



Where to Look?

The greatest crap shoot
in the history of mankind

Early Days of the Oil Industry

1859 - 1901

Birth of the oil industry:

Search and discovery of oil.

Early chaos in the oil fields.

Consolidation and inevitable monopolies.

Early Days of Oil Exploration

No one had any idea of:

- 1. How oil was formed.**
- 2. They didn't realize that oil could migrate through rocks.**
- 3. Why oil accumulated in discrete areas, which could be either small or large.**

Early Exploration

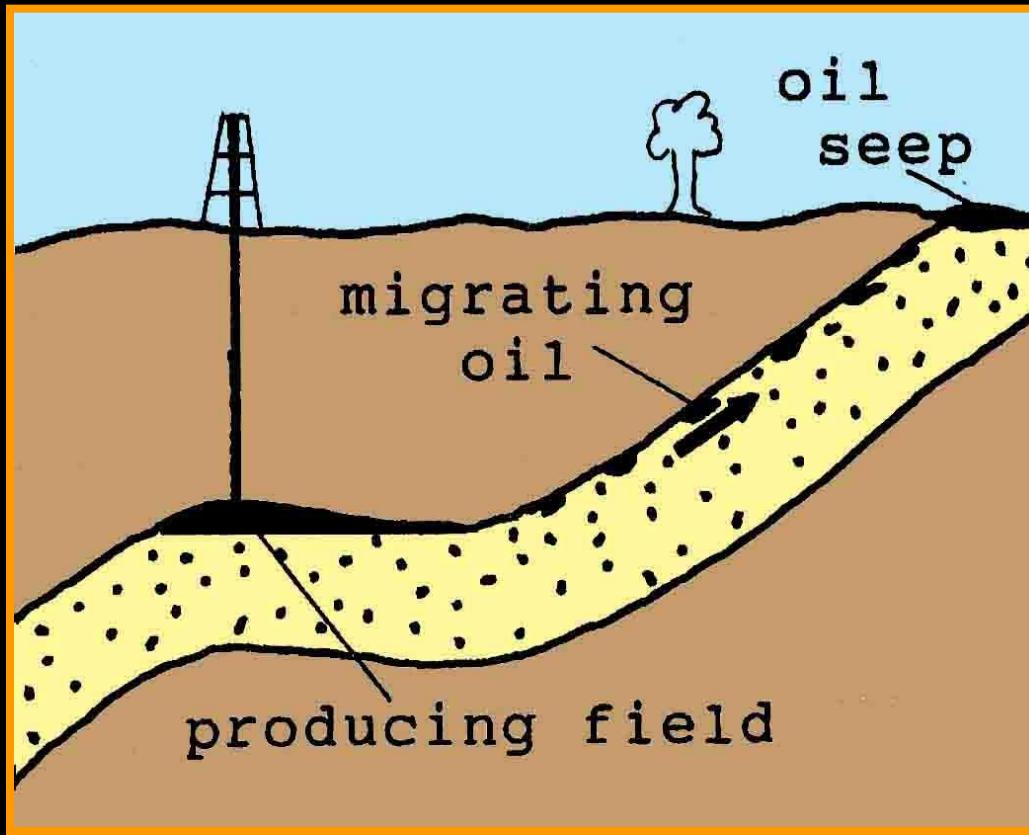
Not based on scientific ideas:

Seepology

Creekology

Closeology (most successful for some)

Oil Seeps



If oil is seeping from the ground, it's a pretty good indication that an oil reservoir is nearby.

Terrestrial oil seeps are difficult to use, these seeps only indicate the presence of a nearby oil reservoir.

