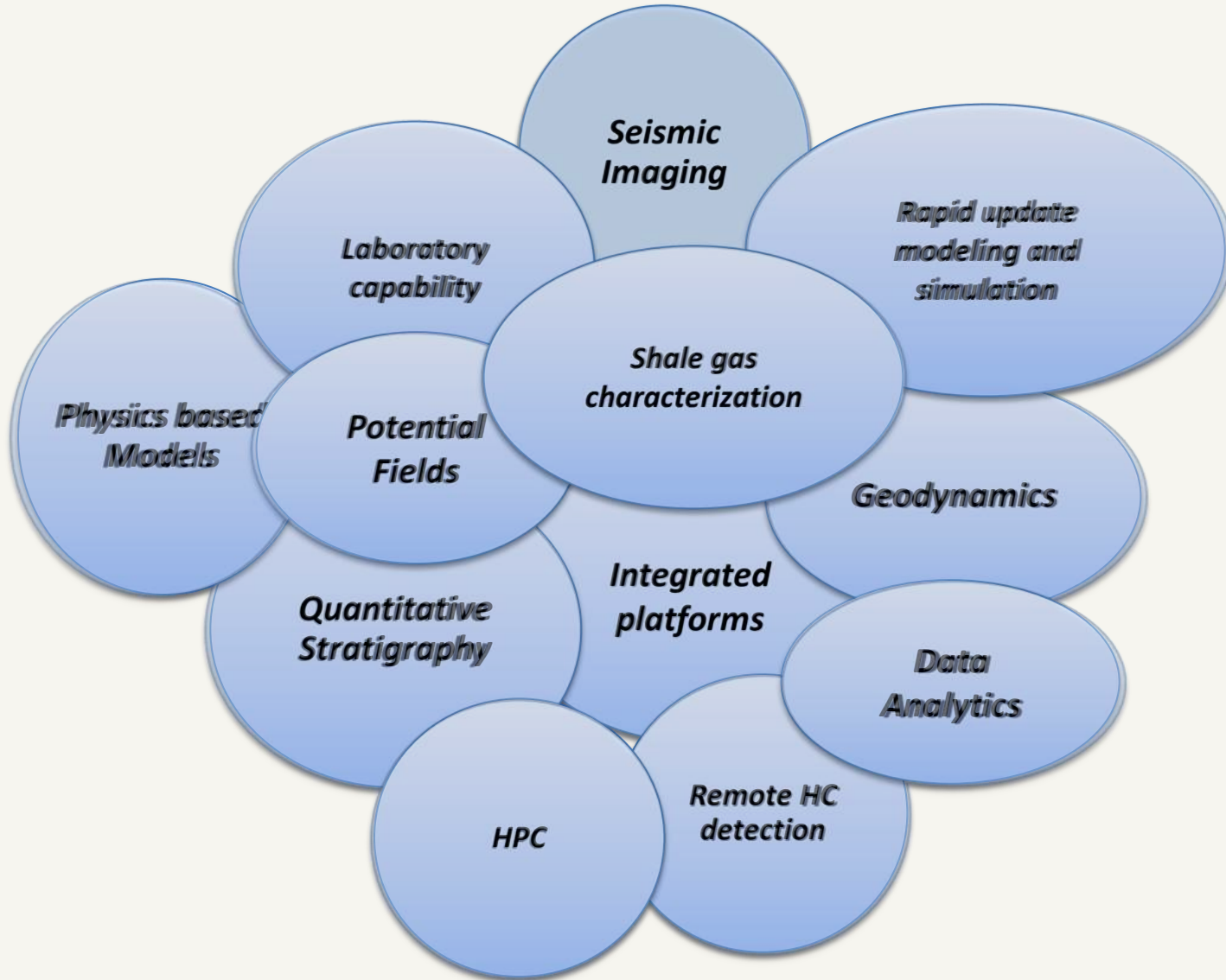
“Economic competition in the flat world will be more equal and more intense...the most important attribute you can have is creative imagination” (T. Friedman, 2005)

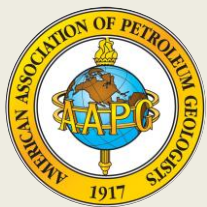
“Where oil is first found, in the final analysis, is in the minds of men” (and women) (W. Pratt, 1952).

“Mental inflexibility is the greatest hurdle to overcome to finding oil” (W. Pratt)

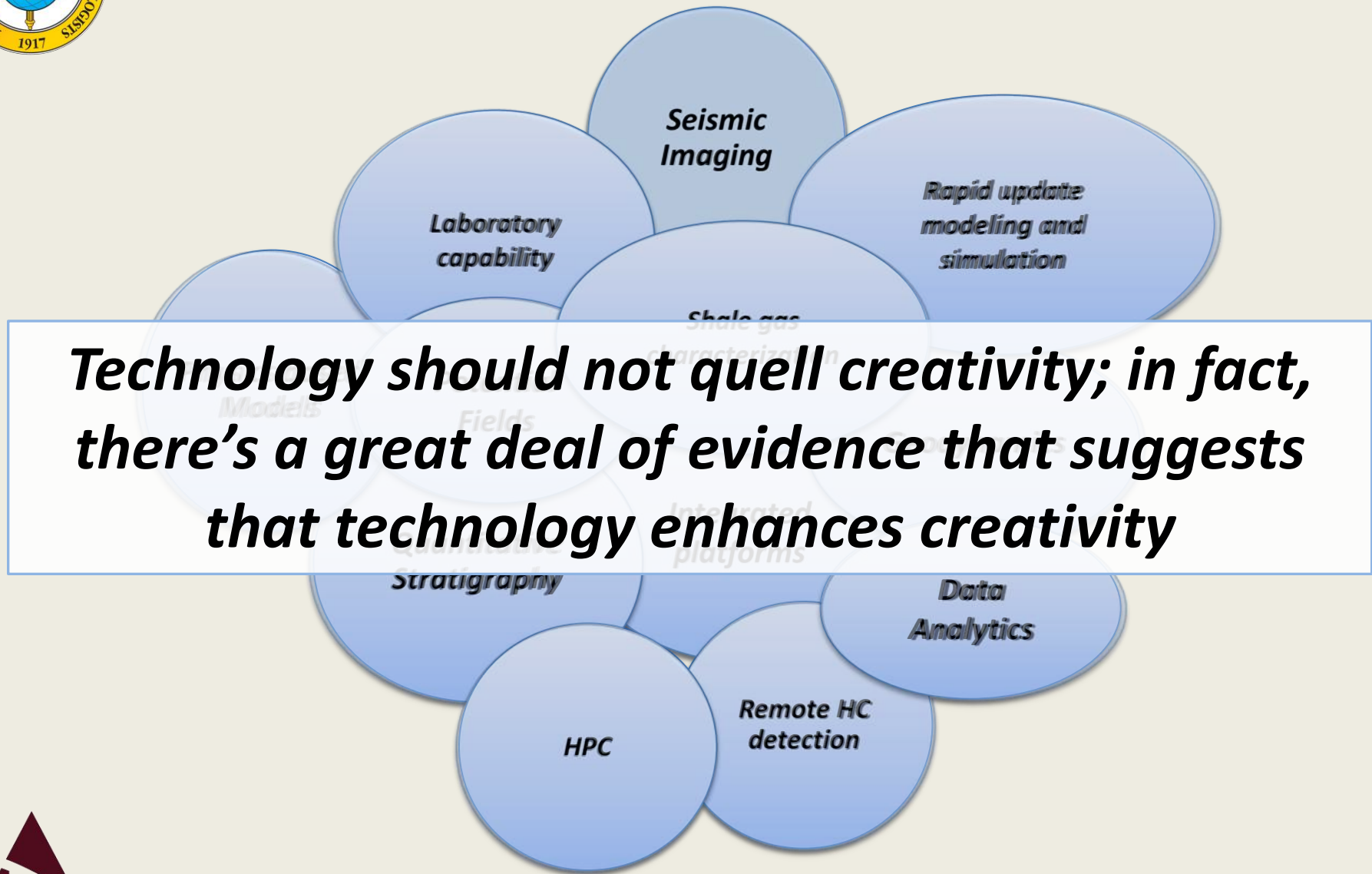


Technology Enables New Plays

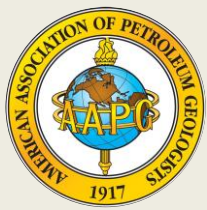




Technology Enables New Plays



Technology should not quell creativity; in fact, there's a great deal of evidence that suggests that technology enhances creativity

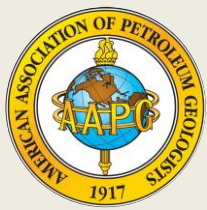


From Data to Wisdom

*"There can be no WISDOM
without UNDERSTANDING
And no UNDERSTANDING
without KNOWLEDGE "*

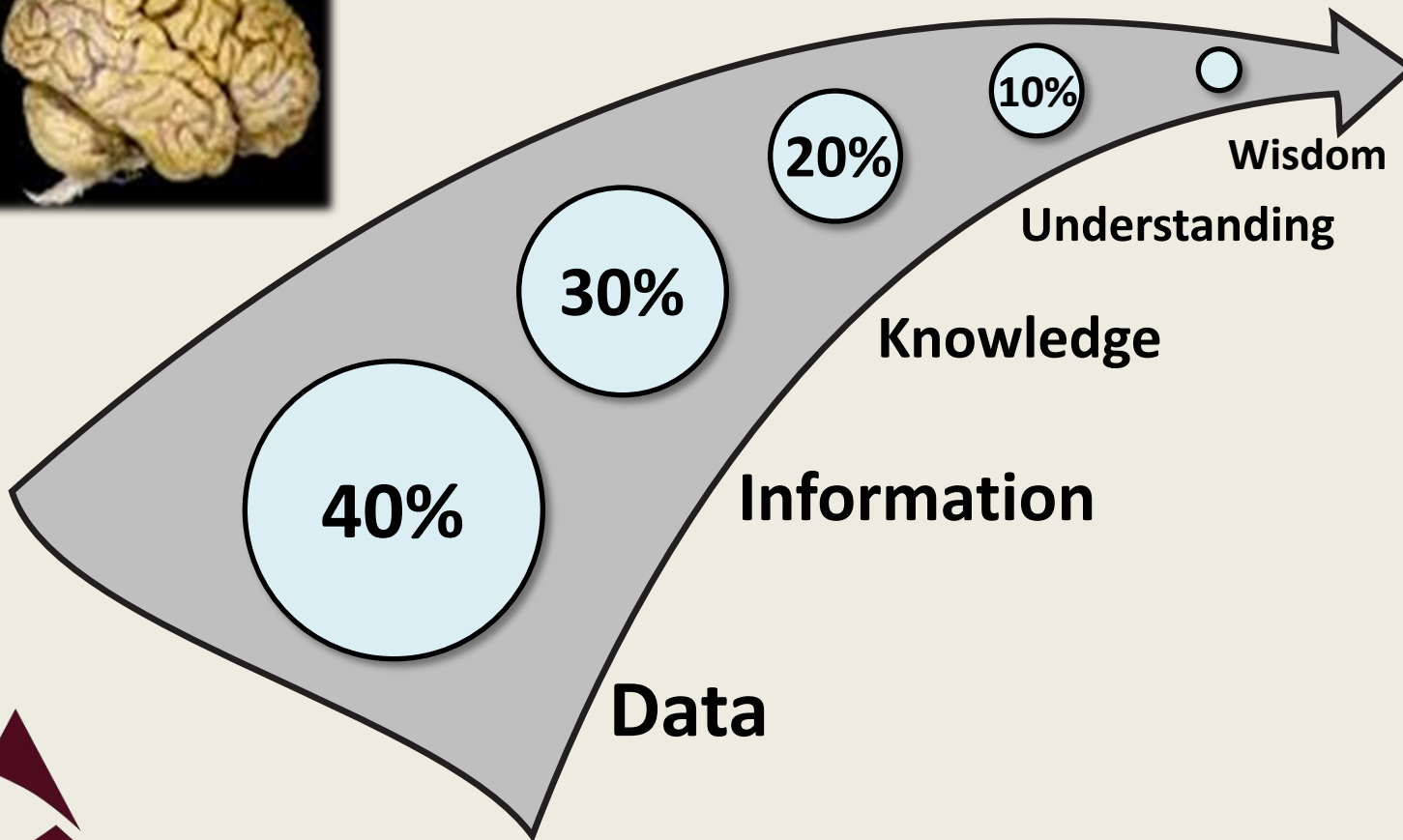
(R. Ackoff, 1989)

