

GEOSCIENCE CAREERS

room to grow...

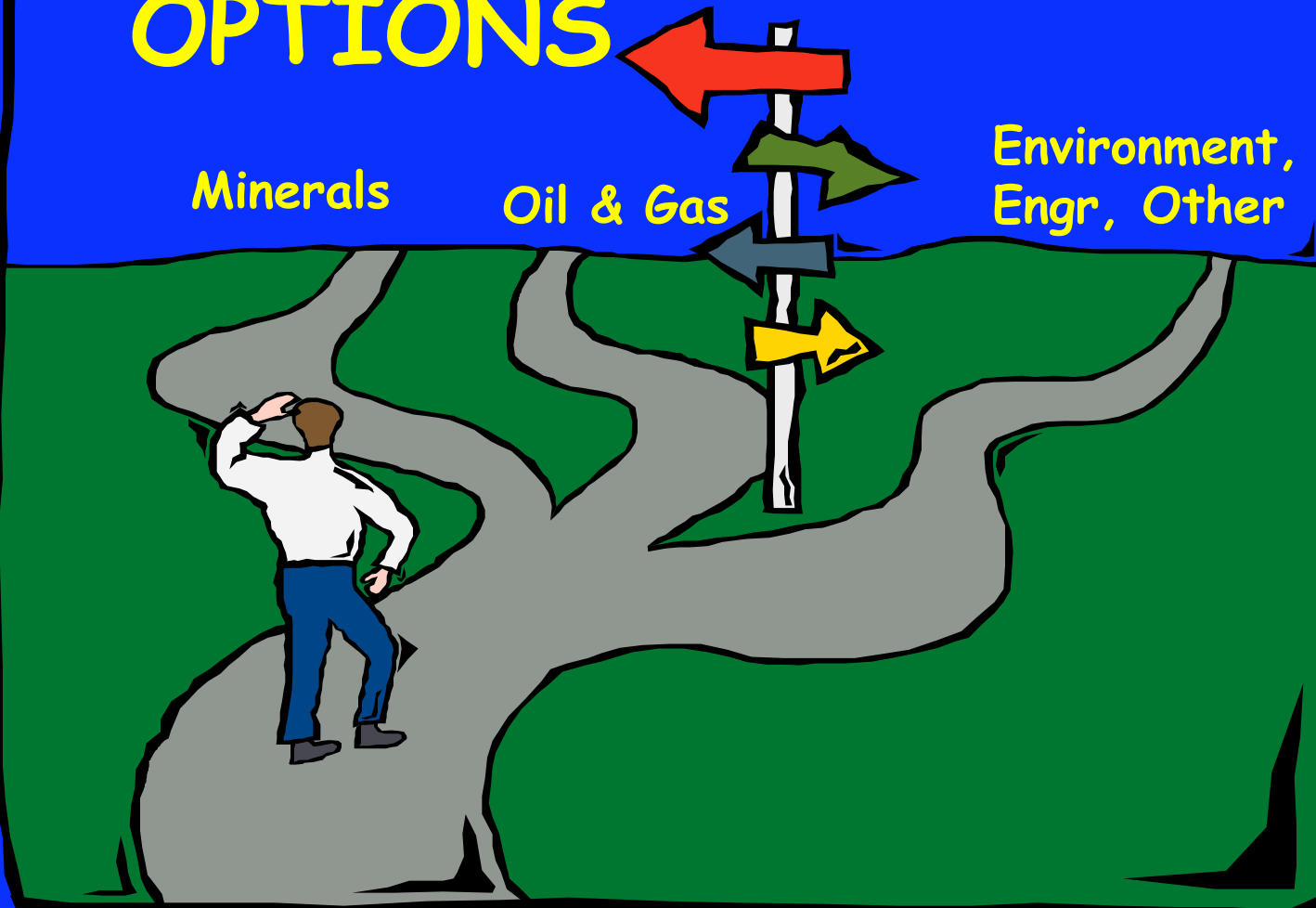
Bata-1 Gas Discovery, Sumatra
Photo by Chuck Caughey

THE GEOSCIENCE GRADUATE'S OPTIONS

Minerals

Oil & Gas

Environment,
Engr, Other



THE PRODUCTIVITY “GAP”