Oil Seeps

Santa Barbara County, CA

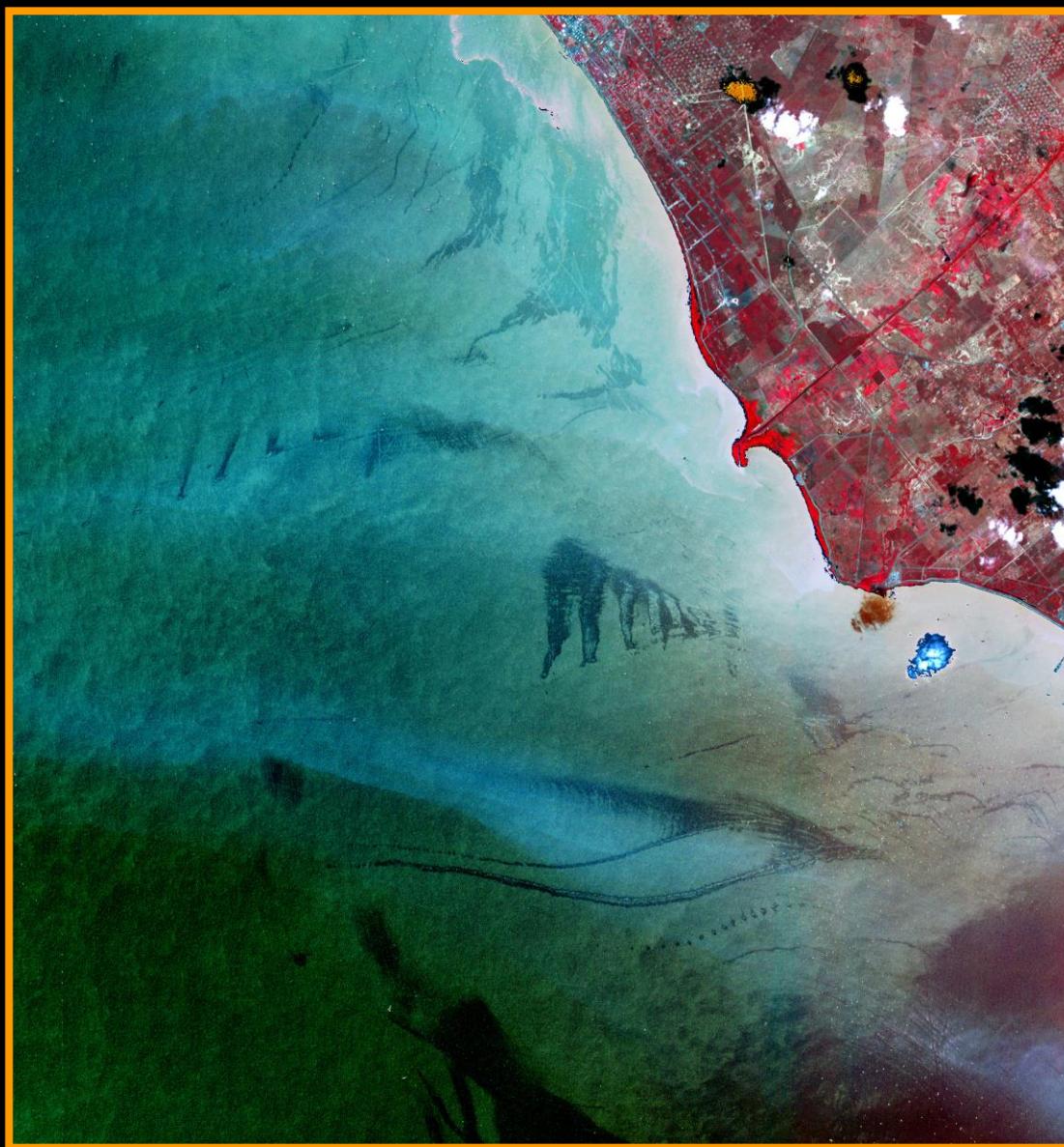


Human or Natural Pollution?