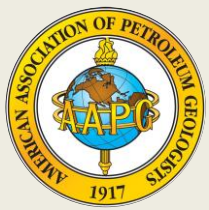




From Data to Wisdom

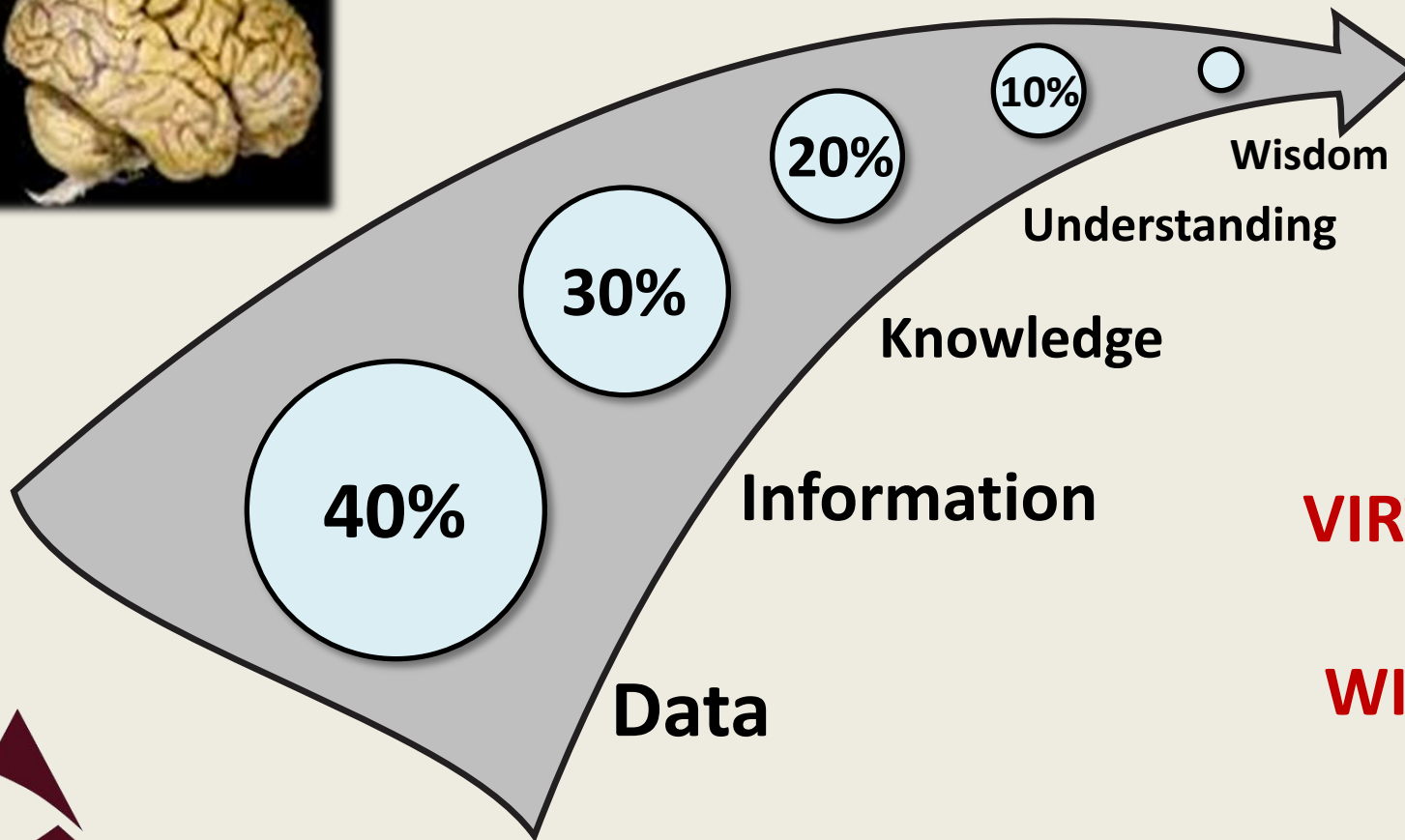
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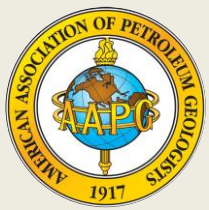


From Data to Wisdom


*"There can be no WISDOM
without UNDERSTANDING
And no UNDERSTANDING
without KNOWLEDGE "*
(R. Ackoff, 1989)



**VIRTUALLY
NO
WISDOM**



Opportunities Grow as the Circumference of Knowledge

A large rectangular area with a background of green and yellow ripples in water, centered around a dark spot. A white oval is superimposed in the center of the ripples.

Seeing
first what
others
have not



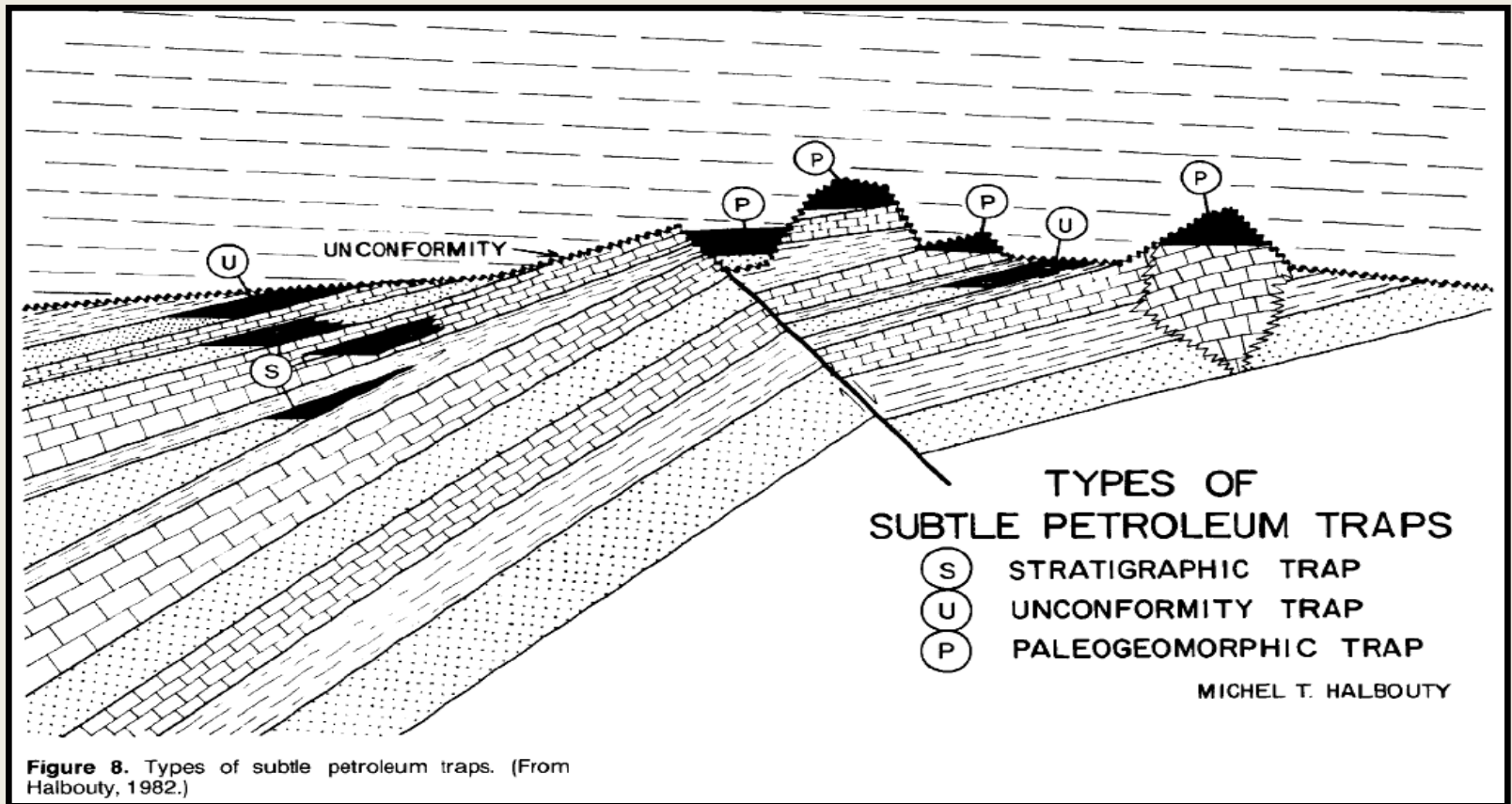
Introduction

Paradigms

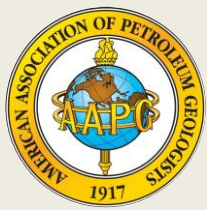
What is next?

Closing

“Experience would say that large accidental discoveries are possible, but should they remain as accidents or do they systematically lead to new opportunities?”