**STARTING
UNIVERSITY**

**PRODUCTIVE
GEOSCIENTIST**

Modified from Kaldi, 2004
Photo by Bennett, 1885,
from Wolf, 1983

PRODUCTIVE PETROLEUM GEOSCIENTIST



MSc

Industry hire



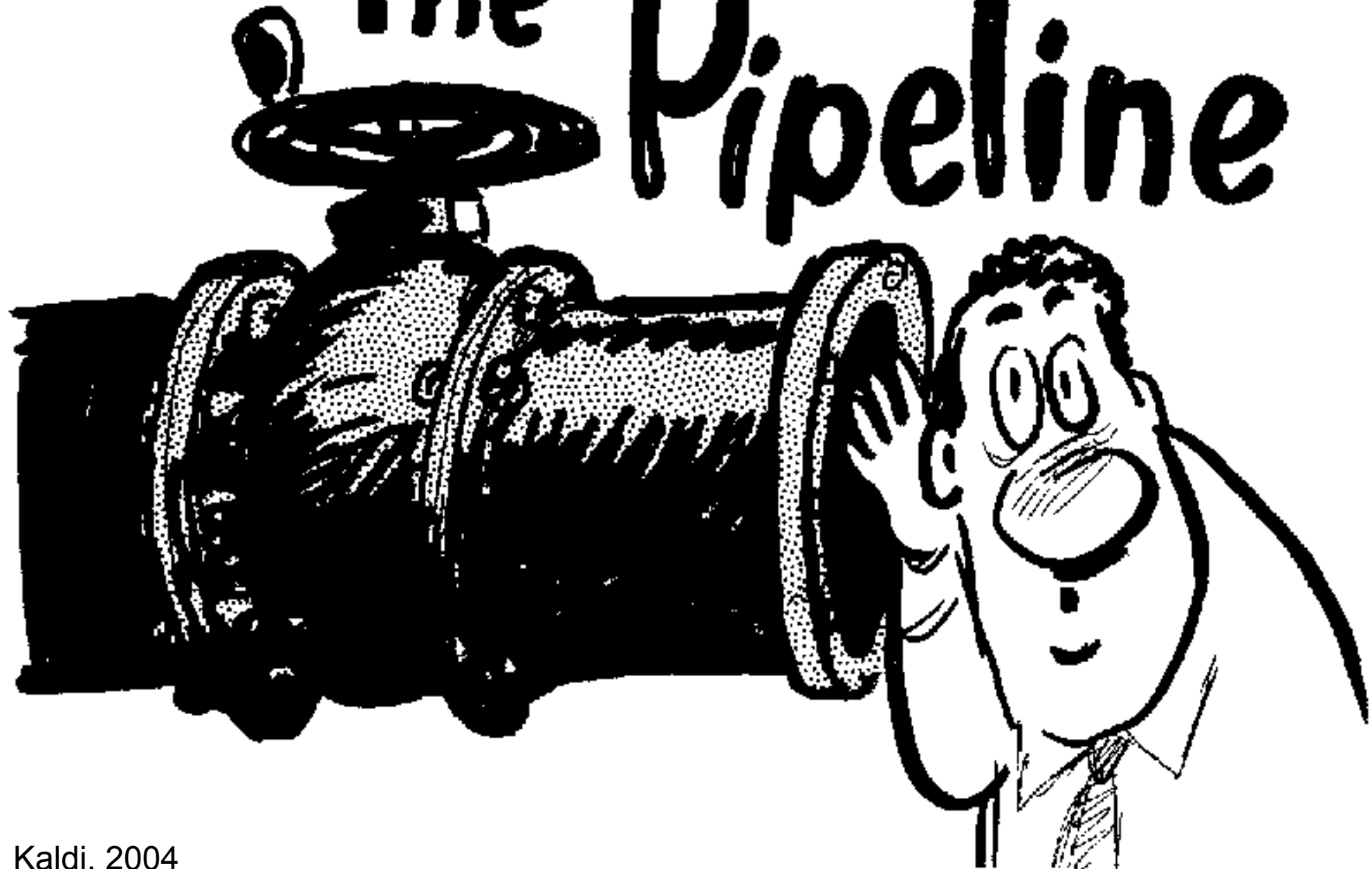
The
Internet

START UNI

BSc



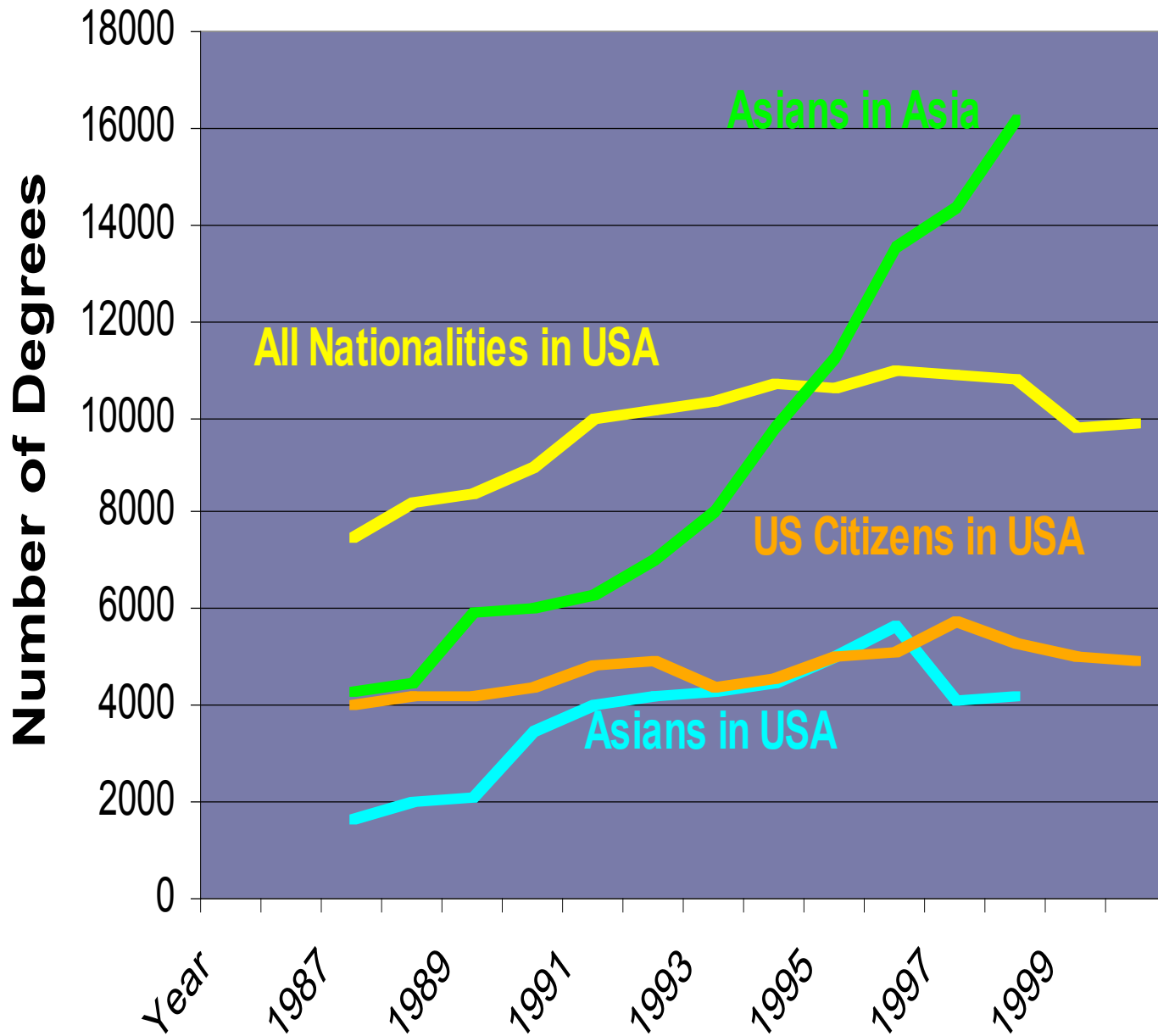
The Pipeline

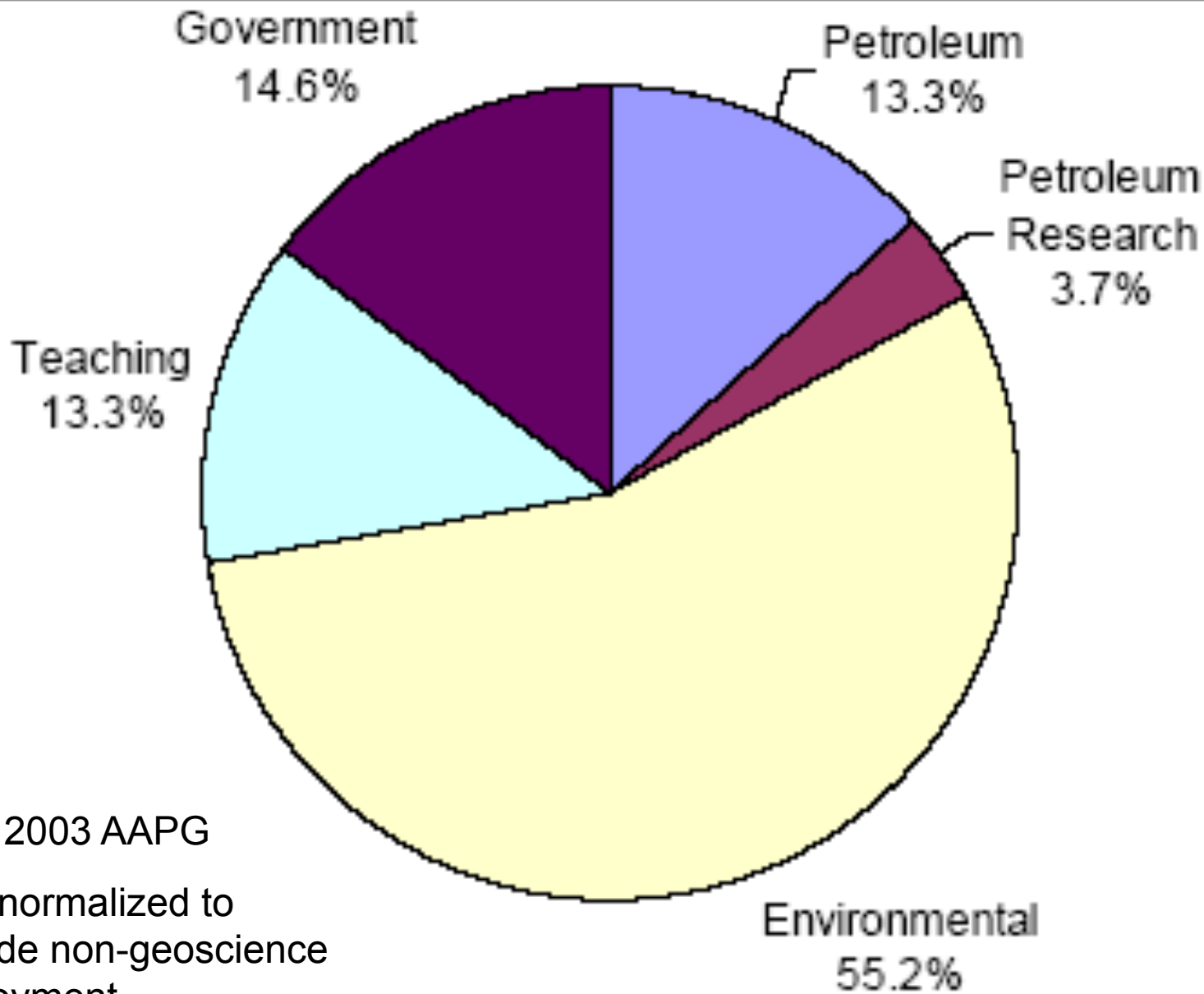


THE GENERATIONS

- **Traditionalists** 1925-45
 - Resistant to high tech
 - Value stable environment
 - Want to leave a legacy
- **Baby Boomers** 1946-64
 - Willing to learn
 - Try to build successful careers
- **Generation X** 1976-80
 - Adept with technology
 - Look for portable careers
- **Generation Y** 1981-02
 - Technologically superior
 - Respectful of tradition
 - Embrace diversity
 - Seek dual careers with spouses

Technical Degrees Asia vs USA





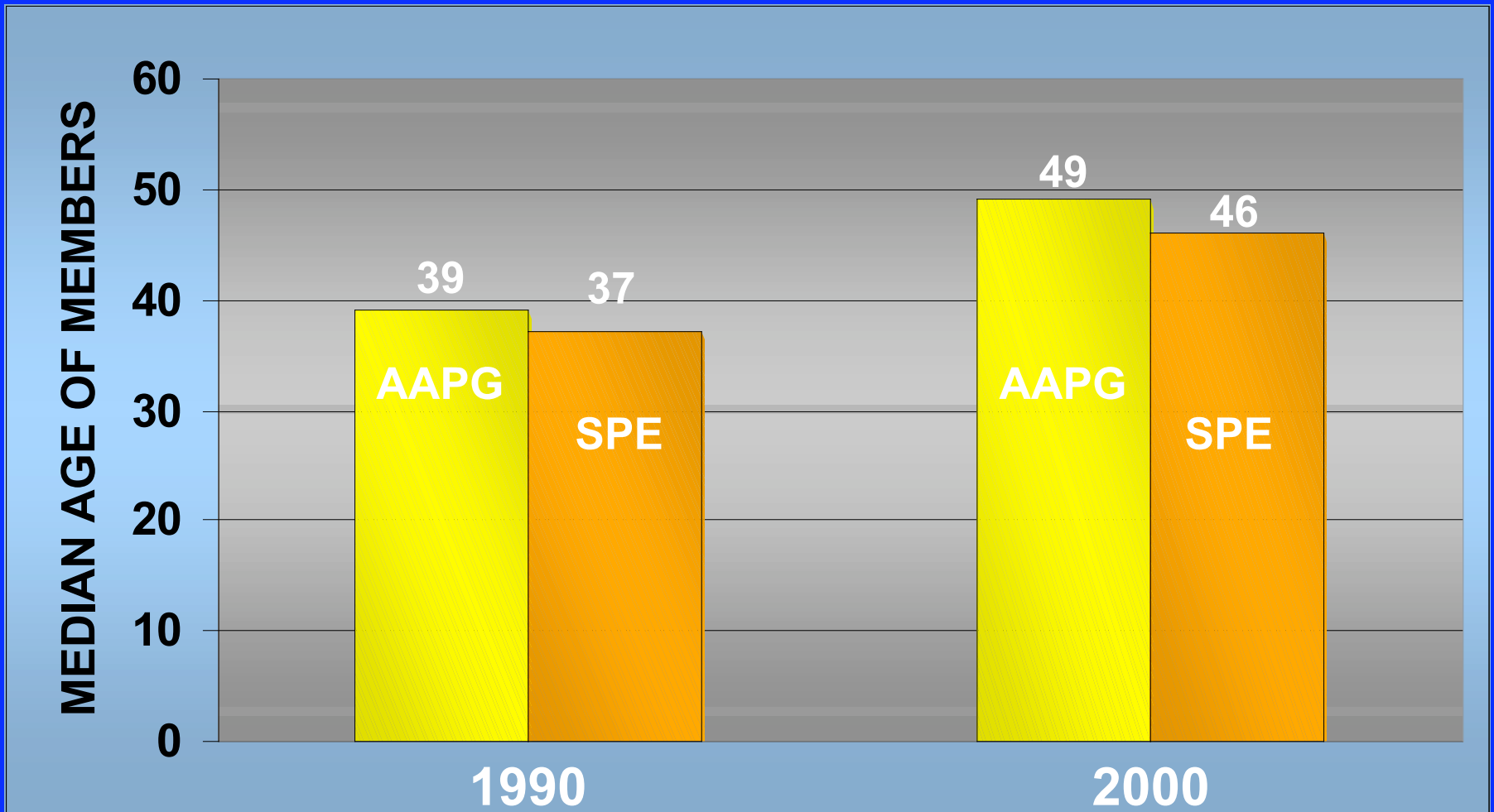
Katz, 2003 AAPG
Data normalized to
exclude non-geoscience
employment