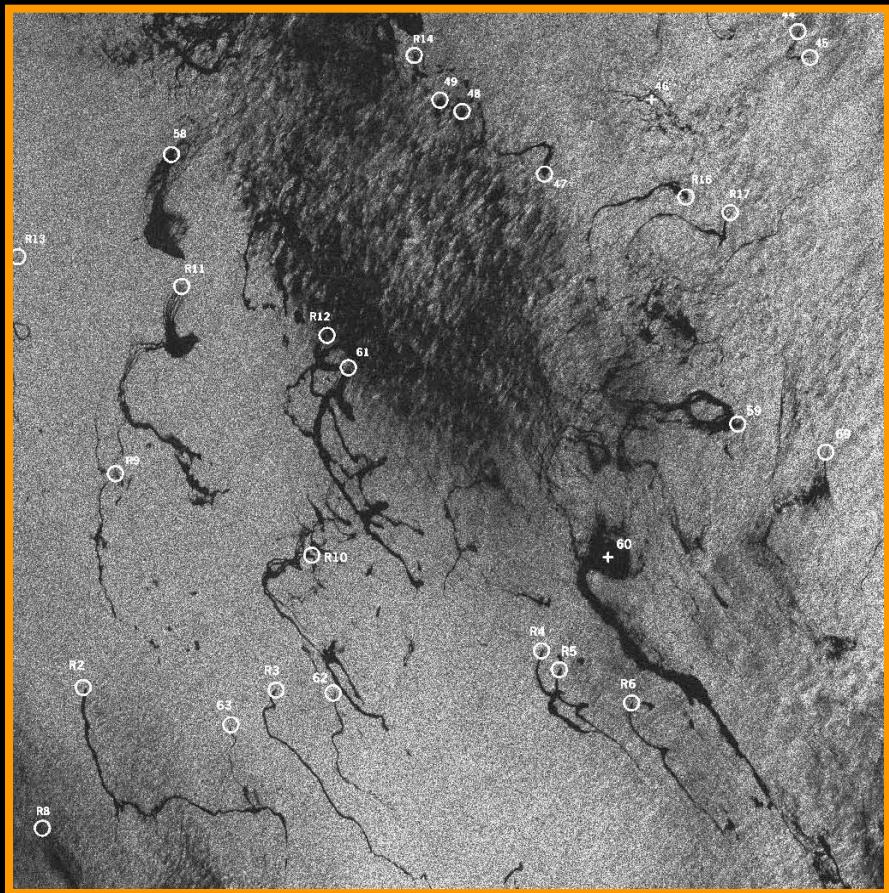


Santa Barbara beaches

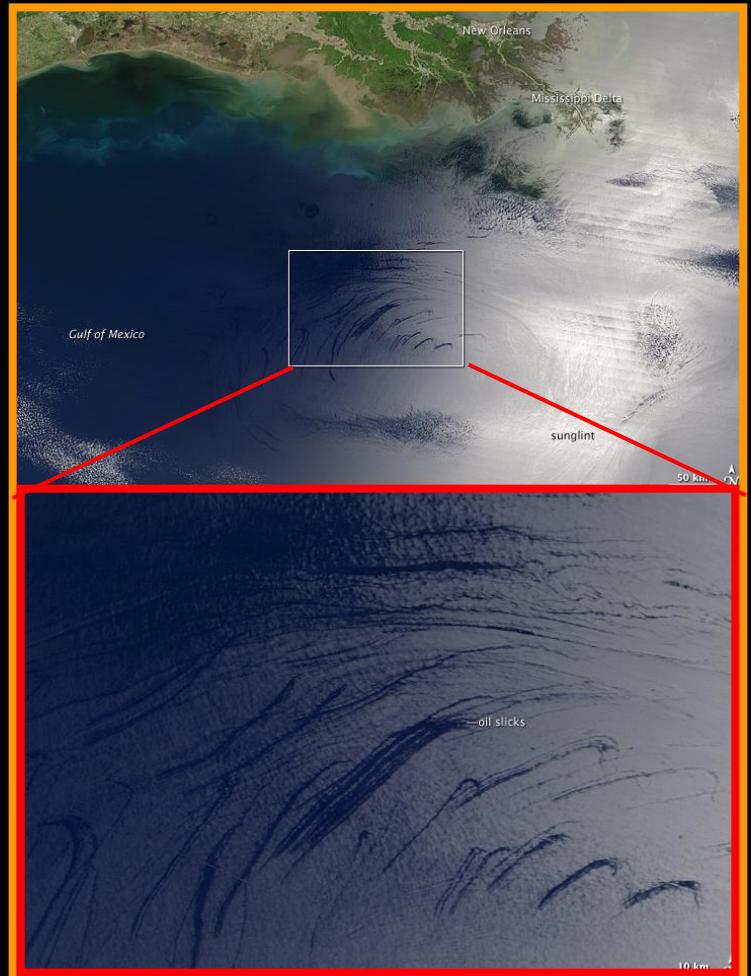
Oil Seeps in the Santa Barbara Channel



Oil Seeps & Satellites

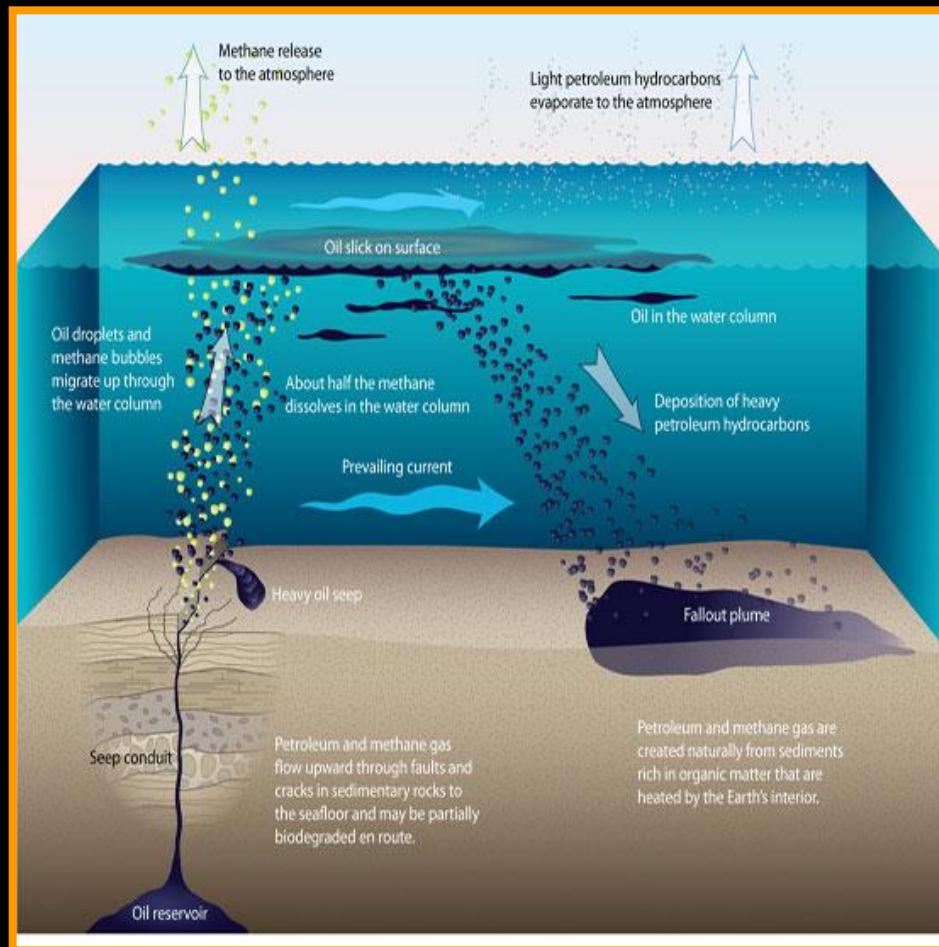


Caspian Sea

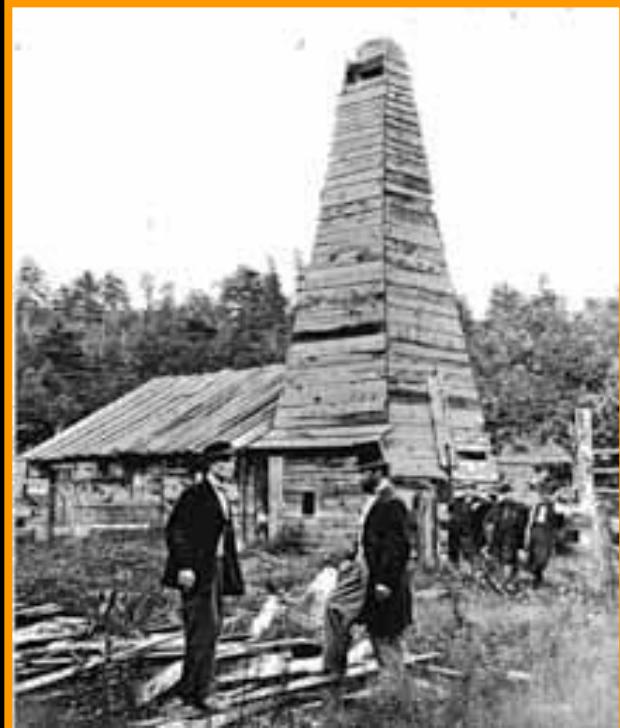


Gulf of Mexico

Oil Seeps are a part of the Natural Environment



Discovery & Exploitation of Early Oil Fields



Drake's discovery well



Chaotic development of early oil fields

Methods of Oil Exploration

Oil companies couldn't depend on dumb luck to find oil.

To be successful in the search for oil, it was necessary to know something about geology.

Recognition of the importance of geology was slow in coming to the forefront.

Exploration 1910-1935

Primarily based on dumb-luck.

Many oil fields were discovered by wildcatters even after they were told by the “so-called experts there was no possibility of finding oil”.

Every time this happened, geologists tried to figure out why oil was present when the experts said there was no oil.