Subtle Traps and Happy Accidents – East Texas Field



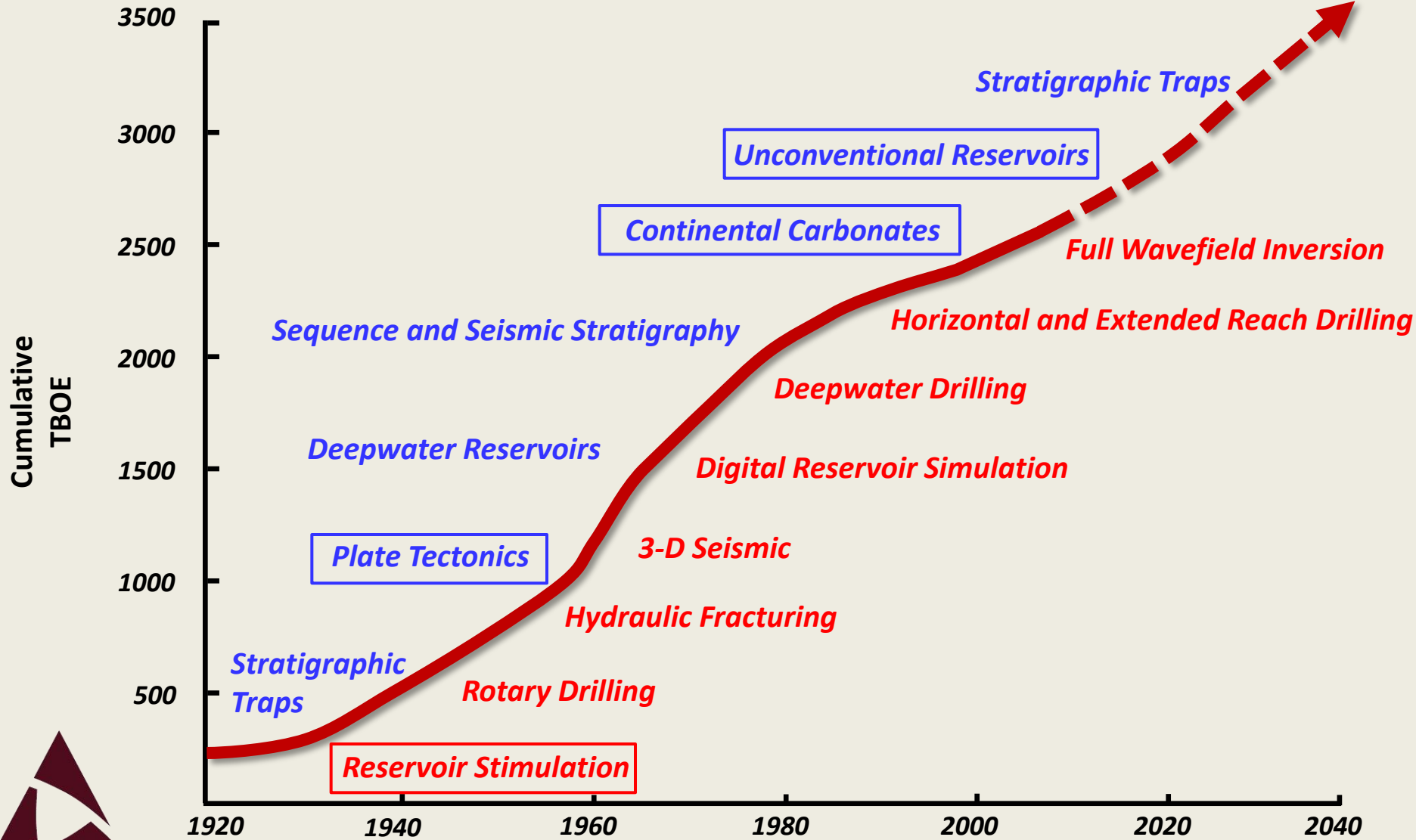
Paradigm Shifts



ACCIDENTAL DISCOVERIES

CONCEPTS

TECHNOLOGY

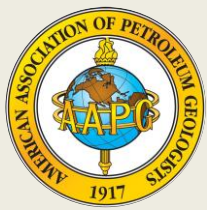


Introduction

Paradigms

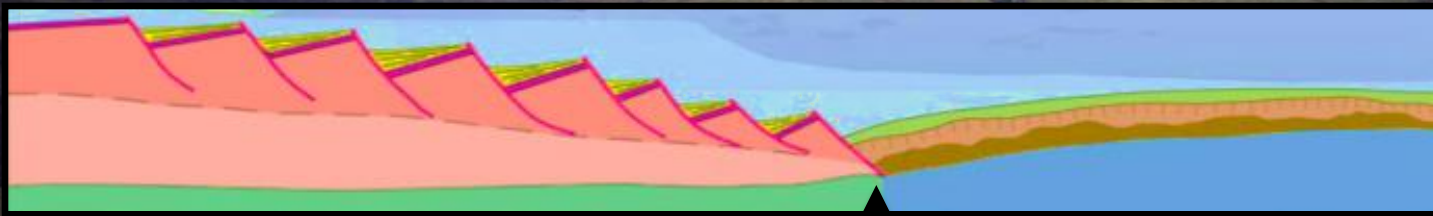
What is next?

Closing



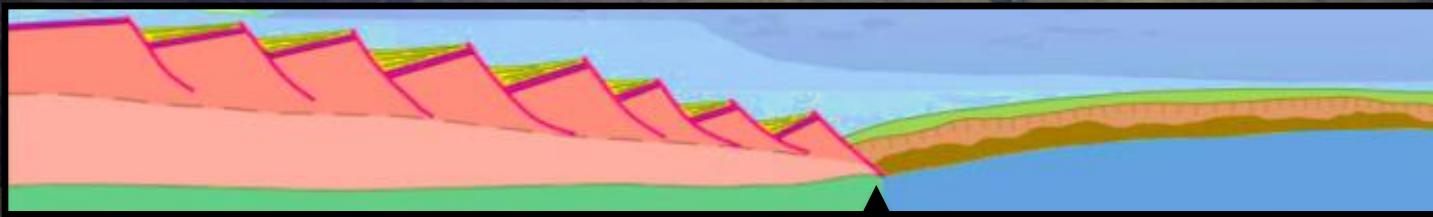
Hyper-Extended Margins



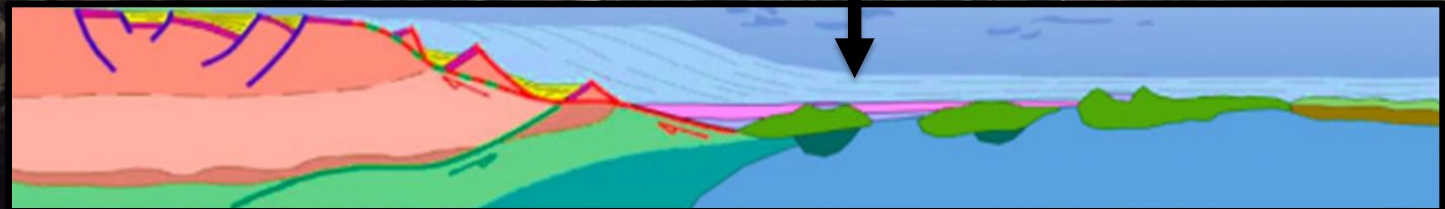


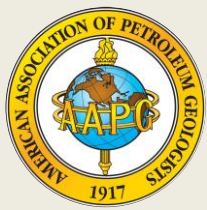
Ocean – Continent Boundary

Péron-Pinvidic & Manatschal (2008)