Brain Drain

(top 25 US O&G Companies)

- Jobs Continued Decline (-4.1% in 2004)
 - 21,000 industry jobs lost in 2004
 - 514,000 jobs now, with record oil prices
 - 1,110,000 decline from last boom in '81
- Productivity Increase: Driven by Technology
 - 10.6% compound annual growth since '94
 - Helped offset job losses in the slowdown
 - Provides no cushion for rebound

MEDIAN AGE OF AAPG / SPE MEMBERS



MEDIAN AGE OF AAPG / SPE MEMBERS



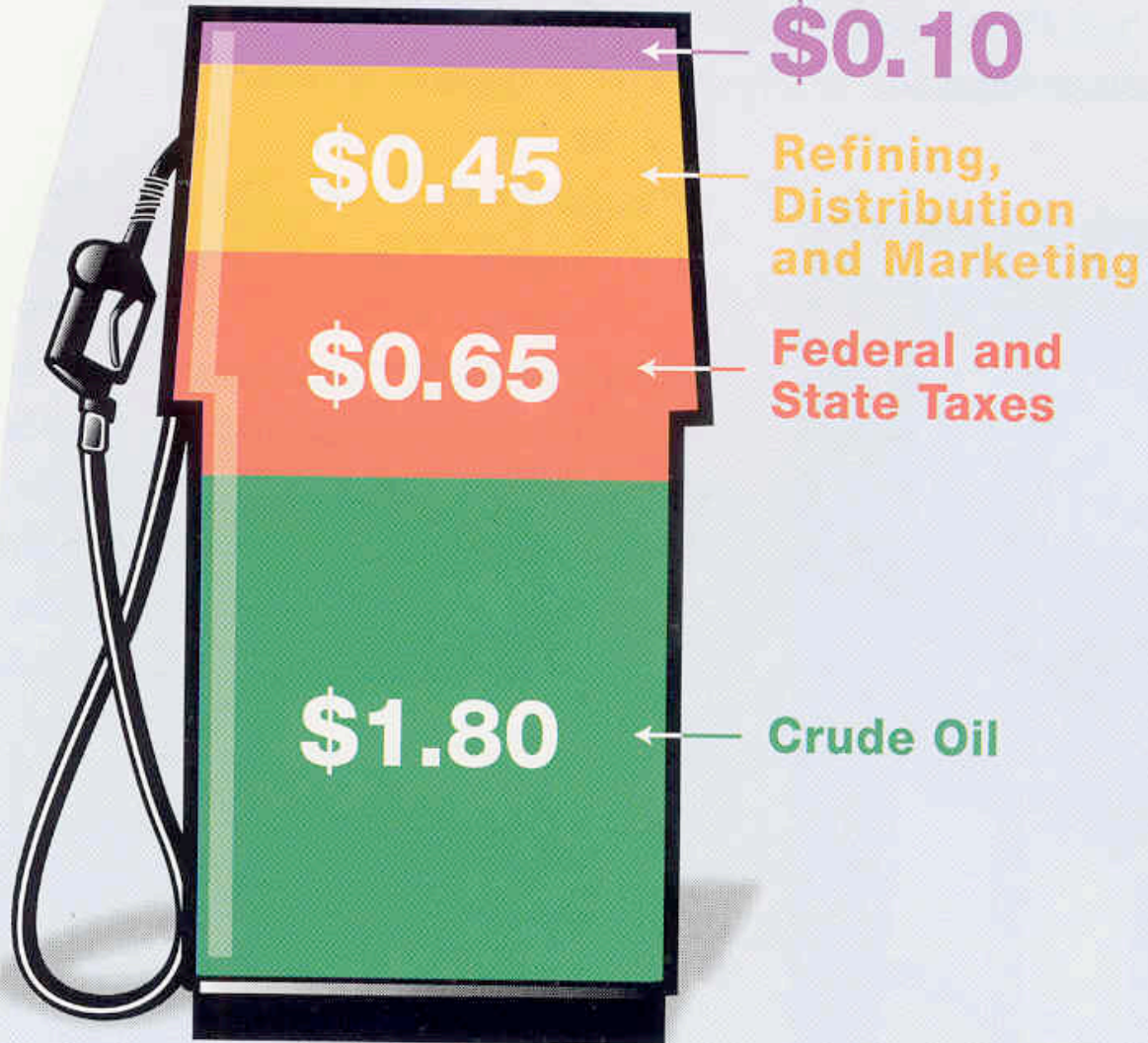
US Graduate Degrees in 2004

- Lawyers: 43,000
- Geologists: 1,681

Lawyers - Gaurdie Banister, Technical Director for Shell Energy Resources,
Houston Chronicle 3.05.05 p. 1; Geologists - AGI

Gasoline Price Components

Retail Price: \$3.00



Source: U.S. Department of Energy and ConocoPhillips estimates

Dynamics of Oil Supply & Demand

- \$ 12.75/bbl, Dec 1998*
- \$143.67/bbl, June 2008

*avg for Illinois Basin, iog.com

cac 2008

Petroleum in Antiquity

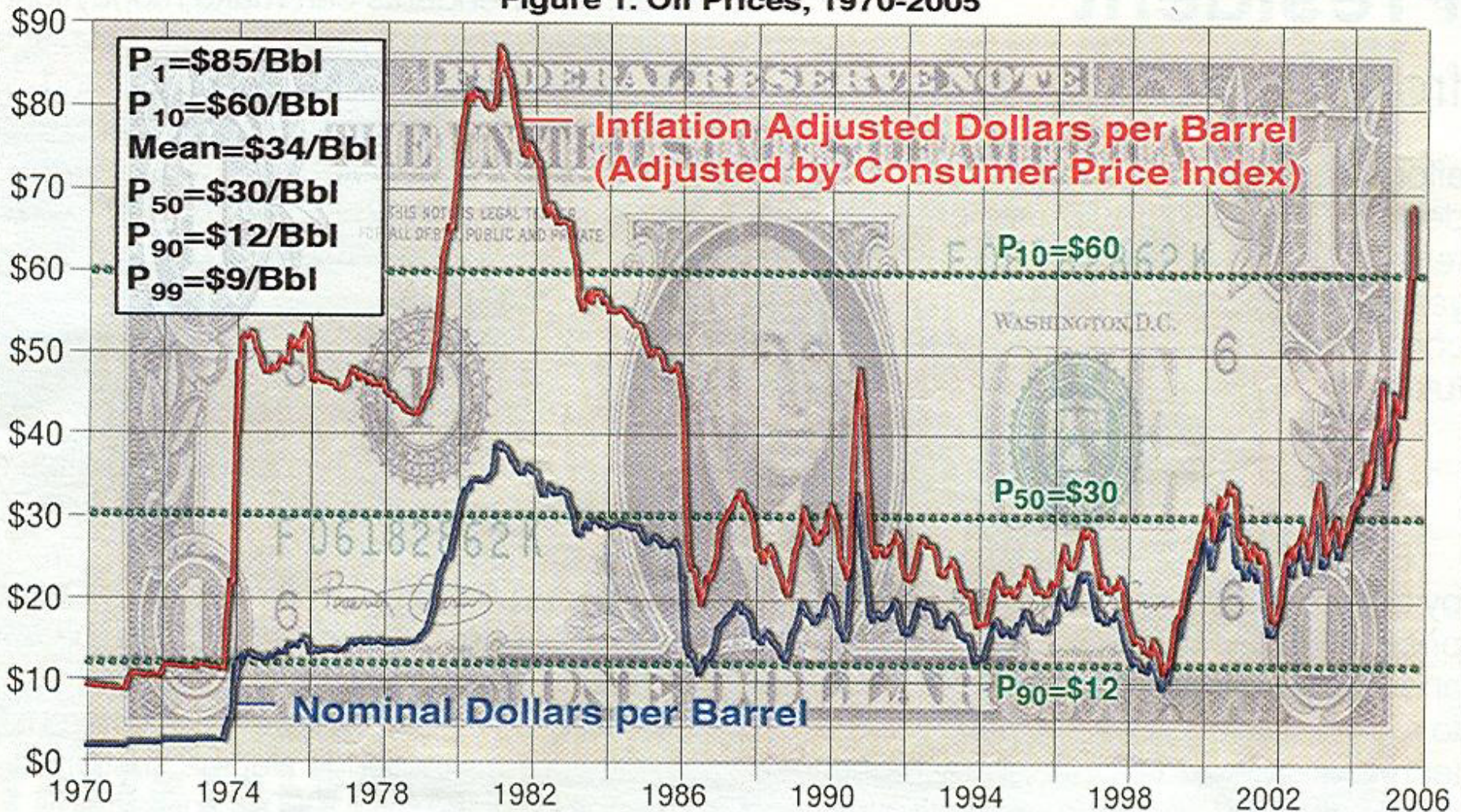
- 3000 BC: Fertile Crescent & Baku Seeps
 - Oil seeps noted along banks of Euphrates
 - Fires of Babylon seen by Greeks, Romans
 - Azerbaijan – Persia's land of fire
- 600 BC: First Production by Chinese
 - Gas burned to evaporate brine for salt
- 1291 AD: Marco Polo's Journey
 - Caspian oil produced for medicine, lamps
 - Brought back sample of oil from Sumatra

THE WORLD IN 2030

*ExxonMobil Study of Energy Demand

- 50% Increase in Energy Demand in 25 yrs
 - 205 to 335 mmoed
 - 80% of increase in developing nations
- 33% Increase in Population
 - 6 to 8 billion people
 - No growth in Europe, Japan, S Korea, Oz
 - N Amer increase less than 33%
- Oil & Gas: total world supply
 - 3.2 tbo Conventional
 - 1 tbo produced, 2 tbo remaining
 - Only N Amer produced > 50% of reserves
 - Non-Conventional: additional 1 tbo