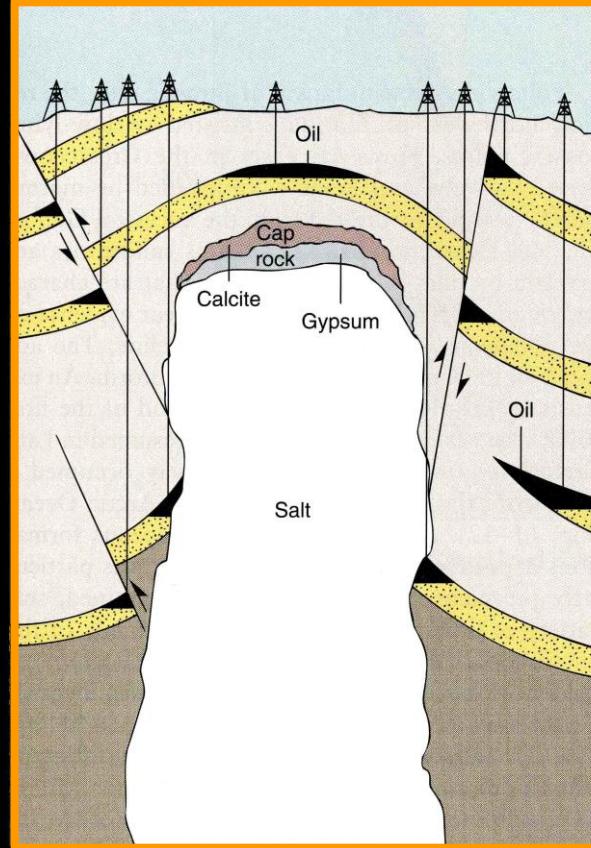
Gradually geologists discovered new types of oil traps which increased finding more oil.

Salt Domes

Spindletop



Jan 1901: world's first "gusher"
**Partilo Higgins & Captain
Anthony Lucas**

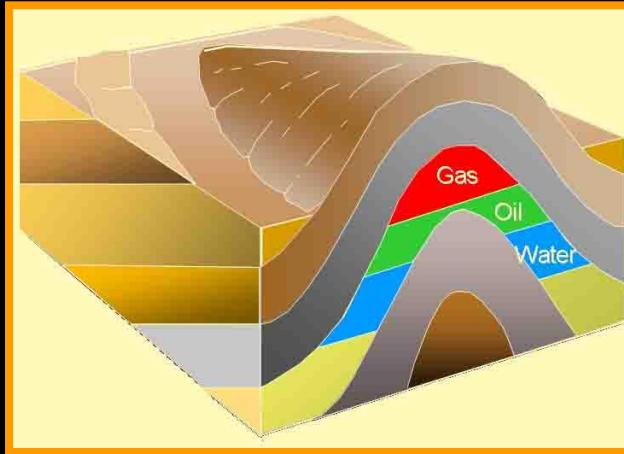


Salt dome

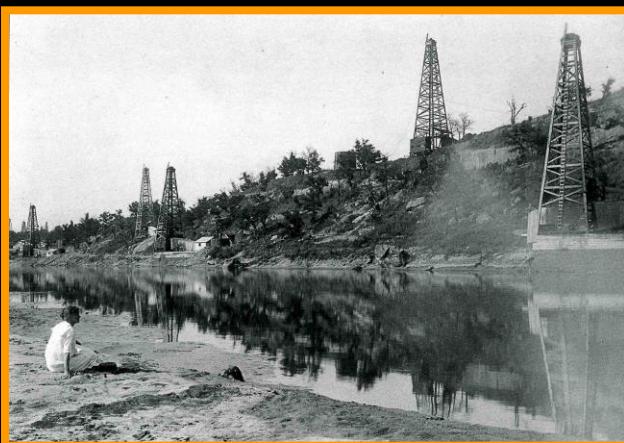
**Spindle top discovery on crest
of salt dome**