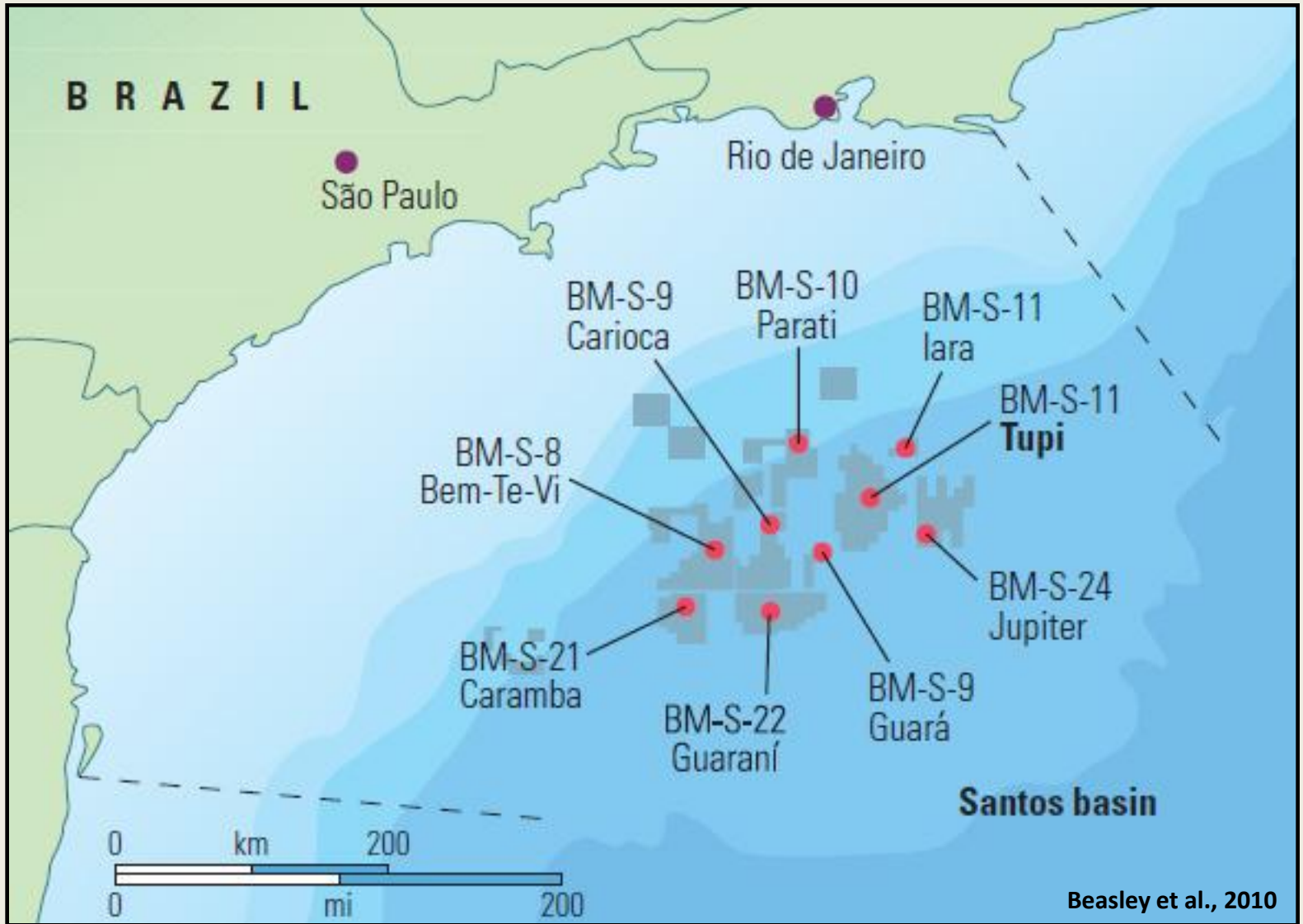


Ocean – Continent Boundary

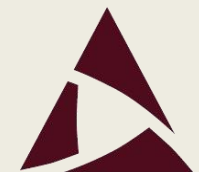


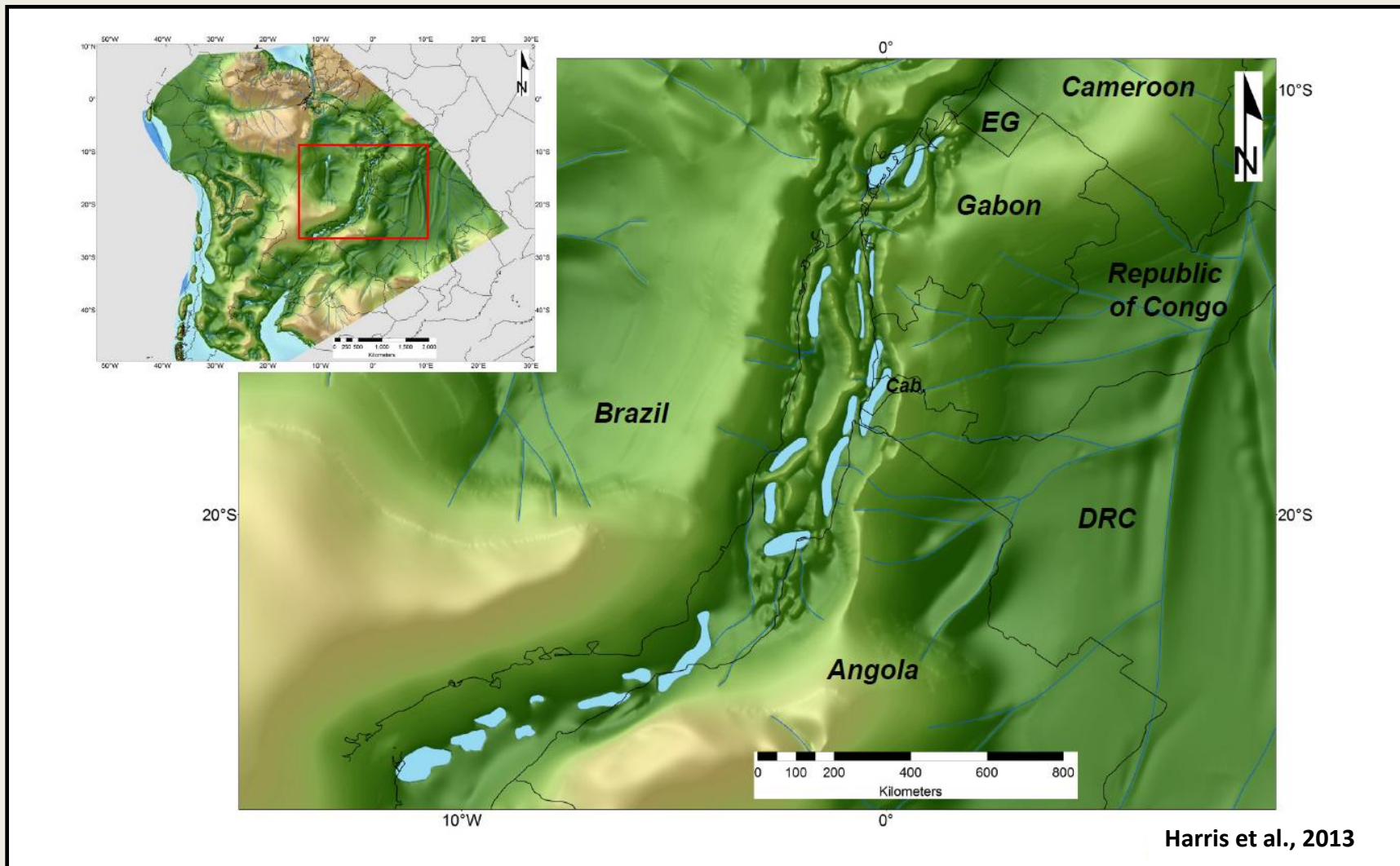


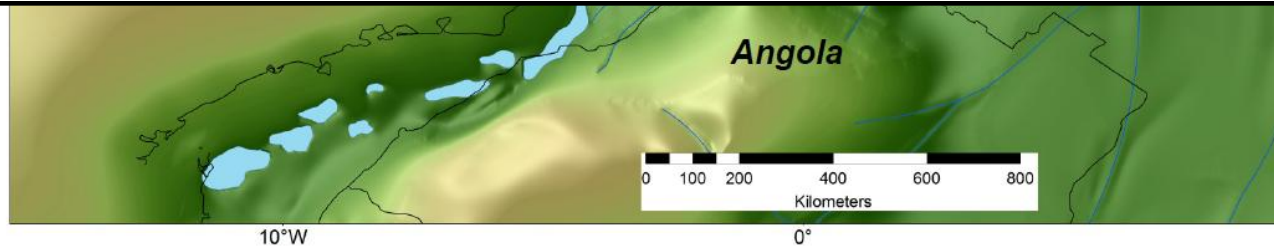
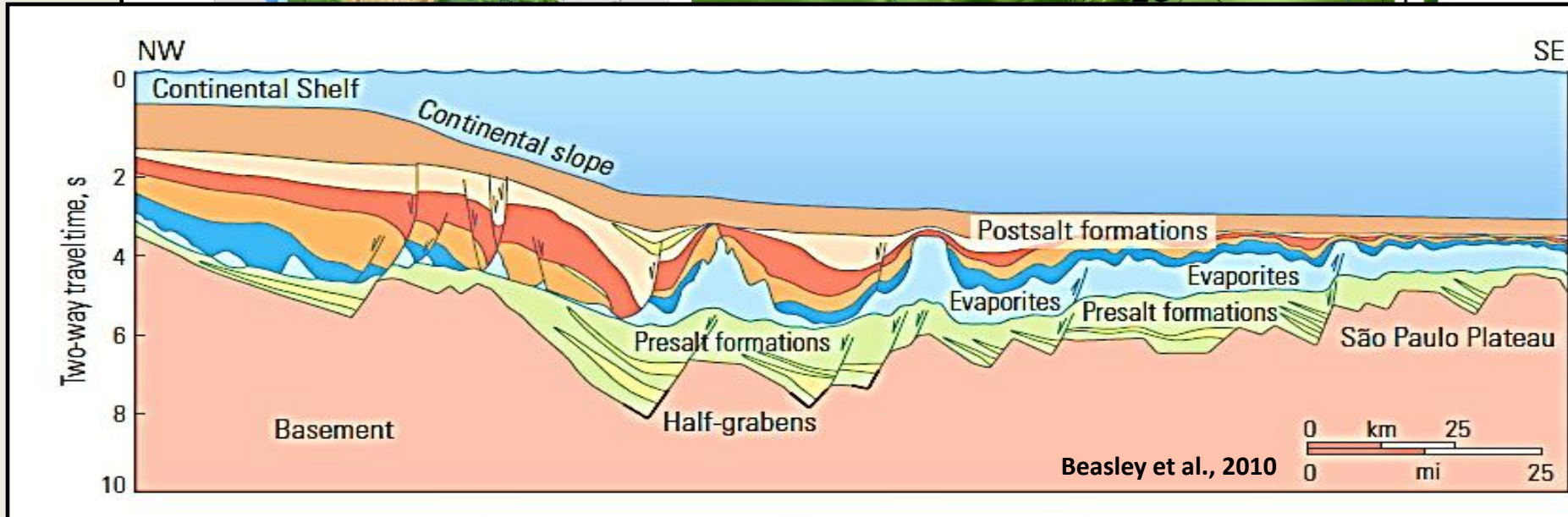
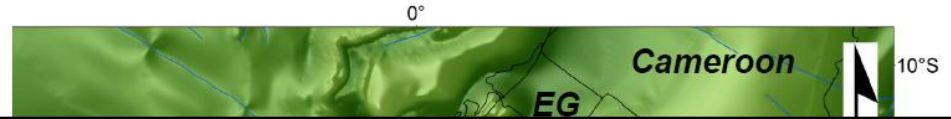
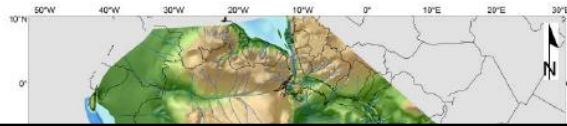
Pre-Salt Play



Beasley et al., 2010







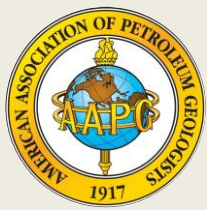
Harris et al., 2013



Wright, 2010



Petrobras, 2004-05



Continental Carbonates



**Marine
Carbonate
Reservoirs**

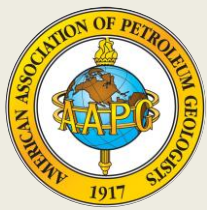


Introduction

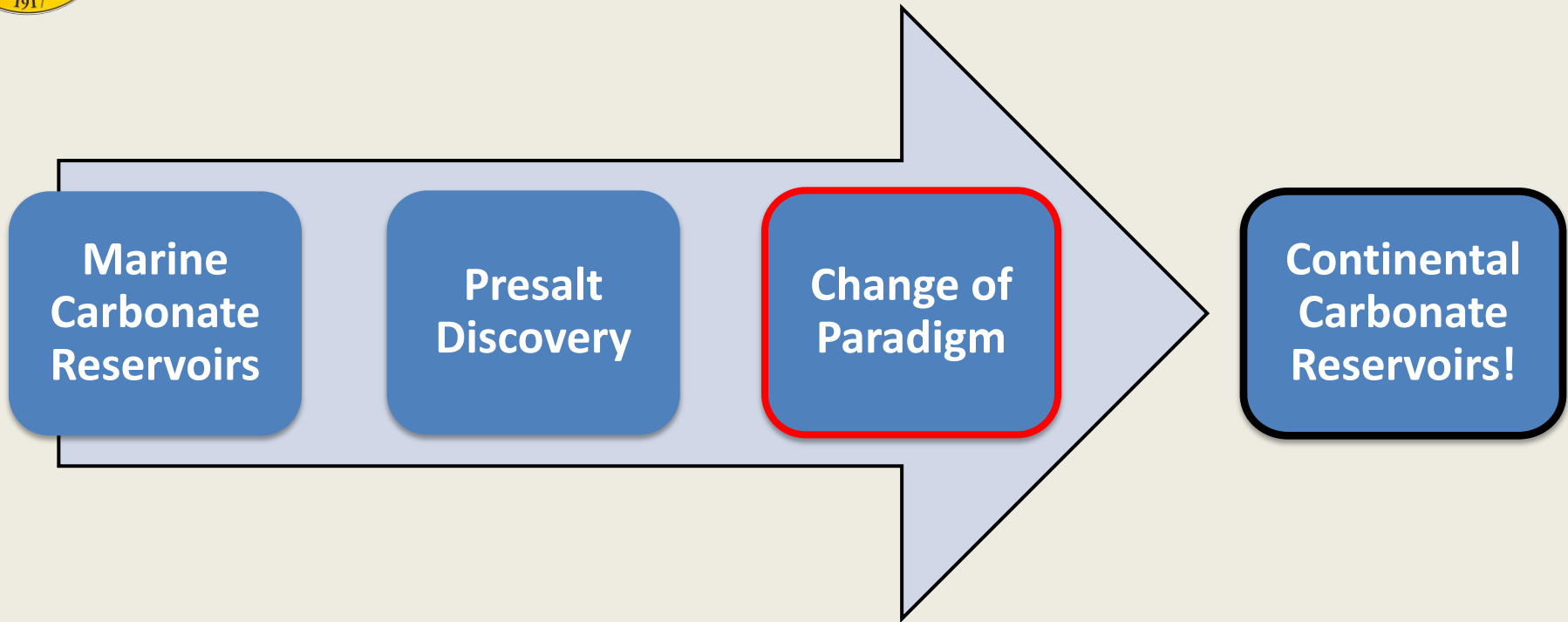
Paradigms

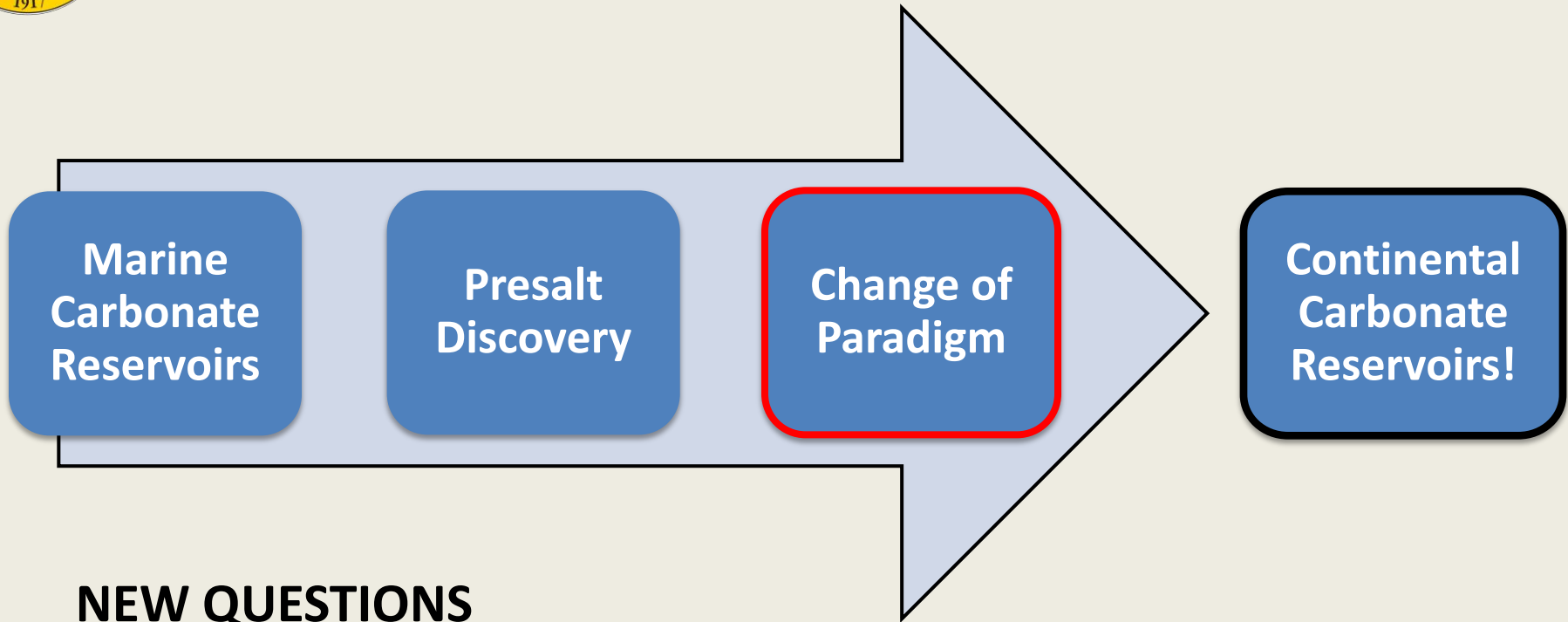
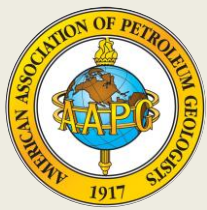
What is next?