Figure 1. Oil Prices, 1970-2005

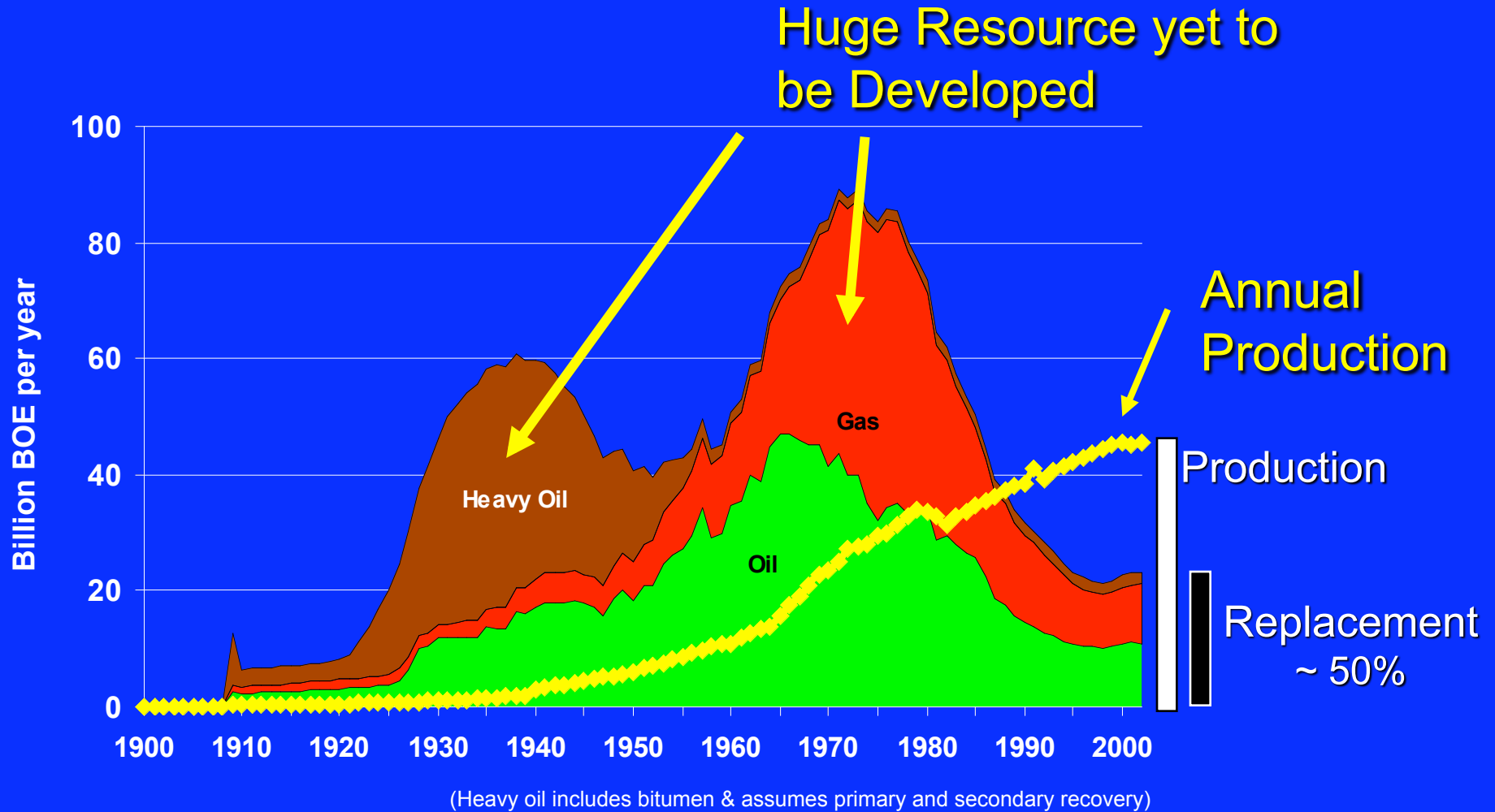


Source: EIA

Exploration Activity

- Declined Worldwide over last 20 yrs
 - 1 bbl discovered for every 4 bbls consumed (Halbouty, Explorer 8.04 p. 36)
 - More oil consumed than discovered every year since 1985 (Wells, OGJ 2/21/05 p. 21)

Global Discoveries Decreasing Global Production Increasing



Oil Produced and Remaining

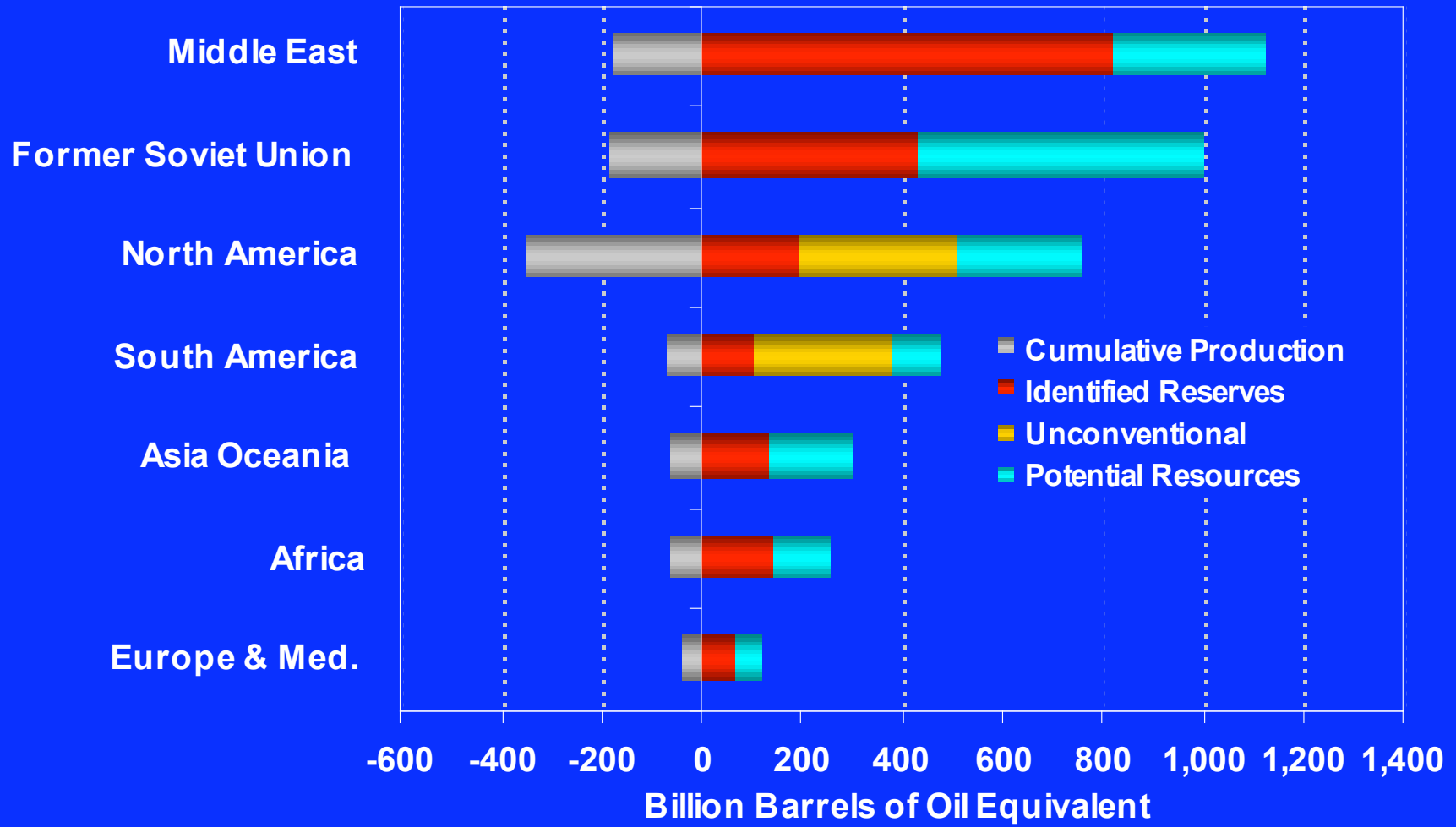
- 952 bbo produced thru 2004
- Represents 32% of total reserves
- remaining recoverable (outside US)
 - 859 bbo remaining discovered
 - 649 bbo undiscovered
 - 612 bbo reserve growth (existing fields)

Oil Discoveries and Reserves

(Brian Maxted quoted by Shirley, AAPG Explorer, 8.04 p. 8-9)

- Ultimate resource base 2.5 tbo
 - 1.9 tbo already discovered
 - 0.6 tbo remaining to be found
 - 90% will be found outside of N America
- Discovery rate peaked in 1960s
 - 1990s discoveries 75% gas
 - Only 1/3rd of total found in 1980s
 - Strat traps increasingly important
 - Now almost 40% of total
 - Up from 10% 50 years ago