Recognition of Anticinal Traps

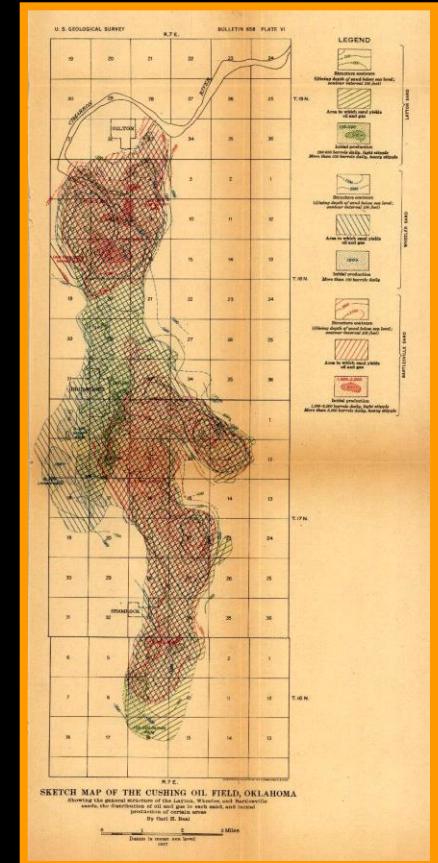
Drumright, Oklahoma



Anticline

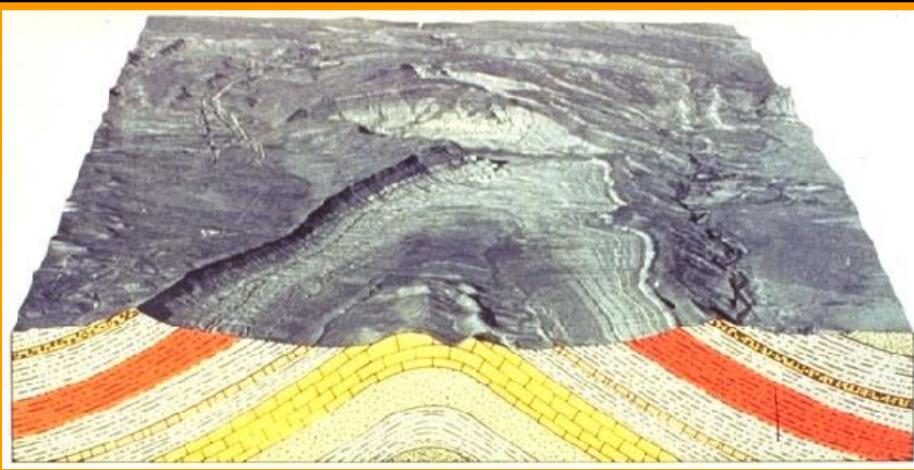


Derricks along the Cimarron River,
Drumright, OK

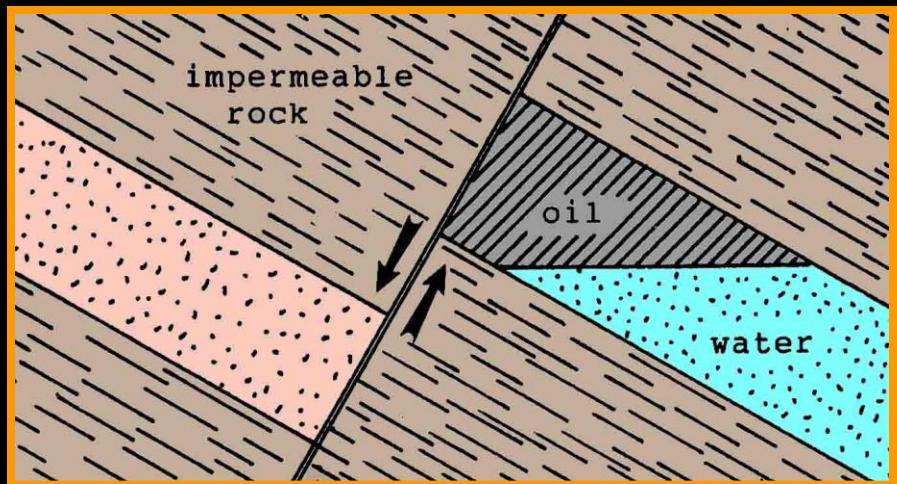
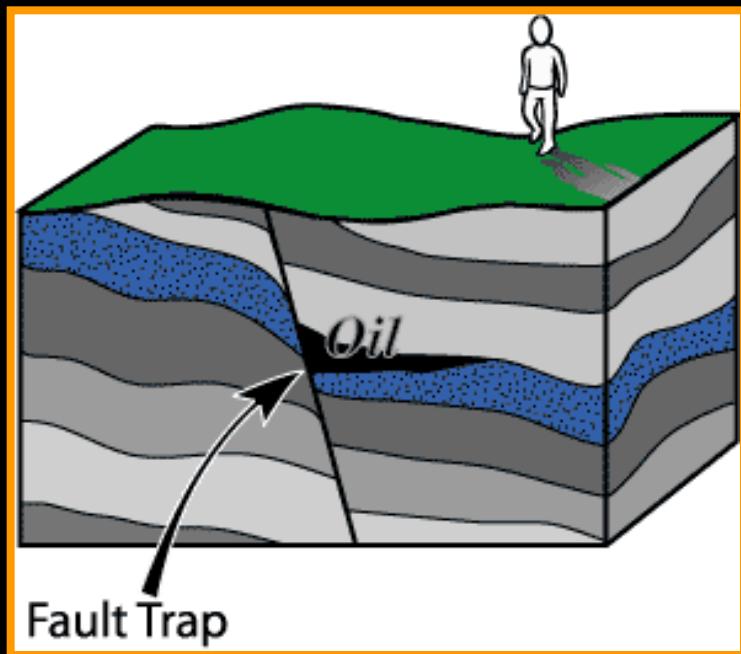