Closing



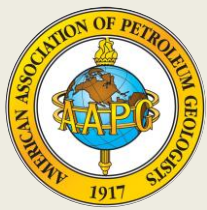
Continental Carbonates



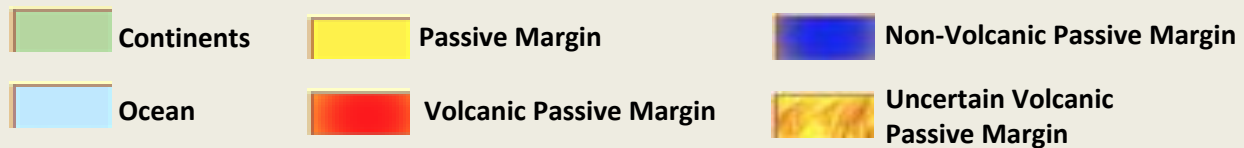
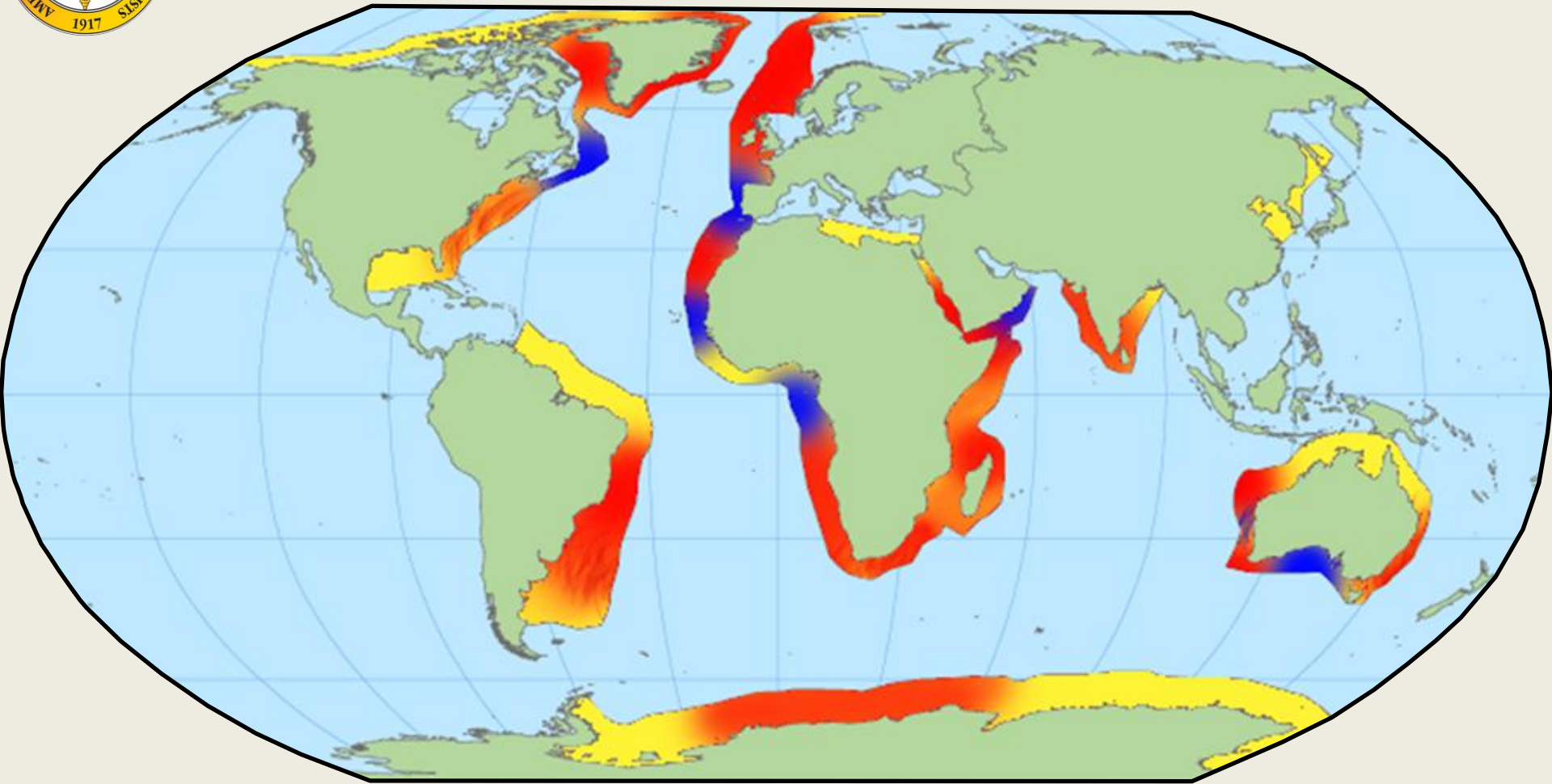


NEW QUESTIONS

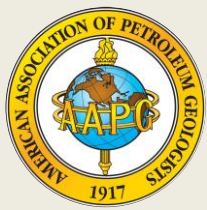
- Reservoir Architecture
 - Physical Properties
 - Reservoir Performance



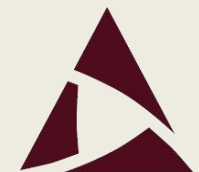
Rift and Passive Margin Basins



after Pinto, 2007



Unconventional Shale Basins



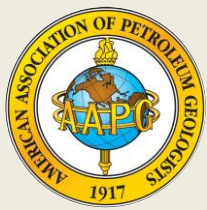
BERG-HUGHES
CENTER

Introduction

Paradigms

What is next?

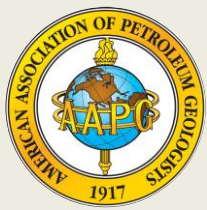
Closing



Paradigms

*If you are a hammer, all your problems look like nails.
But what happens if you encounter a screw?*



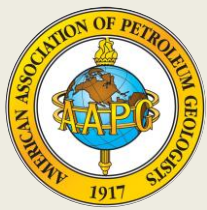


“Unconventional Fracking”

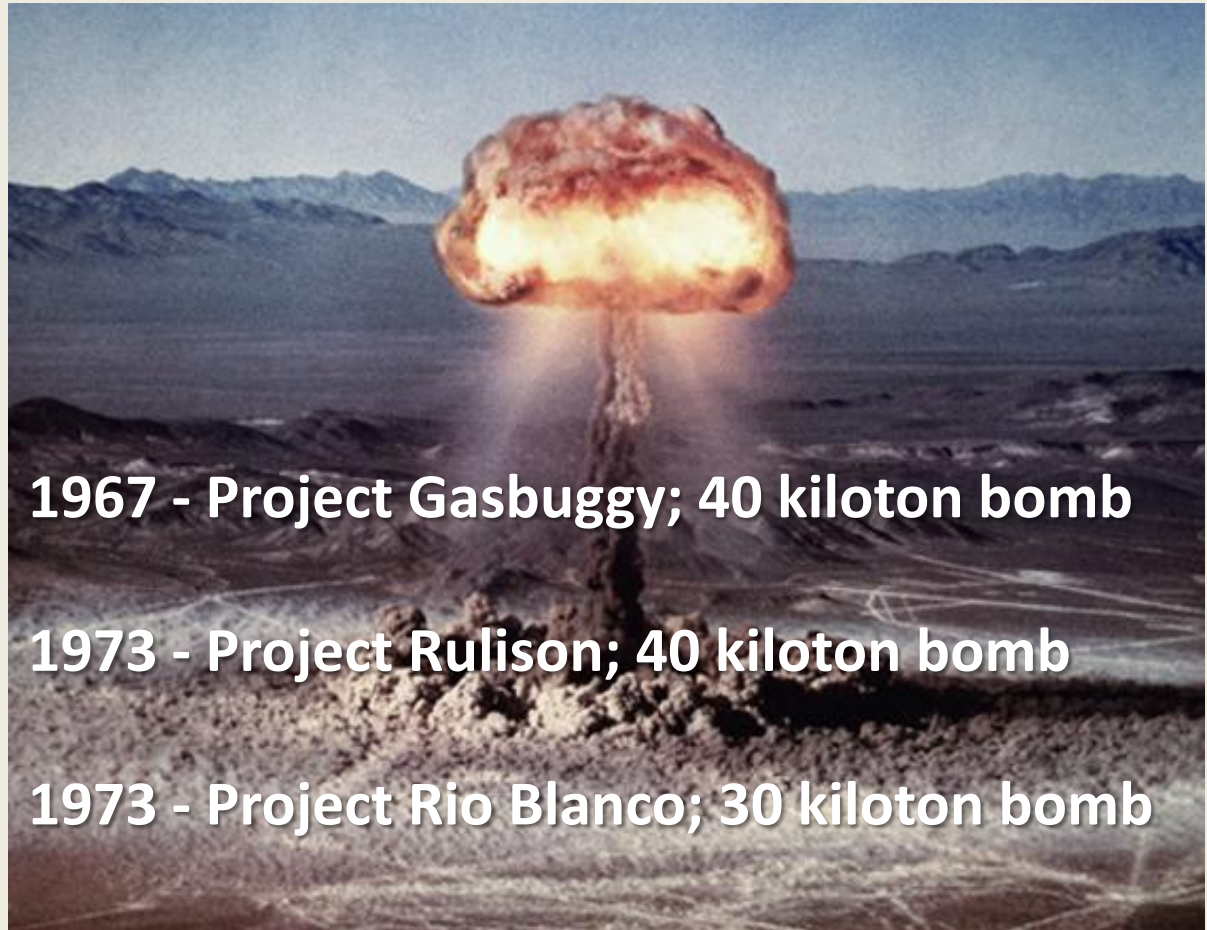


1860 – Stimulation job with liquid nitroglycerin

1883 – Stimulation job using 40 lb of black powder



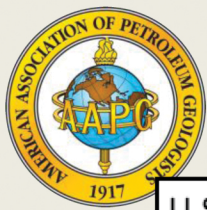
“Unconventional Fracking”