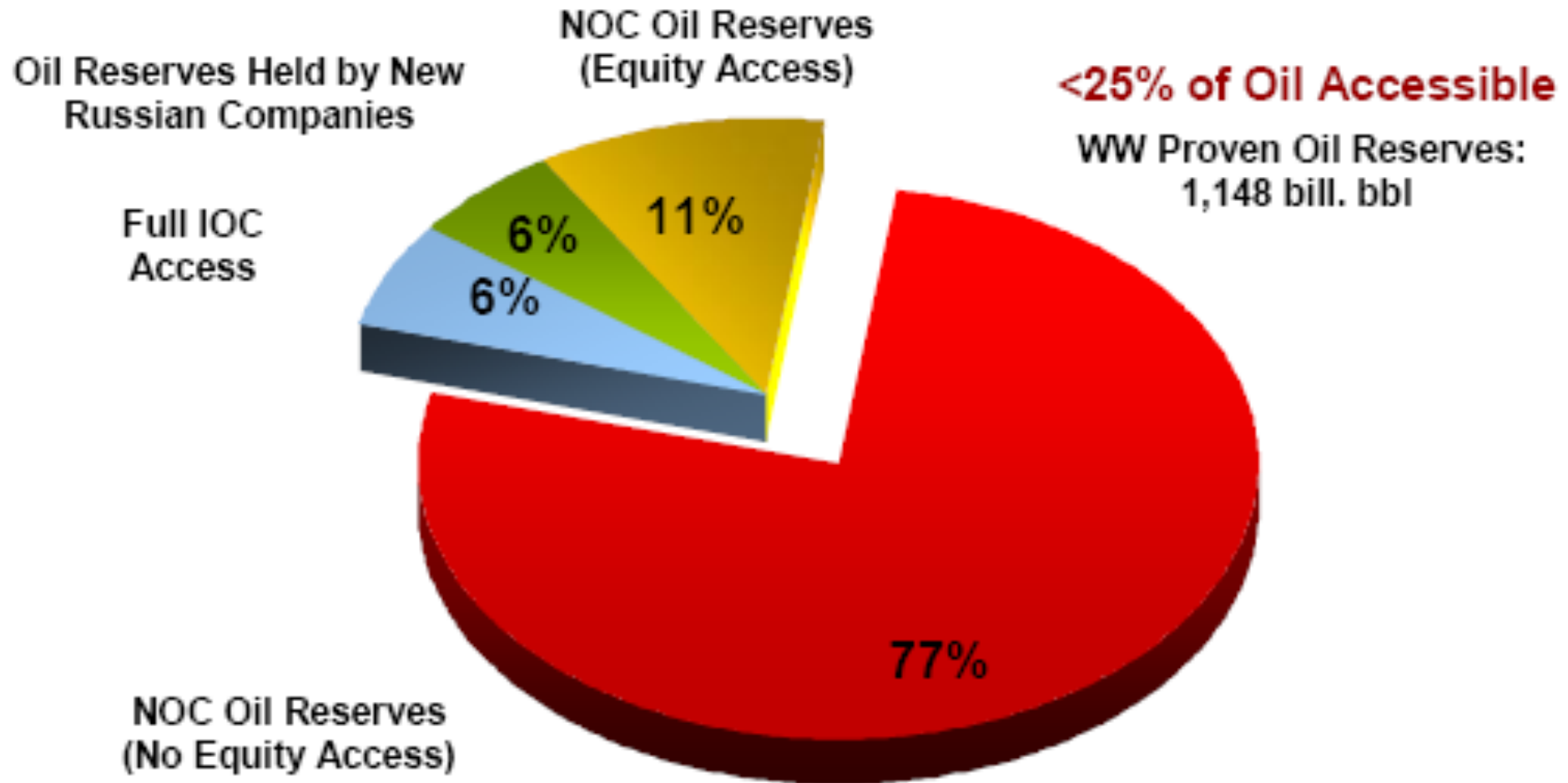
Remaining Global Oil & Gas Resources



Unconventional is ultimate recoverable heavy oil reserves from primary recovery.

Source: U.S. Geological Survey, IEA

Control of Proven Oil Reserves



World Oil Balance

	2008		2007			
Quarter	2 nd *	1 st *	4 th	3 rd	2 nd	1 st
Supply	87.7	87.7	86.7	84.1	85.1	85.4
Demand	87.7	86.2	86.9	85.3	84.7	85.5
Balance	0.0	1.5	-0.2	-1.2	0.4	-0.1

*estimated

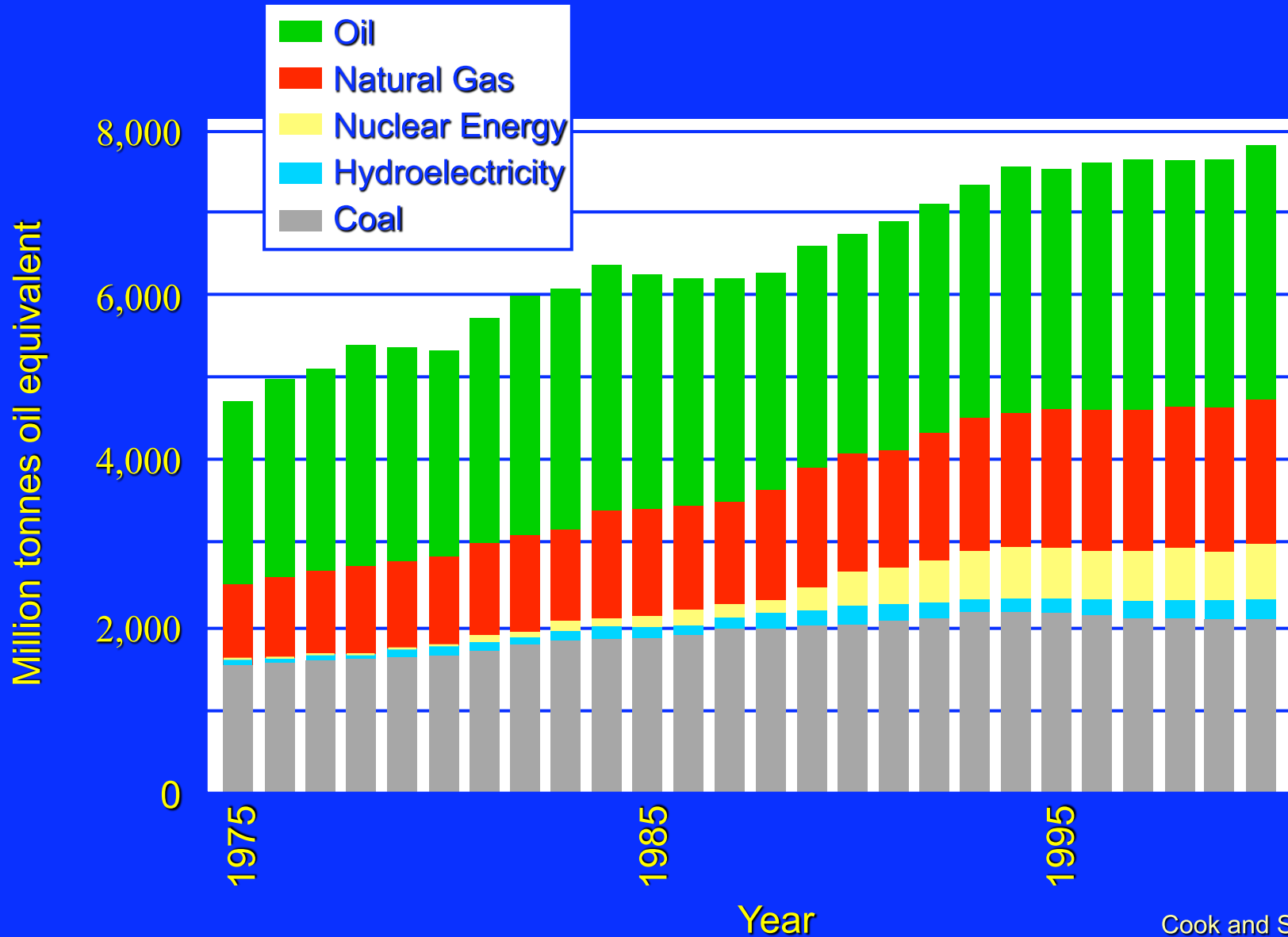
Per Capita and Total World Demand for Oil

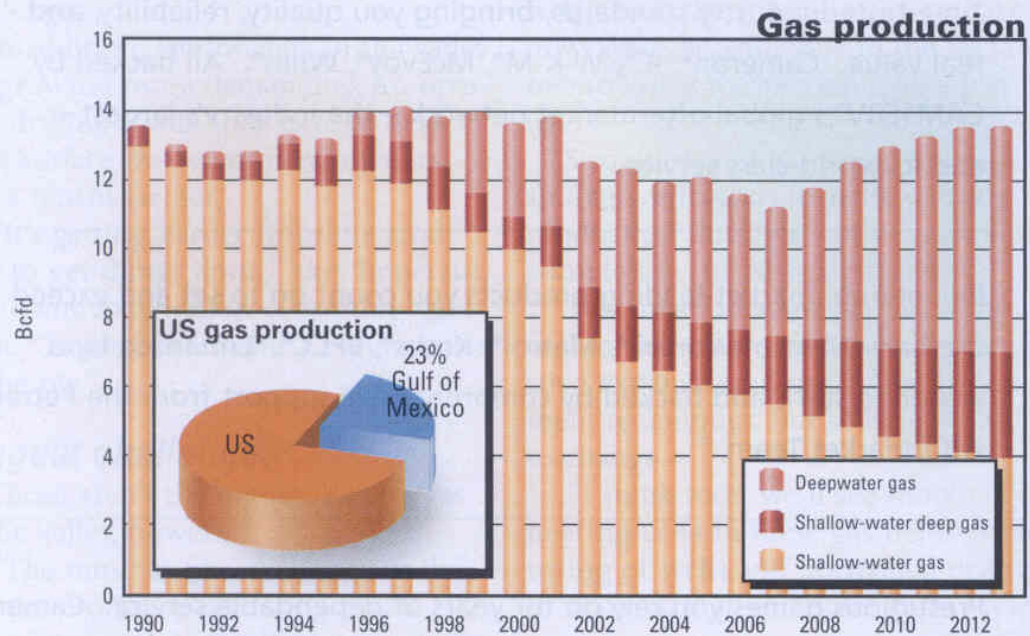
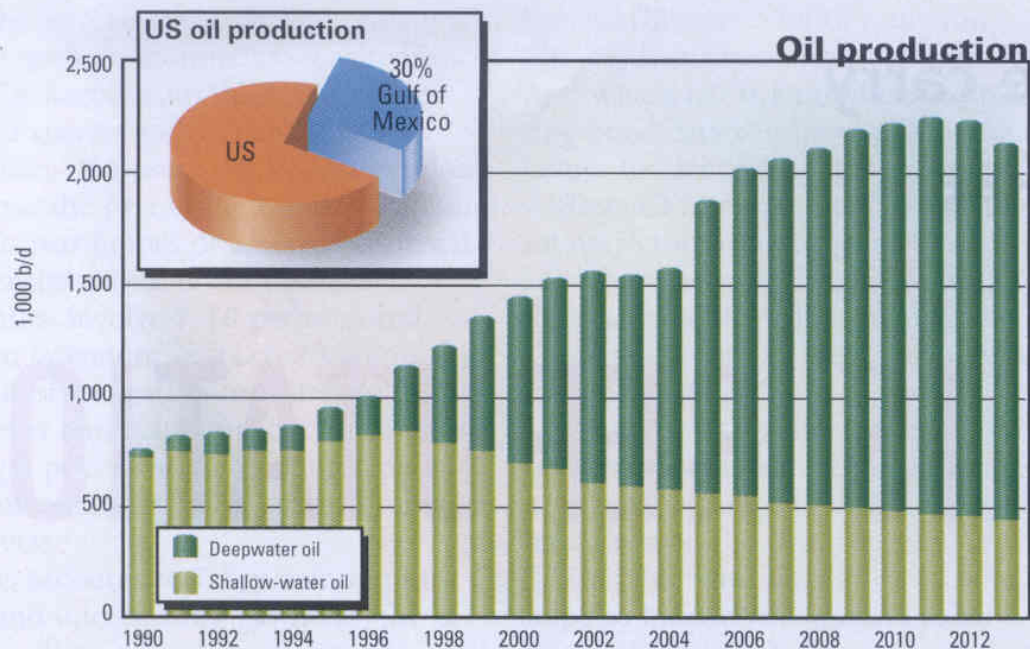
Country	Bbl/person/yr	World Demand*
US	25.6	445
Italy	12.4	215
Indonesia	1.9	25
Low Income	1.5	3
World	4.5	78