Drumright oil field, OK
1914

Drill Every Anticline



Role of Faults as Traps



Displacement of Oil Sand by Faults



Near Shell Beach, CA

Unconformities & Stratigraphic Traps

The Black Giant, East Texas



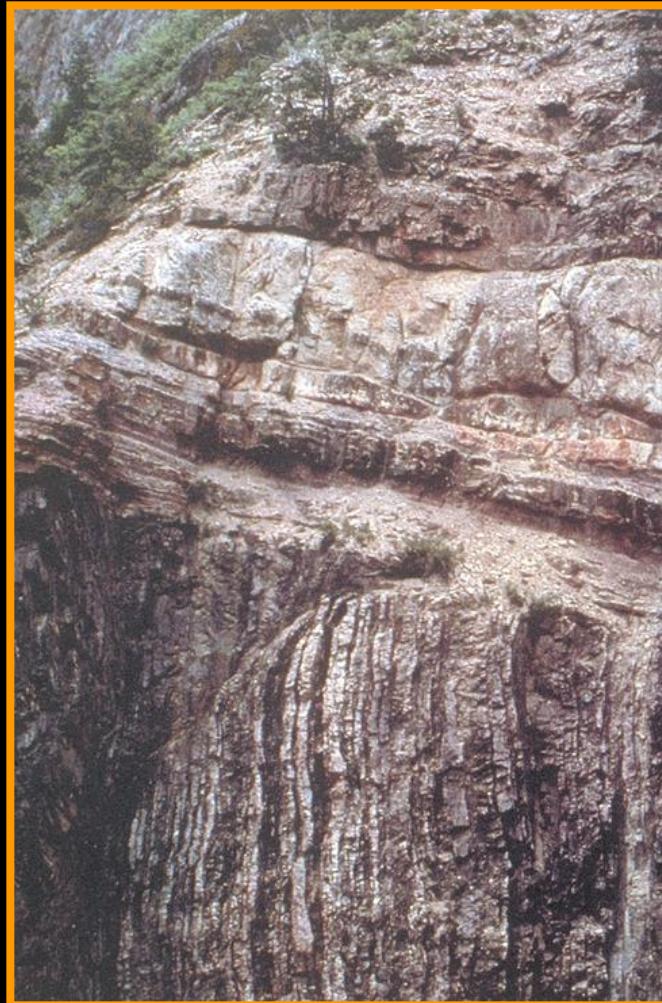
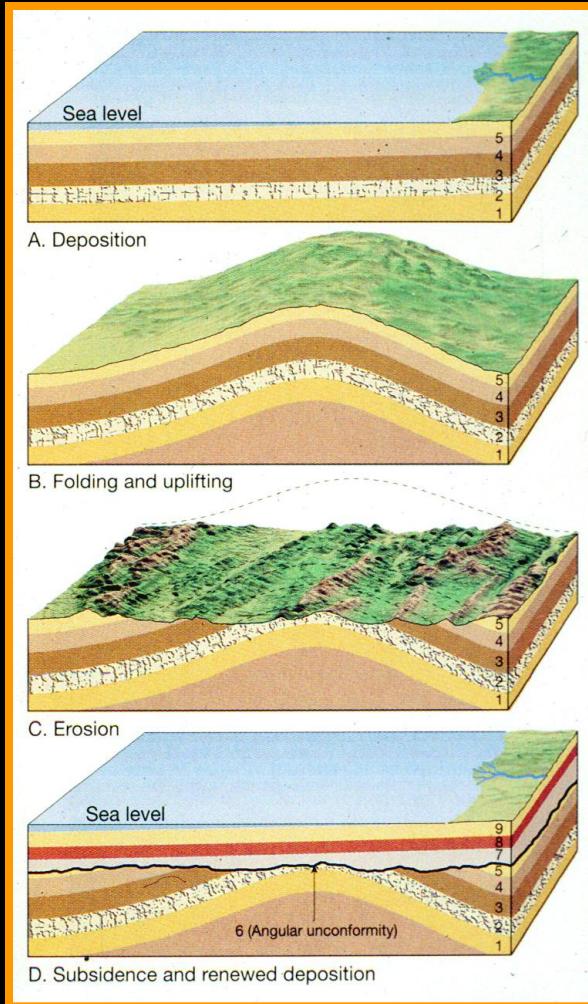
Dad Joiner



Dad Joiner's No. 3 Daisy Bradford

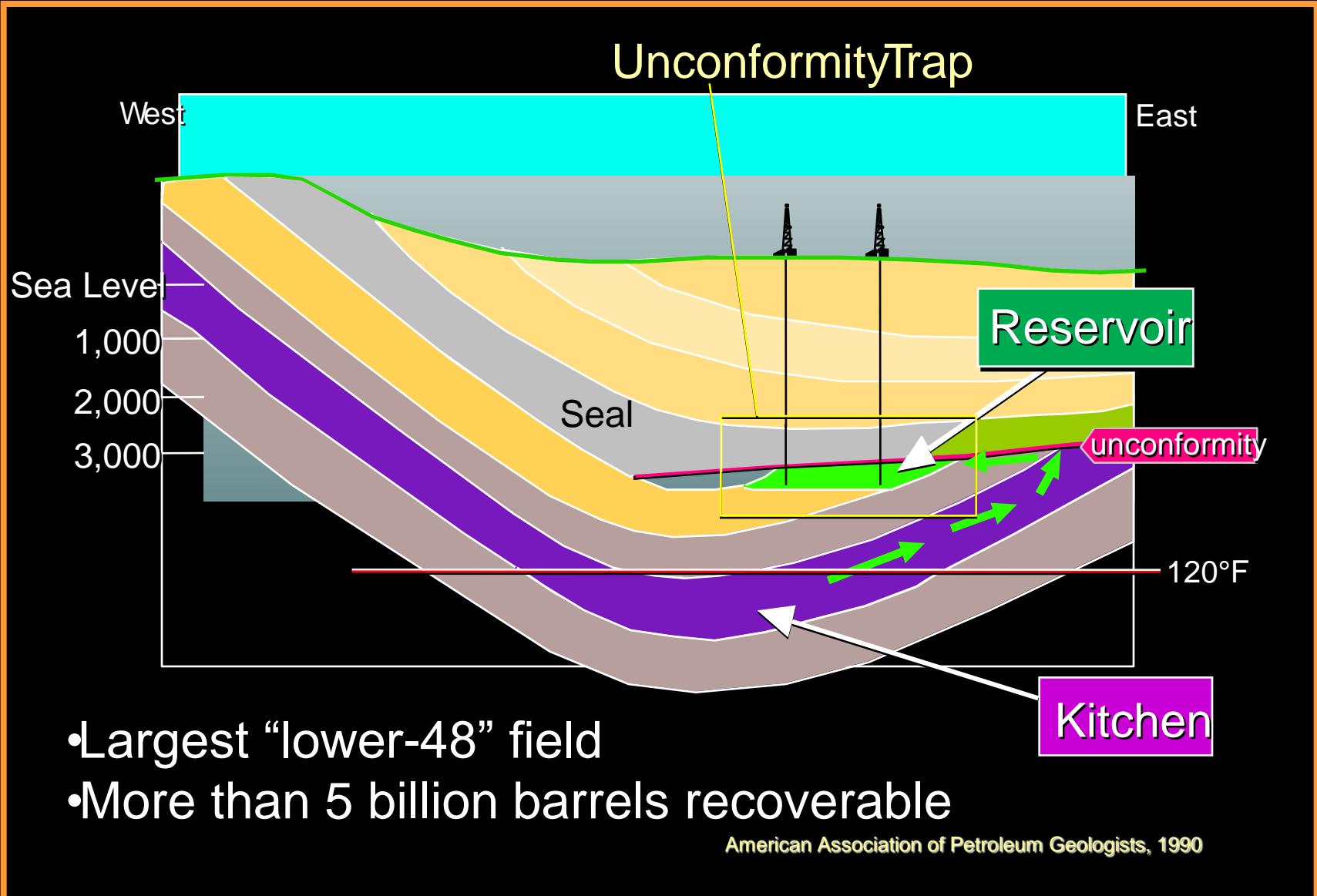
“Under Texas is an ocean of oil, a treasure trove all kings of earth might covet.” *Columbus “Dad” Joiner, 1930*