1967 - Project Gasbuggy; 40 kiloton bomb

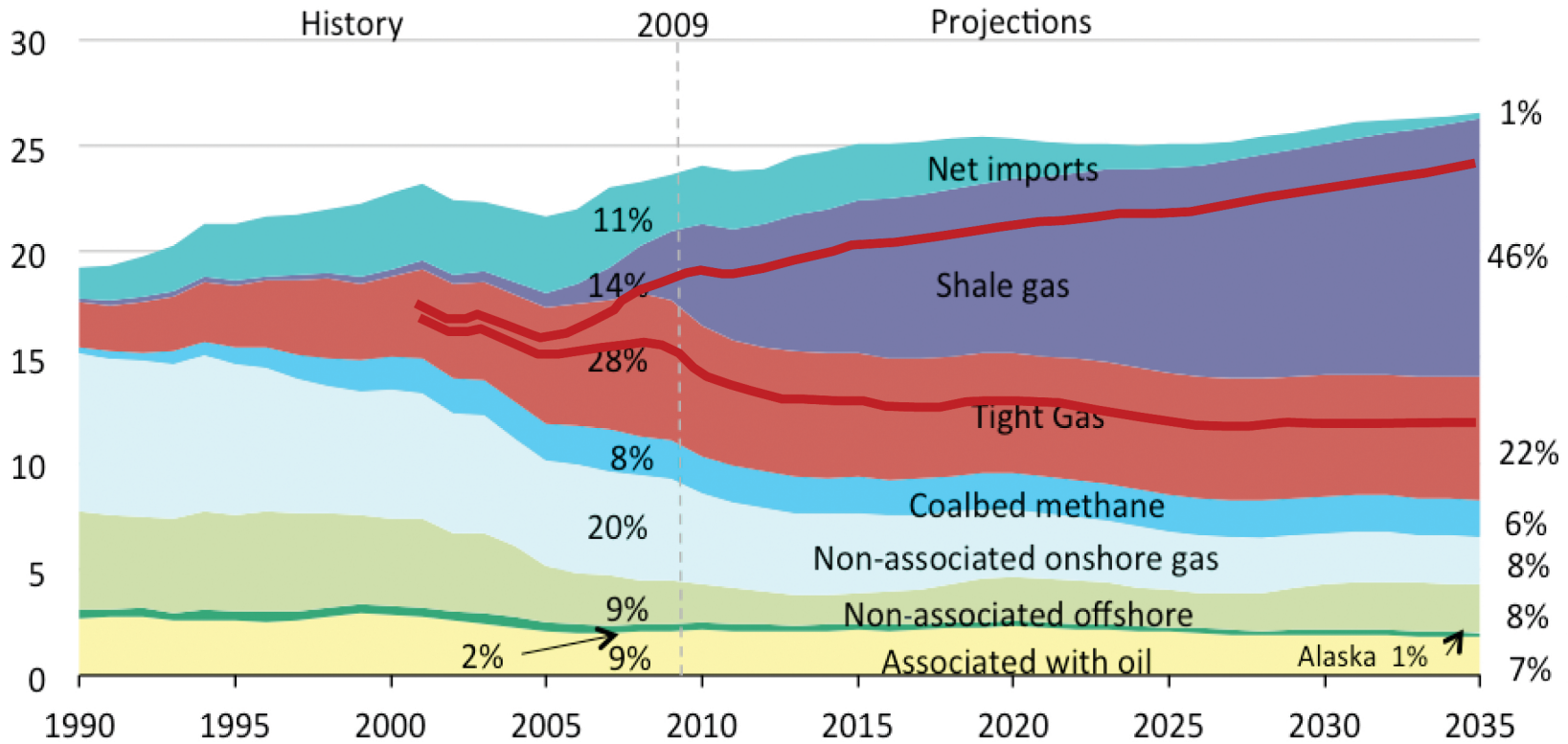
1973 - Project Rulison; 40 kiloton bomb

1973 - Project Rio Blanco; 30 kiloton bomb

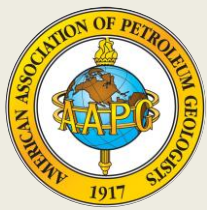


Unconventional Shale Basins

U.S. dry natural gas
trillion cubic feet

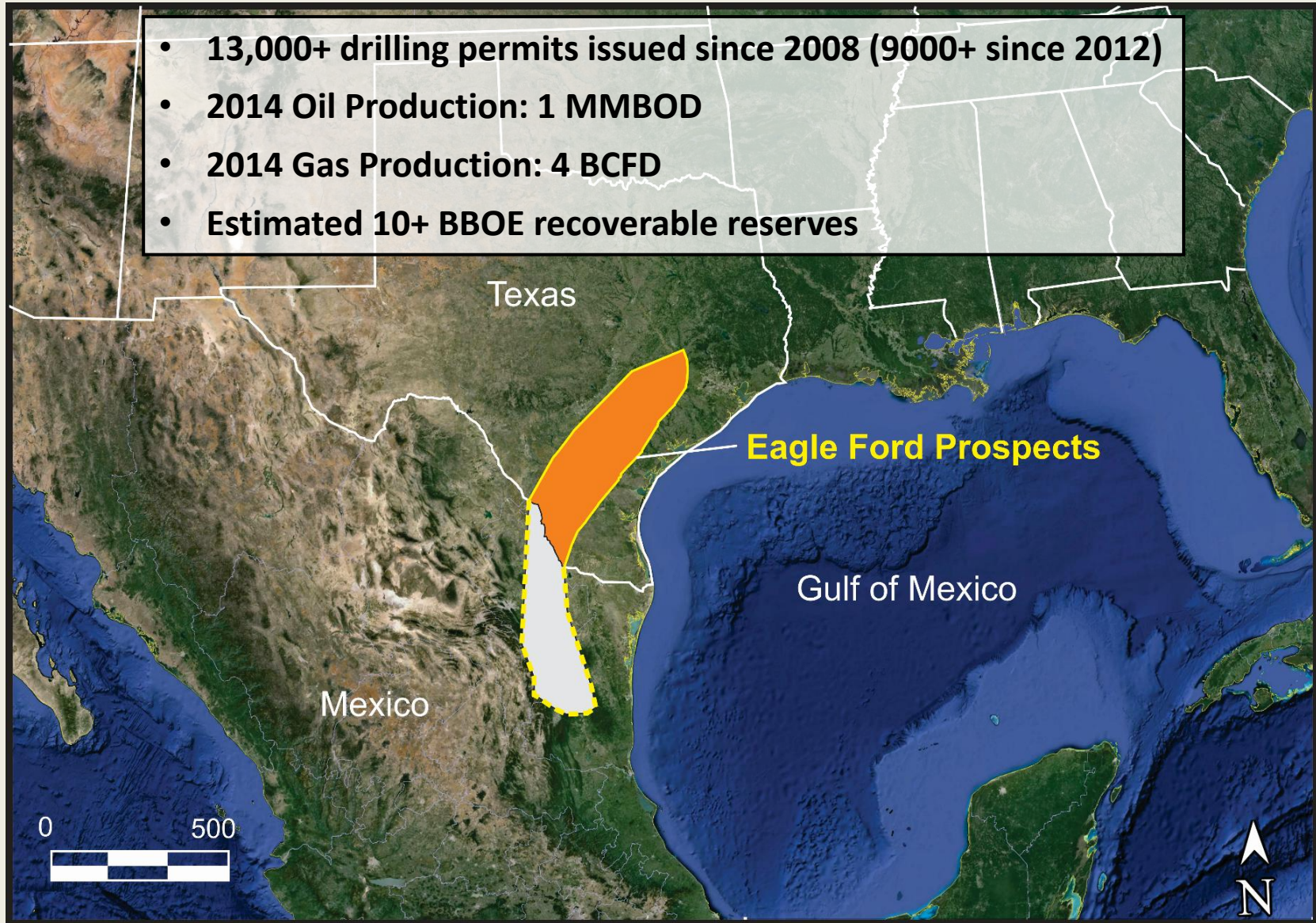


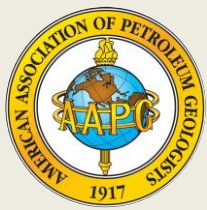
eia.gov



Eagle Ford Play

- 13,000+ drilling permits issued since 2008 (9000+ since 2012)
- 2014 Oil Production: 1 MMBOD
- 2014 Gas Production: 4 BCFD
- Estimated 10+ BBOE recoverable reserves

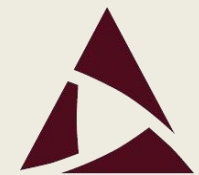
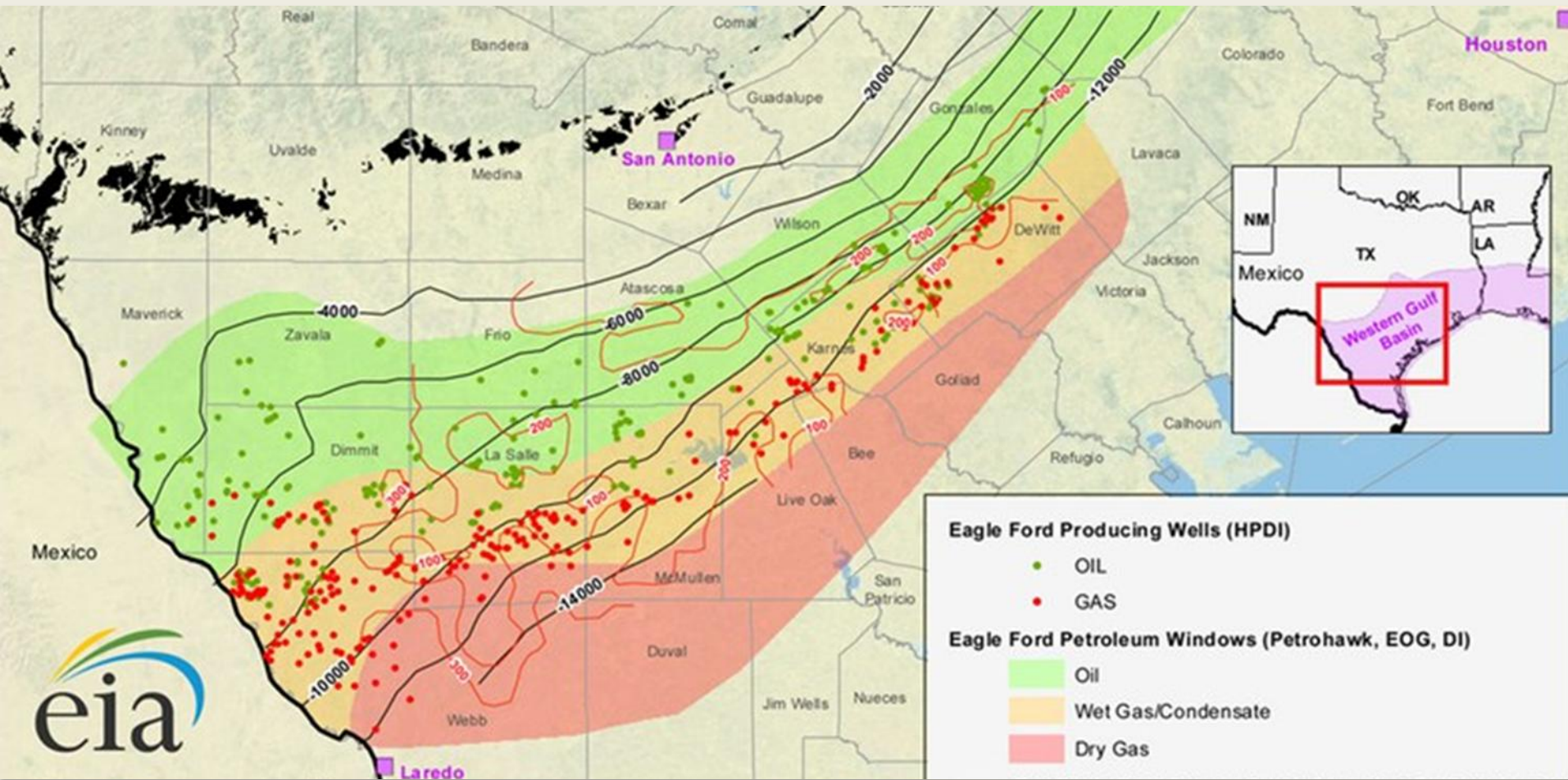