*MMbo/day

2002-2003 figures from OGI 17 Apr 04 (except Indonesia)

World Fuel Consumption: 1975-2000

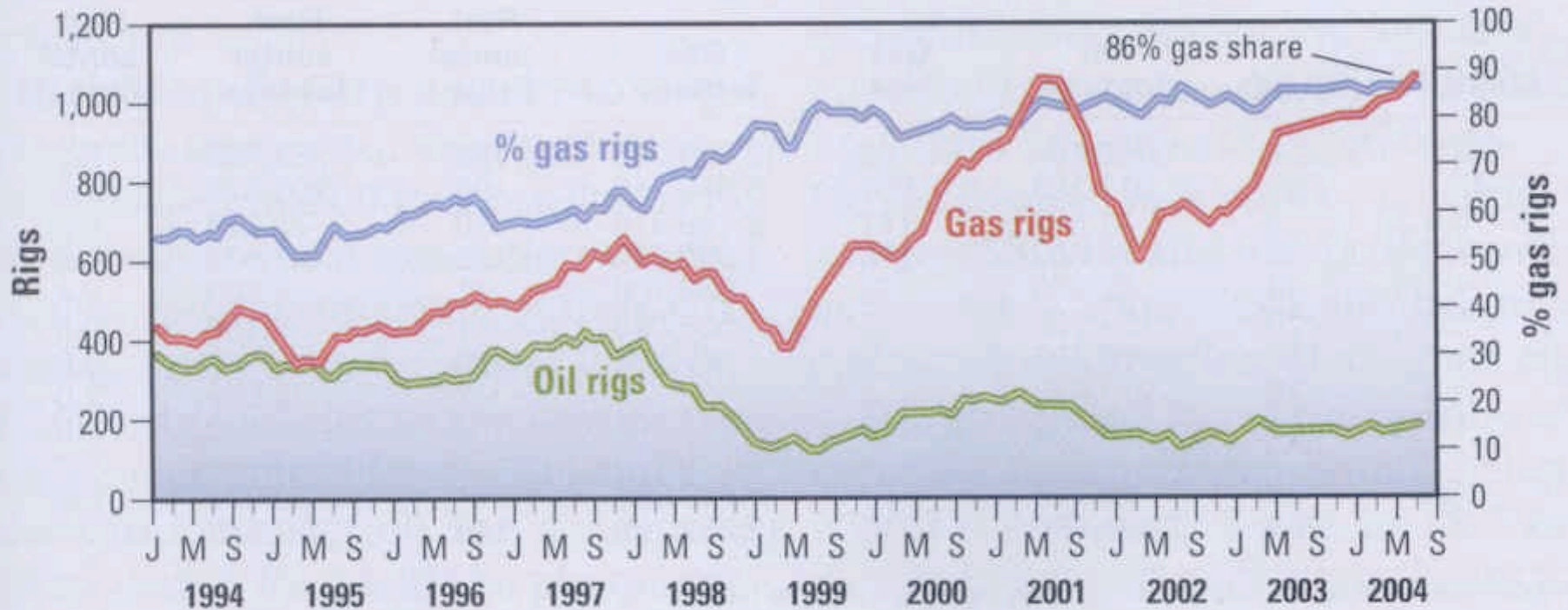




Future GOM Oil and Gas Production

US Exploration Switches to Gas

US OIL AND GAS DRILLING



Source: Baker Hughes Inc.

General Industry Trends

- Production rates exceed discovery rates
- Large volume of discovered resource is undeveloped
 - mainly gas & heavy oil in remote or sanction areas
- Discovery rate continues to decline long term
 - Will be perturbations – DW, N.Caspian etc.
- Geography & control of undiscovered reserves
 - Middle East, FSU, NOC > 75%
- New resource discovery & development of discovered resource will be key and challenging
- Understand market & technology drivers

GLOBAL OIL AND GAS FIELDS



Living & Working Abroad: Concerns

- Culture Shock
- Medical
 - Services & Infrastructure
 - Exposure to Disease
- Security Concerns and Stress
- Family Concerns
 - Living remote from family & friends
 - Schools and Child Care
 - Spouse Work and Activities
 - Access to Consumer Goods

Living & Working Abroad

Advantages

- Exposure to New Culture & Friends
- Exciting Work Environment
- Increased Responsibility
- Travel
- Lifestyle
- Compensation & Benefits

The Petroleum Geoscientist - A Detective

- Predicts where oil and gas occurs by using well data and 'remote sensing'
- Uses tools to gather data -
gravity and magnetics rock distribution and properties
geophysical imaging computer process & visualization
- Uses concepts to develop models:
structural concepts, petrol systems, etc
- Makes economic analysis and recommends
drilling

Geologic Mapping and Sampling

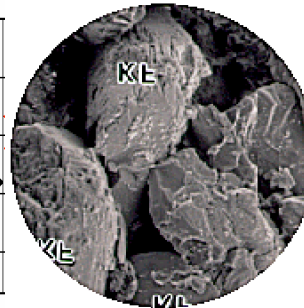
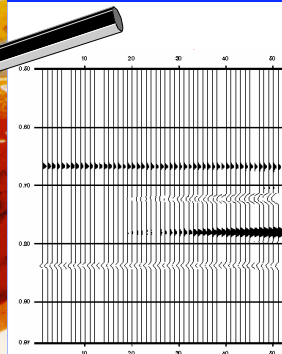
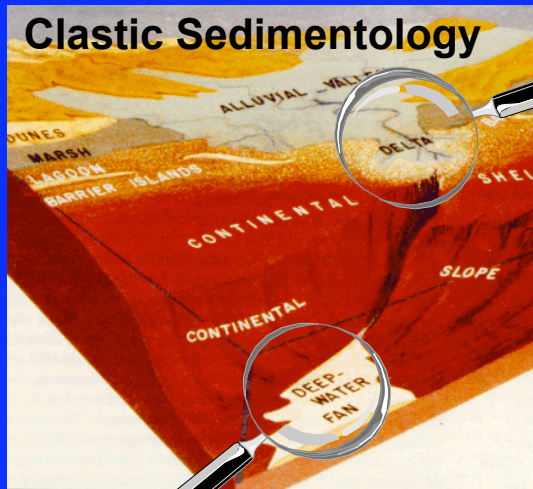
- Gravity
- Seismic Reflection
- Magnetics
- Geologic Mapping



Stratigraphy:

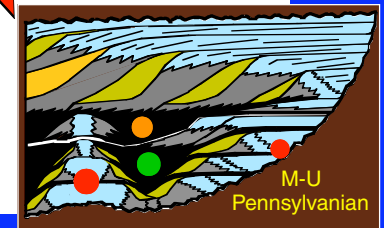
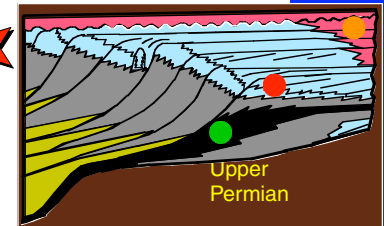
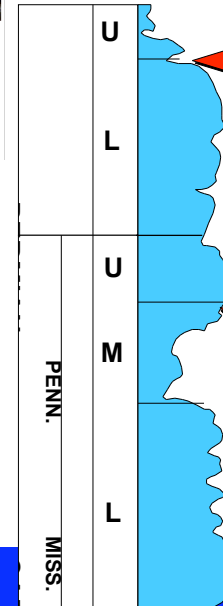
Depositional Systems
Sequence Stratigraphy
Petrophysics and Paleontology