Unconformities



Unconformites - gaps (missing time) in the geologic record

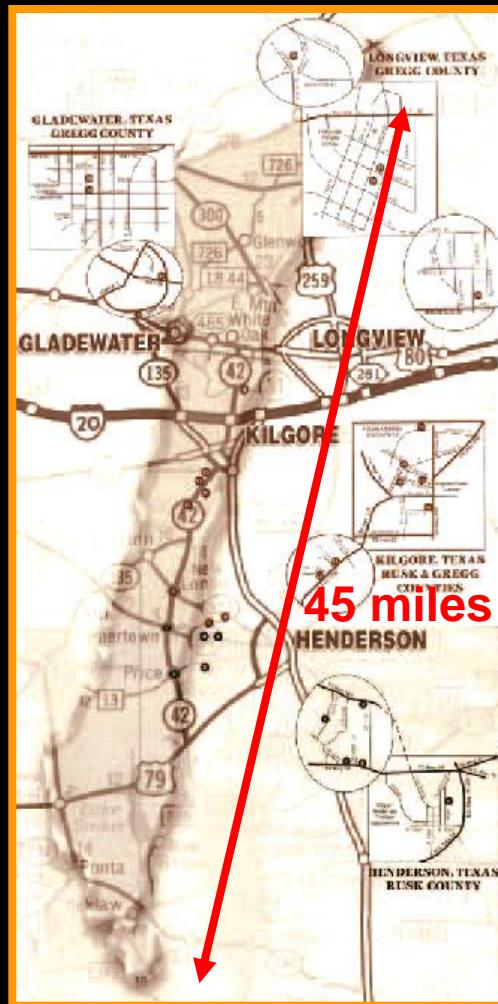
The Back Giant, East Texas



Stratigraphic trap

Black Giant of East Texas

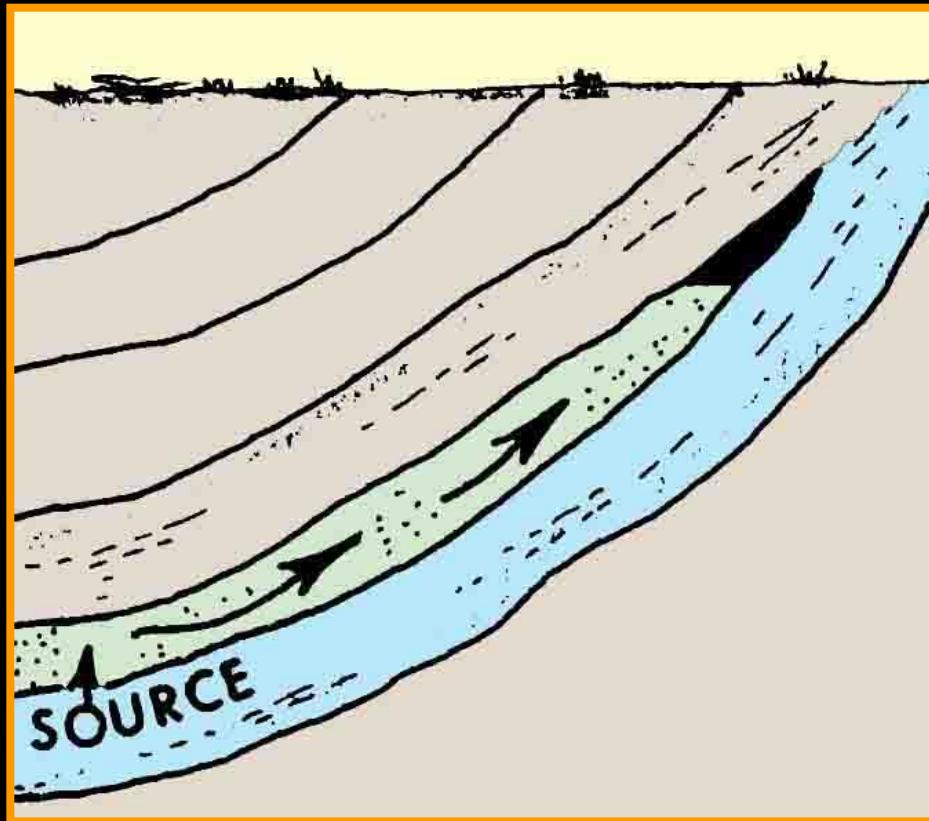
First Supergiant Oil Field



Black Giant has produced over 5 billion barrels of oil since it was discovered

Stratigraphic Traps

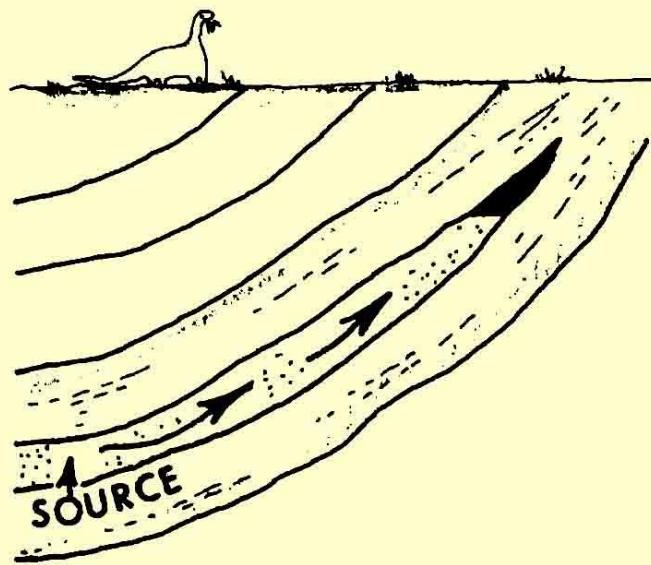
Lithologic Changes



Oil is trapped in reservoir rocks (light green) between two impermeable layers of rocks