Unconventional Shale Basins

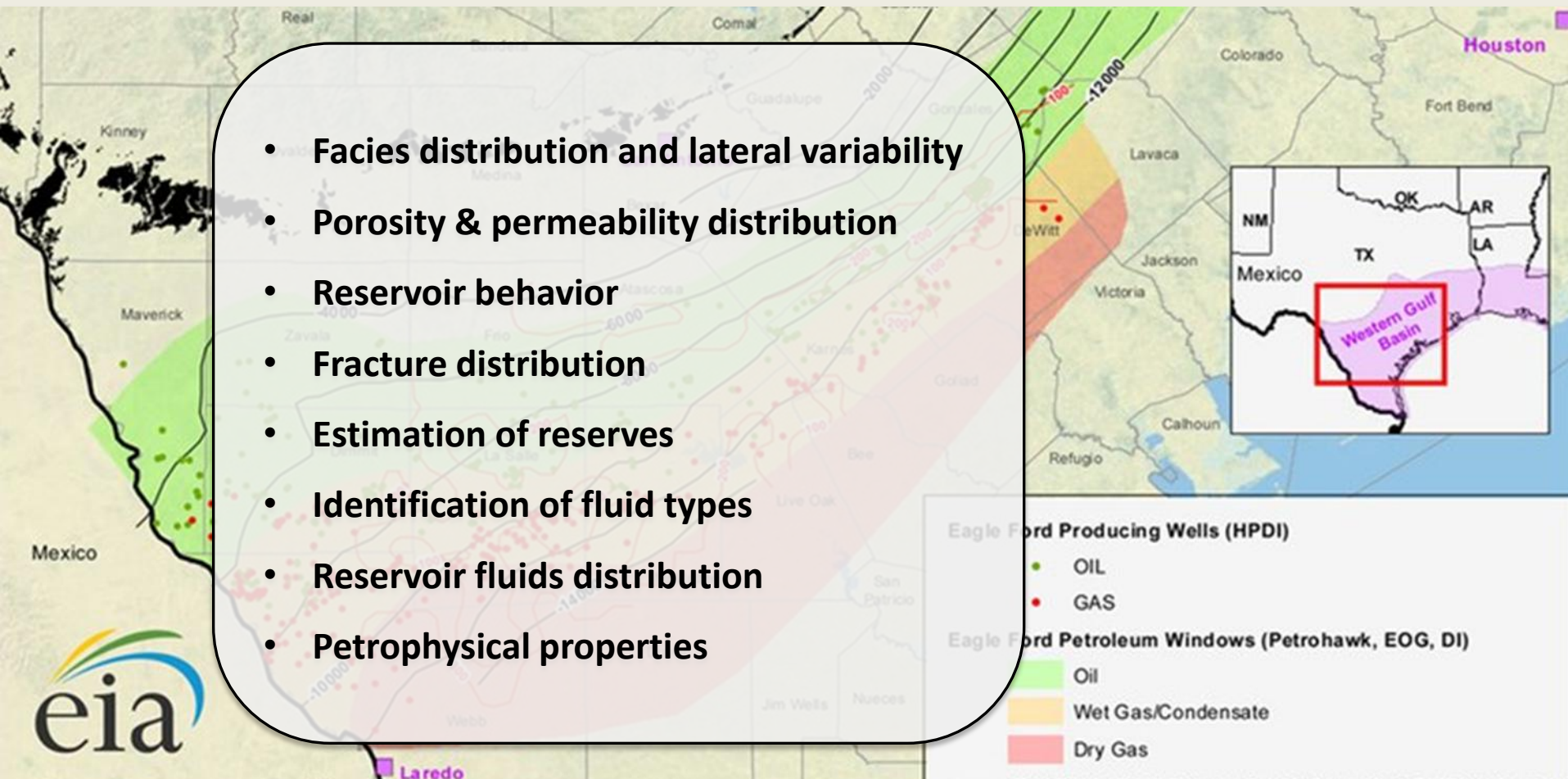


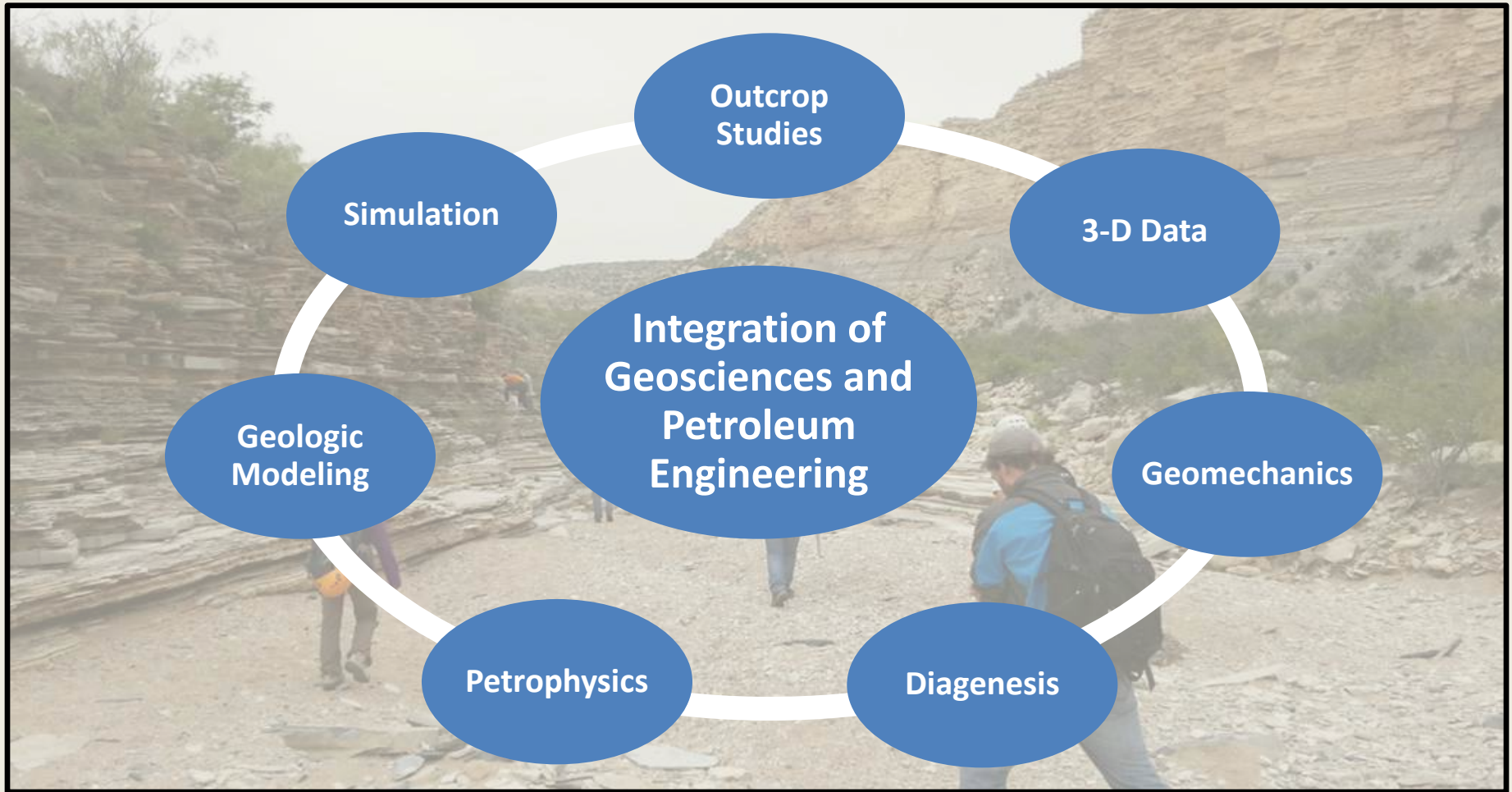
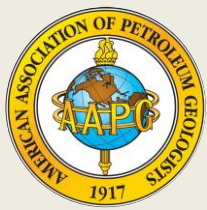
General Questions

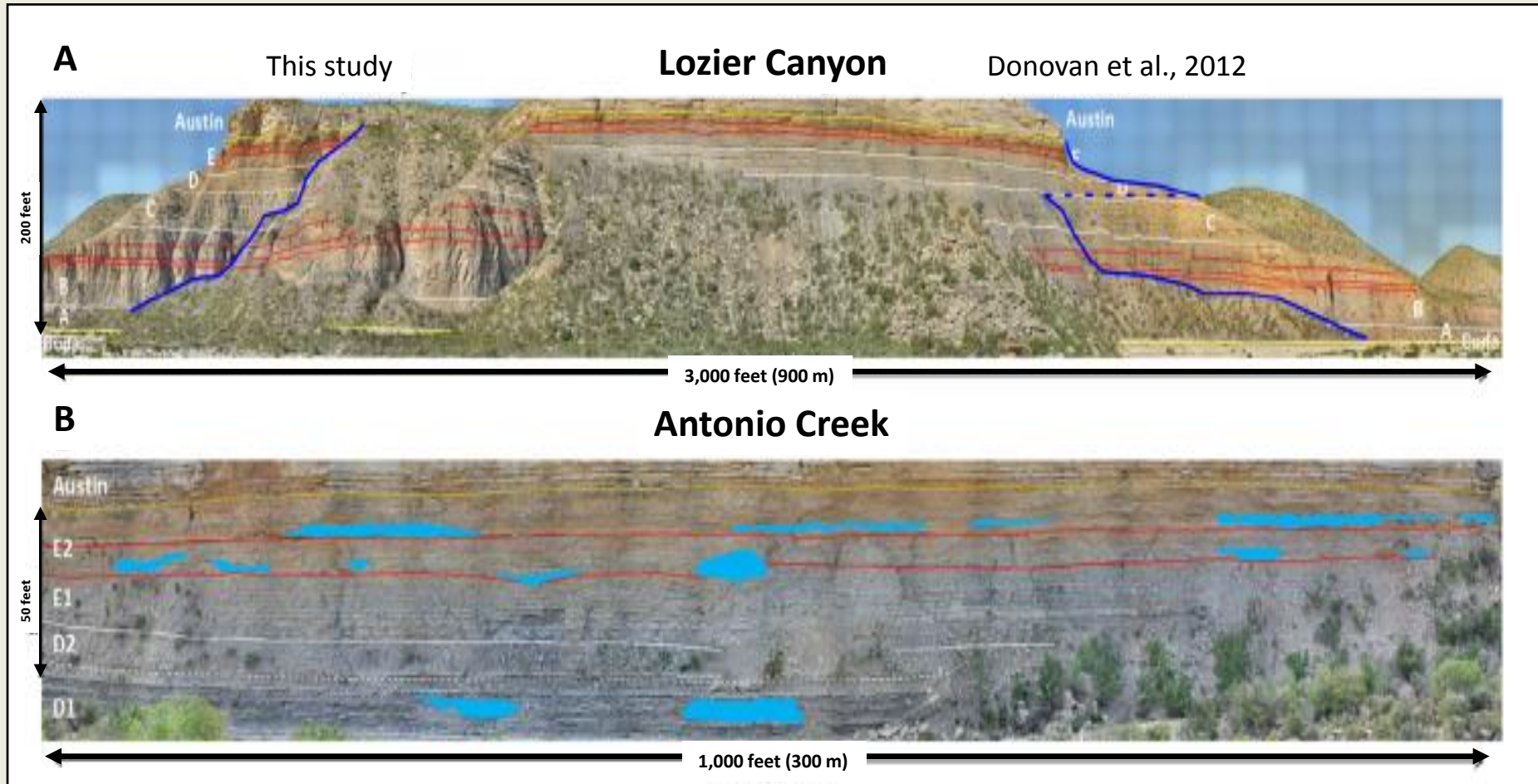


General Questions

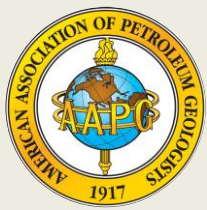
- Facies distribution and lateral variability
- Porosity & permeability distribution
- Reservoir behavior
- Fracture distribution
- Estimation of reserves
- Identification of fluid types
- Reservoir fluids distribution
- Petrophysical properties