Understanding the processes creating sedimentary units

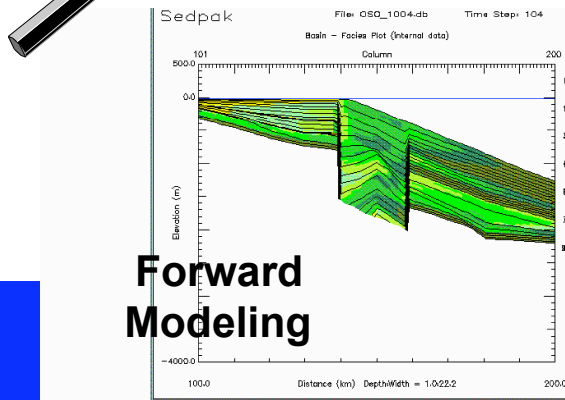


MESOZOIC & CENOZOIC

Record missing due to erosion: Must reconstruct history from regional data



Carbonate Analogues



Forward Modeling

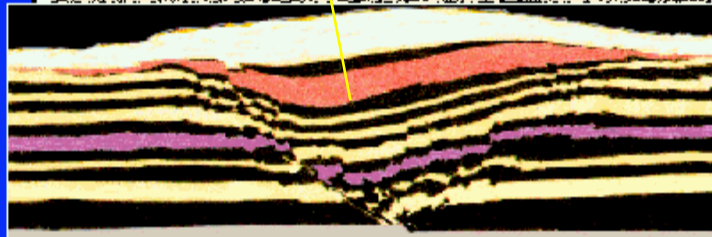
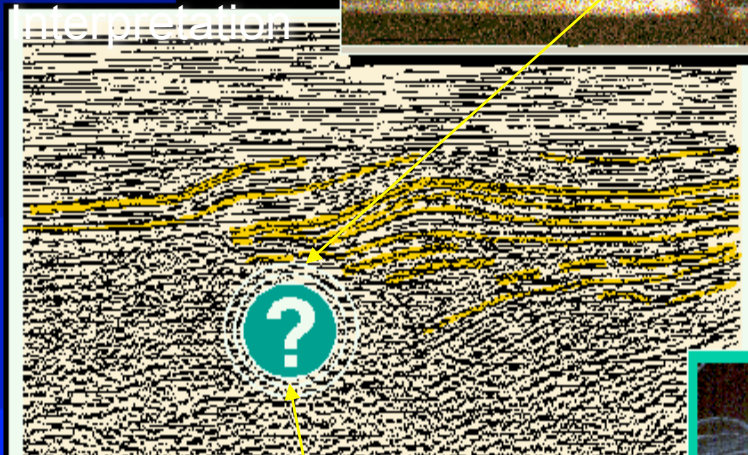
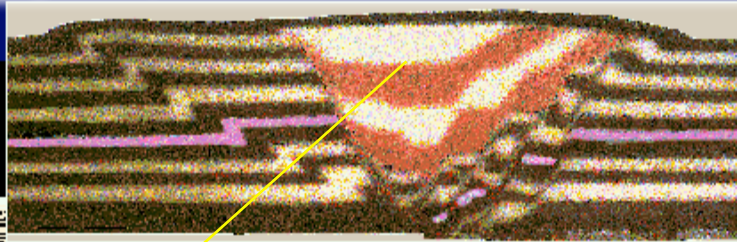
Sedimentary Modeling

Structural Geology

Case Histories: Outcrop and Seismic
Modeling: Physical and Computer
Stratigraphic Consequences

Understanding the process of deformation of the subsurface due to external forces

Seismic

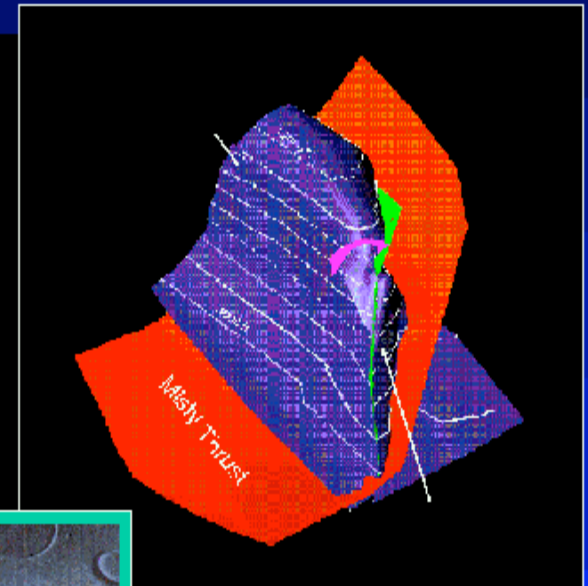


Physical Models as Guides
to Interpretation

Physical Models



Oblique Slip Model

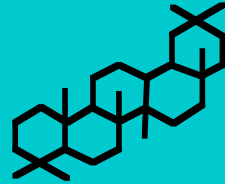


3D Kinematic
Model Building

Exploration Geochemistry:

Inorganic & Organic Sedimentology

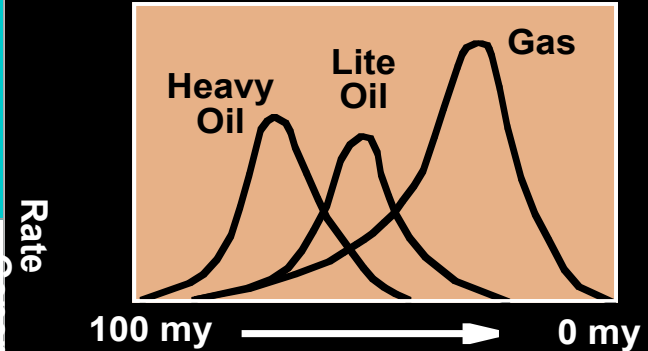
Characterizing the type, history and origin of petroleum