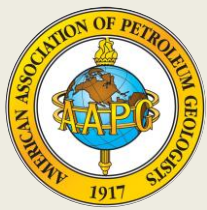


Gardner et al., 2013



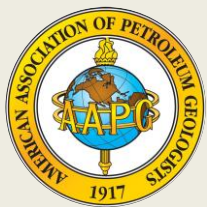
Fundamental Questions



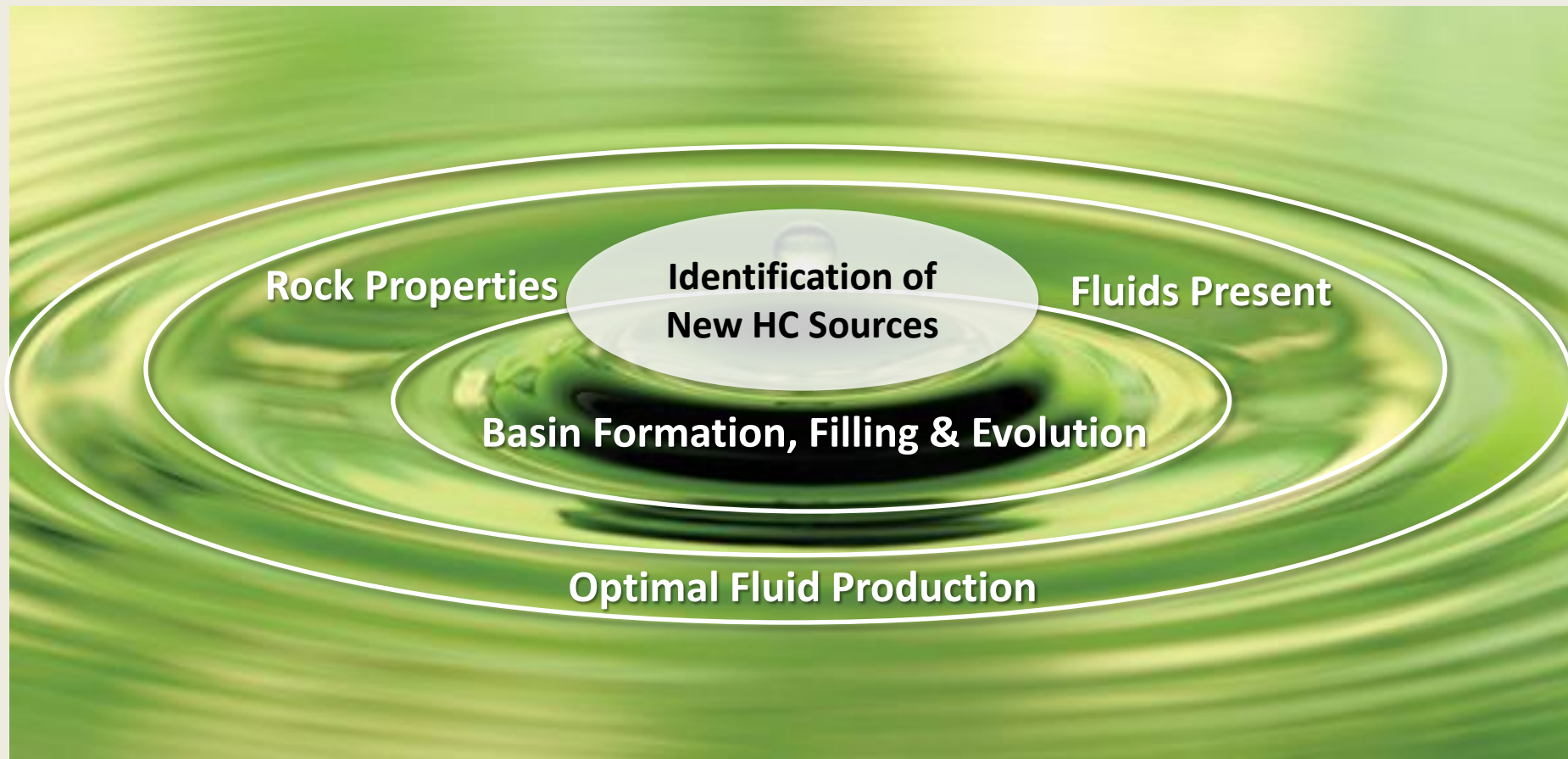


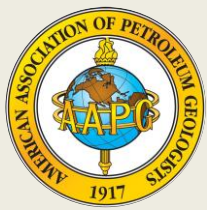
Fundamental Questions

**Identification of
New HC Sources**

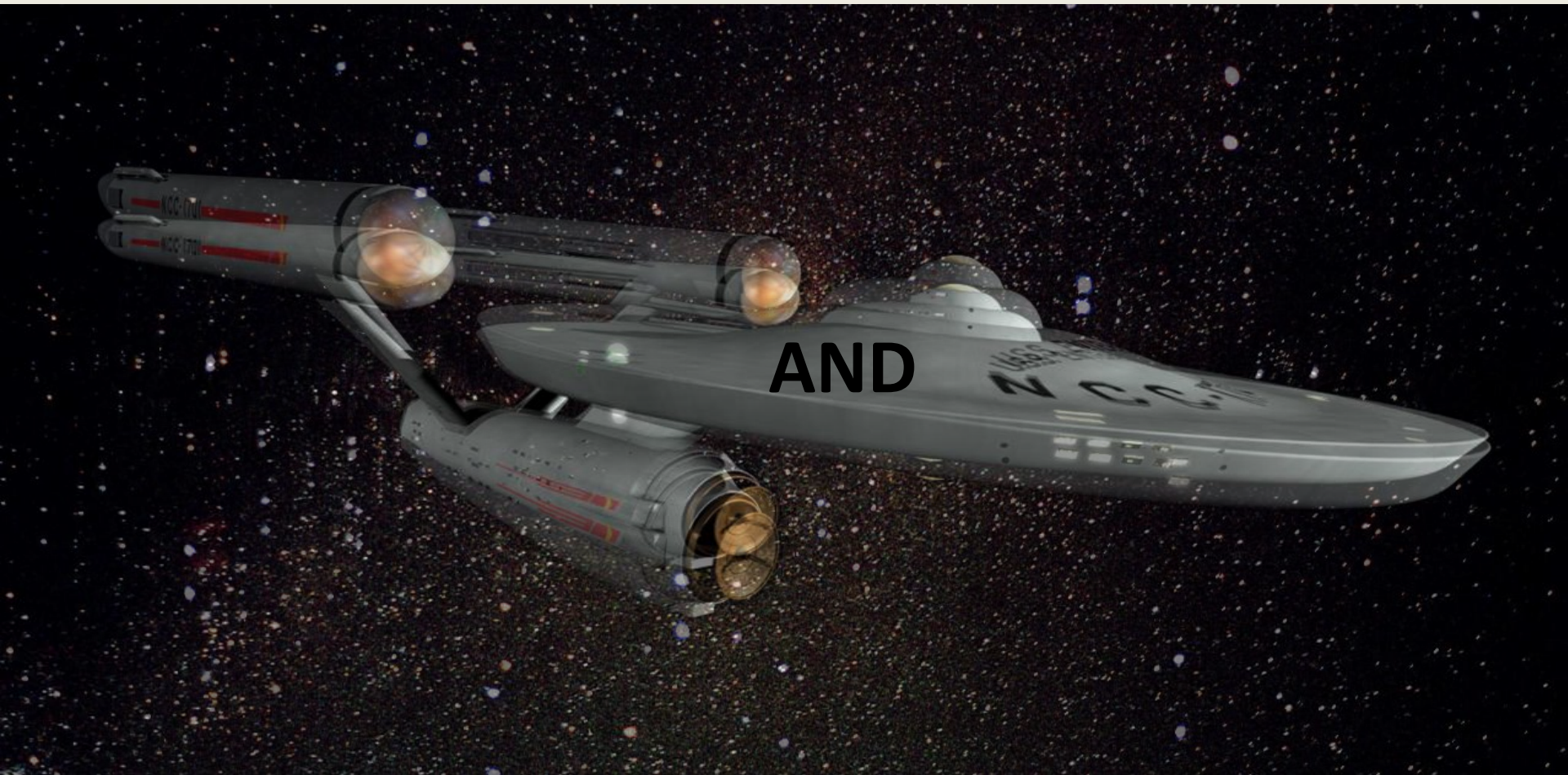


Fundamental Questions





Human Creativity and Technology

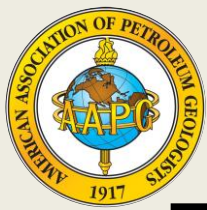


Introduction

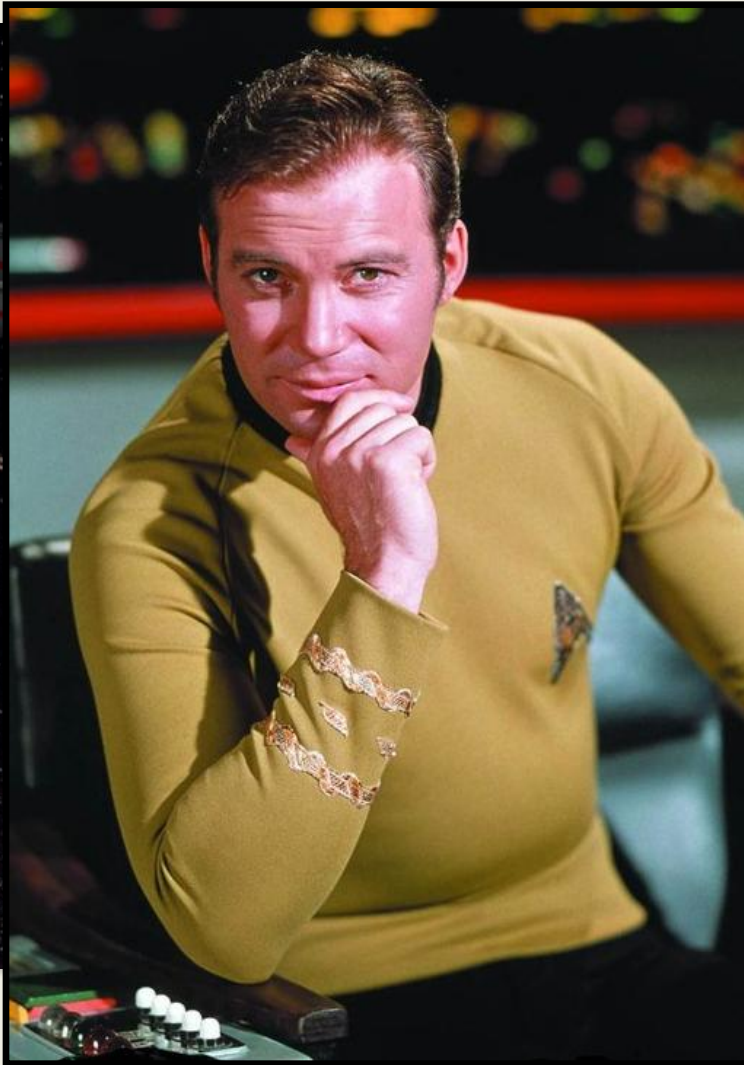
Paradigms

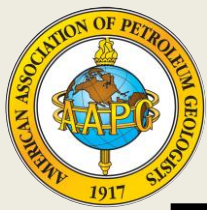
What is next?

Closing

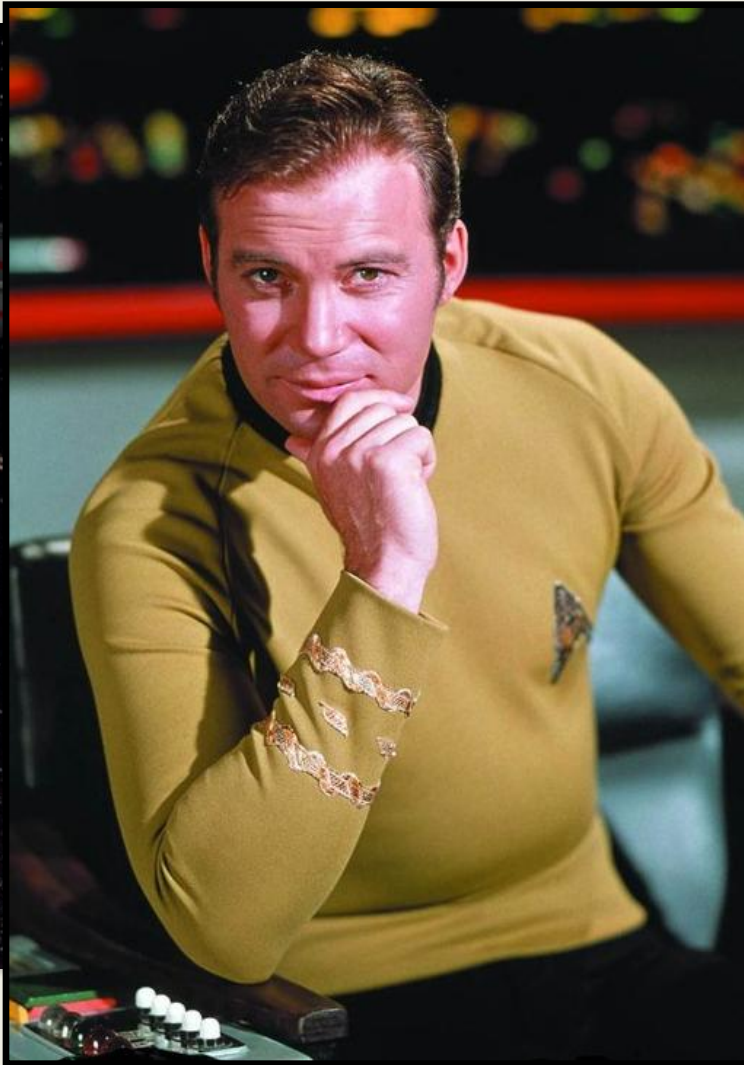


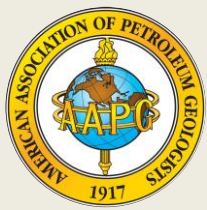
Human Creativity and Technology





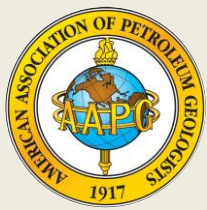
Human Creativity and Technology





The Human Element

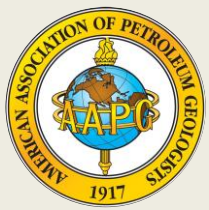




The Human Element

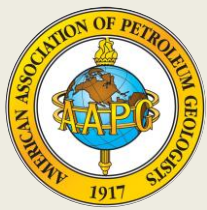


DATA - INFORMATION - KNOWLEDGE - WISDOM



The Way Ahead





THANK YOU



AAPG FOUNDATION

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