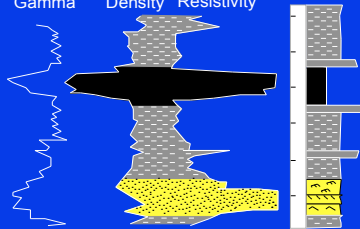
Determine Age of Oils



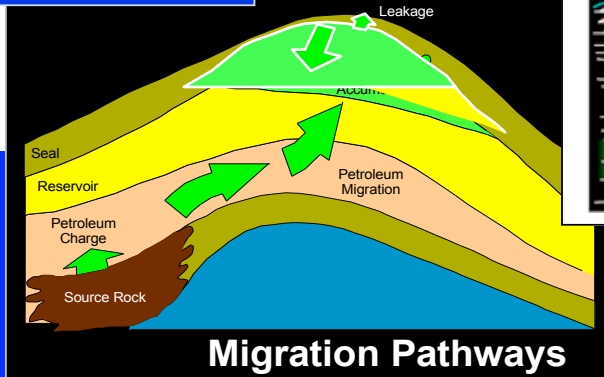
Predict Oil Quality



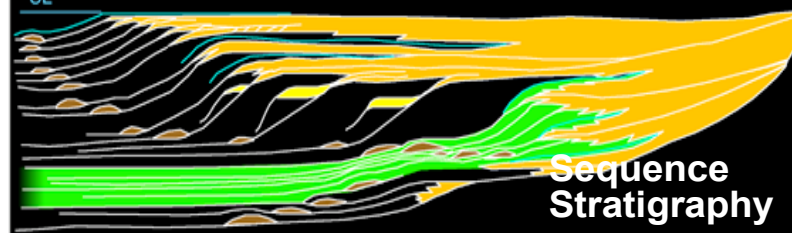
Gamma Density Resistivity



Coaly Source Model



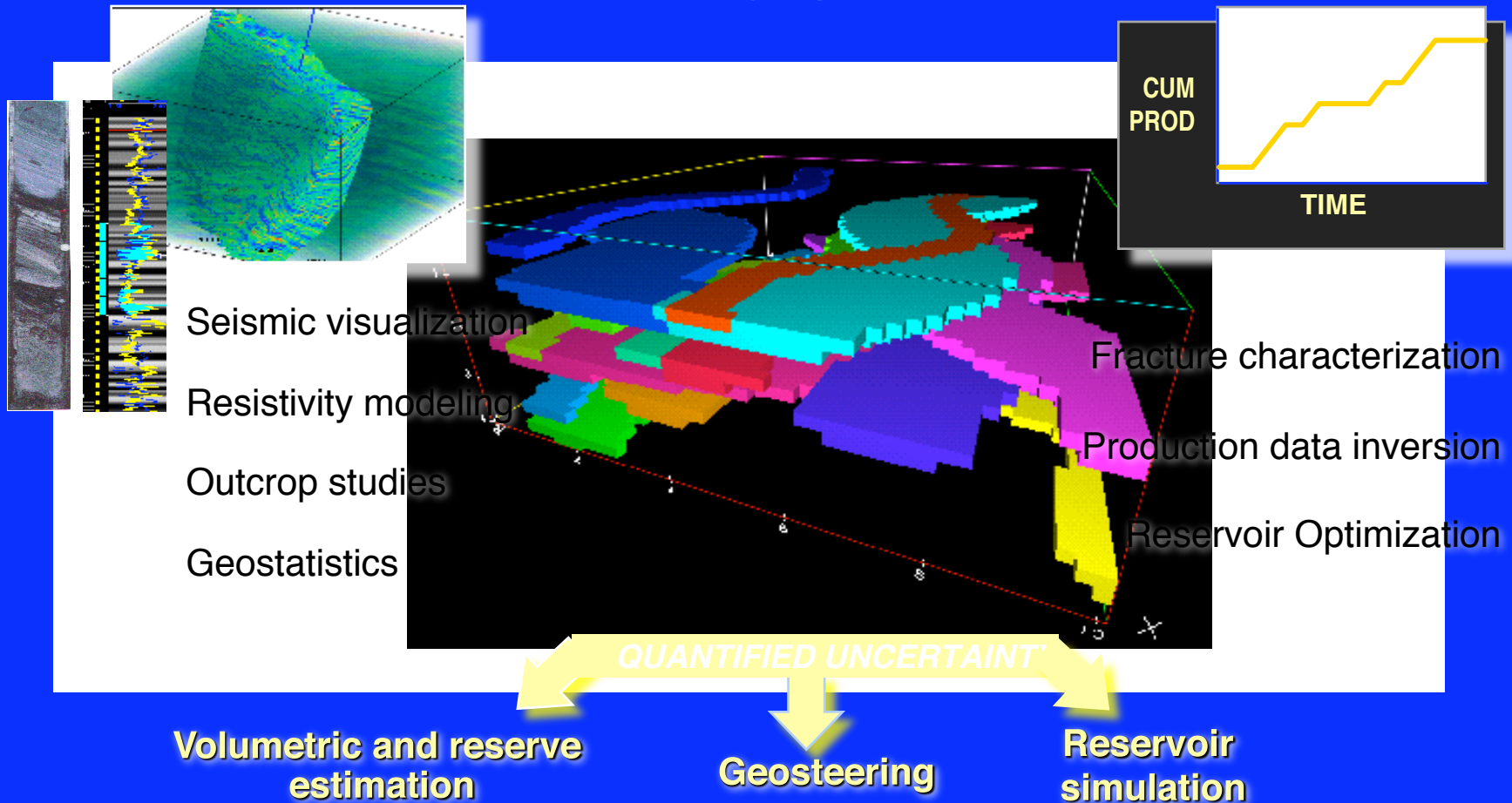
Source Rock Prediction



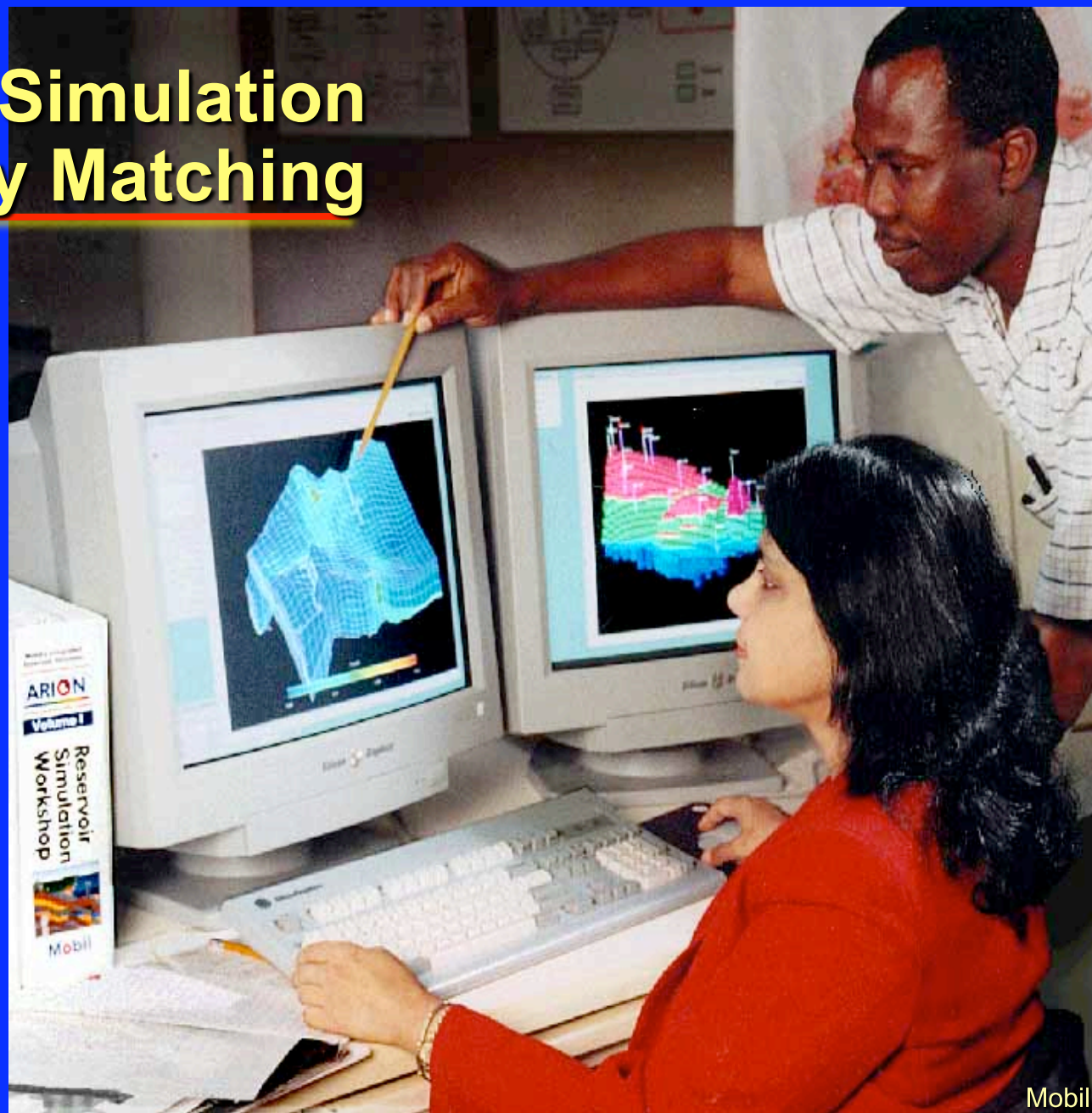
Reservoir Characterization:

Sedimentology
Fluid Flow
Computer Simulation

Reservoir Characterization focuses on data integration to model reservoir architecture and flow properties



Computer Simulation and History Matching



Job Market Expectations

By Employers

Required Traits

Self-motivated

Computer Literate

Well Educated

Team Player

Excellent Communicator

GEOSCIENCE SKILLS

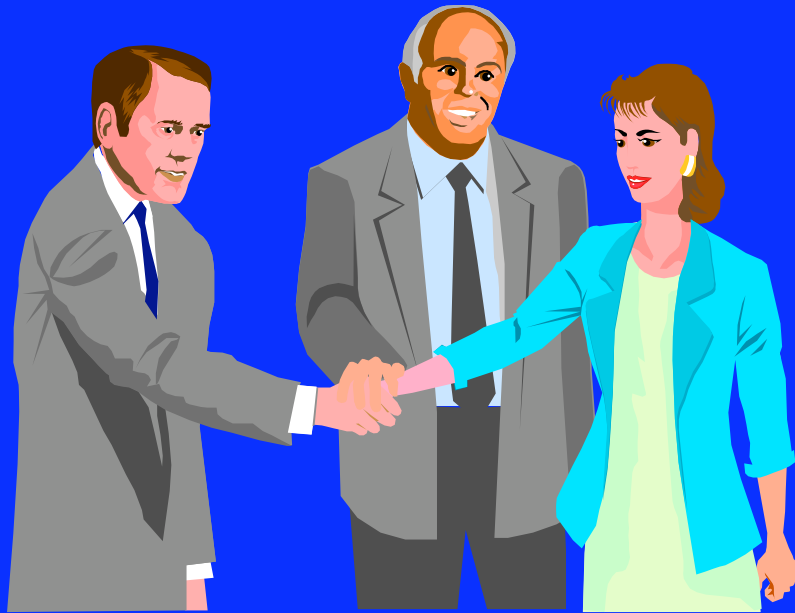
- Companies differ, but
- All favor a mixture: science, computer, non-tech
- Geology & Geophy
- Fieldwork and mapping experience are important
- Top Technical Skills:
 - Petroleum Geol
 - Geophysics
 - Sedimentology
 - Mapping
 - Strat/Sequence Strat
 - Petroleum Systems
 - Regional Geology
 - Reservoir Geology

COMPUTER SKILLS

- PC skills Required
 - Word Processing
 - Spreadsheet
 - Presentation
- Workstation
 - Try to get exposure
 - Interpretation most important: Landmark, Charisma, etc.



NON TECHNICAL SKILLS



- Initiative
- Ethics and Integrity
- ENTHUSIASM
- Adaptability
- Cooperation
- Oral Communication
- Grasp & Summarize Key Issues

PRESENT REALITY: RELEVANT INTERACTIVE RESEARCH



Career Strategies

- Set Goals –
 - Direction
 - Timing
- Prepare to Compete
 - Stay Versatile
 - Be Patient
- Network
- Keep Growing
 - Find, use a Mentor
 - Develop New Skills



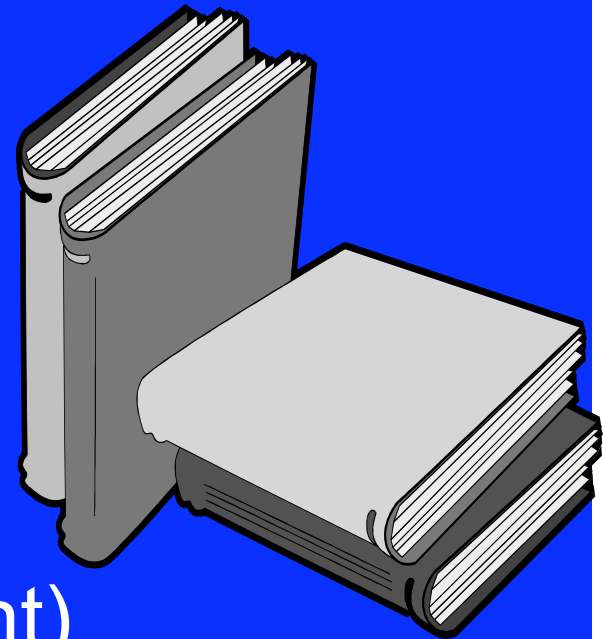
Professional Societies

Why Join?

- Learn about your future career
- Increase your knowledge with exposure to leaders in science and industry
- Expand interpersonal, organizational, & management skills
- Network – interaction with peers
- Helps you throughout your career

AAPG STUDENT BENEFITS

- Great Publications: Bulletin, Explorer
- Books, Books, Books
 - Publication Pipeline
 - Discounts on AAPG Books
 - \$500 Book Gift (3 yr cycle)
- Grants-in-Aid for Grad Study
- Weeks Grants (SC and student)



WEEKS GRANT

2003 awards

\$500/yr for Chapter

\$500/yr for Student

STUDENT CHAPTER ACTIVITIES

- Distinguished Lecturers from AAPG and Industry
- Short Courses and Seminars
- Field Trips
- Exhibits at Conferences
- Other Events: on Campus & off Campus



Univ Sriwijaya geophysical survey in Sumatra, 21 Feb 2004

Why stay an AAPG Member
through your career?





Membership Value Pyramid



A
A
P
G

Professional Standing & Recognition

- Code of ethics
- Membership limited to trained & experienced professionals
- Professional certification available
- Networking opportunities
- Present your work at meetings & conventions
- Regional & international contacts & events
- Honors & Awards