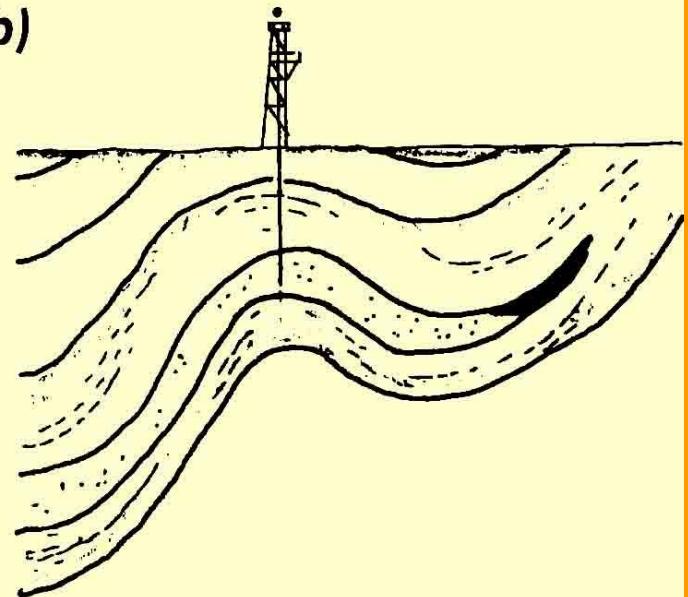
Timing of Trap Formation

(a)



Migration before folding

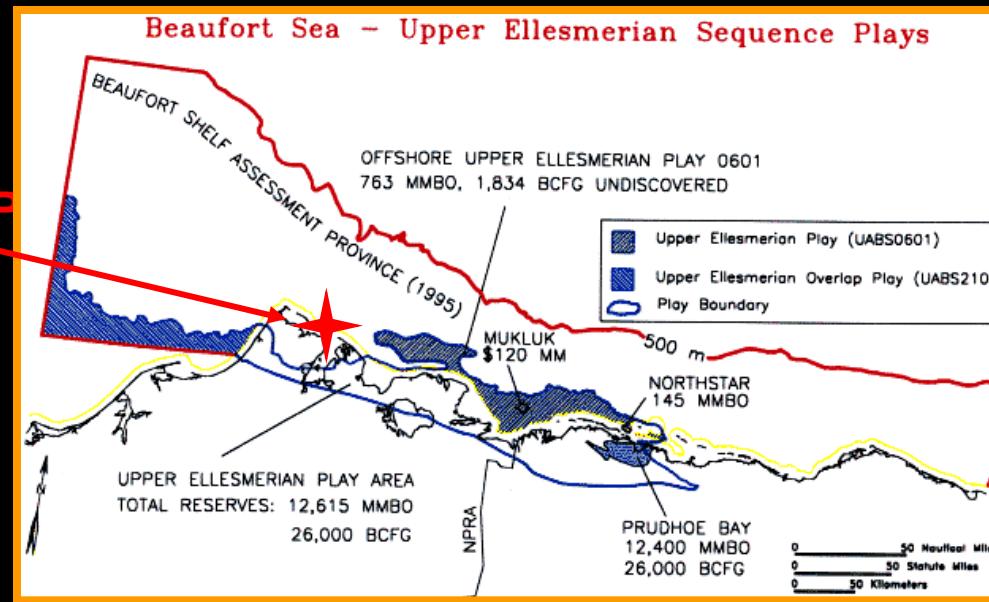
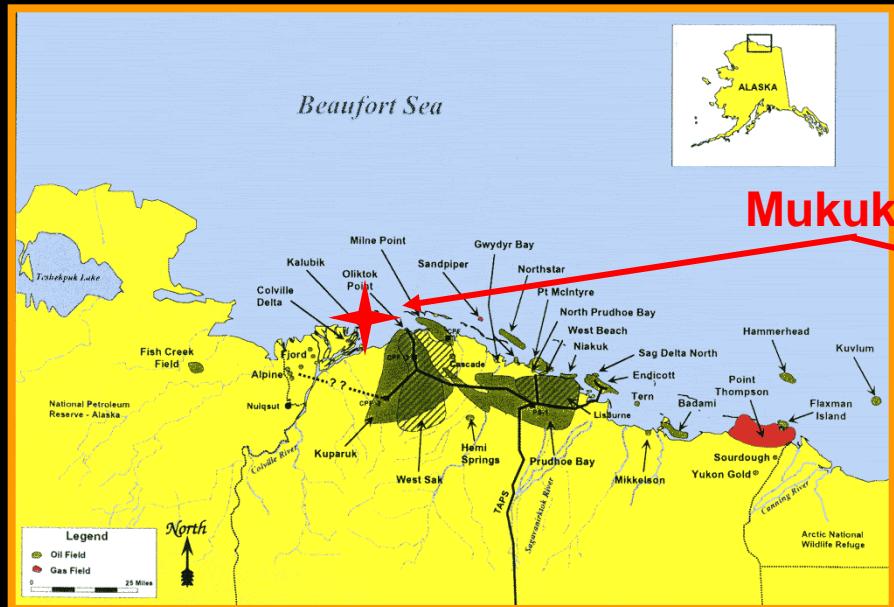
(b)



Folding after migration

Mukuk Play

30 million years too late



14 miles offshore in 50ft of water.

Built an artificial island (1.25 million cubic-yards gravel; 350 ft diameter; 70 ft above water level).

Cost 2 billion dollars.

Drilled to 8,000 ft.

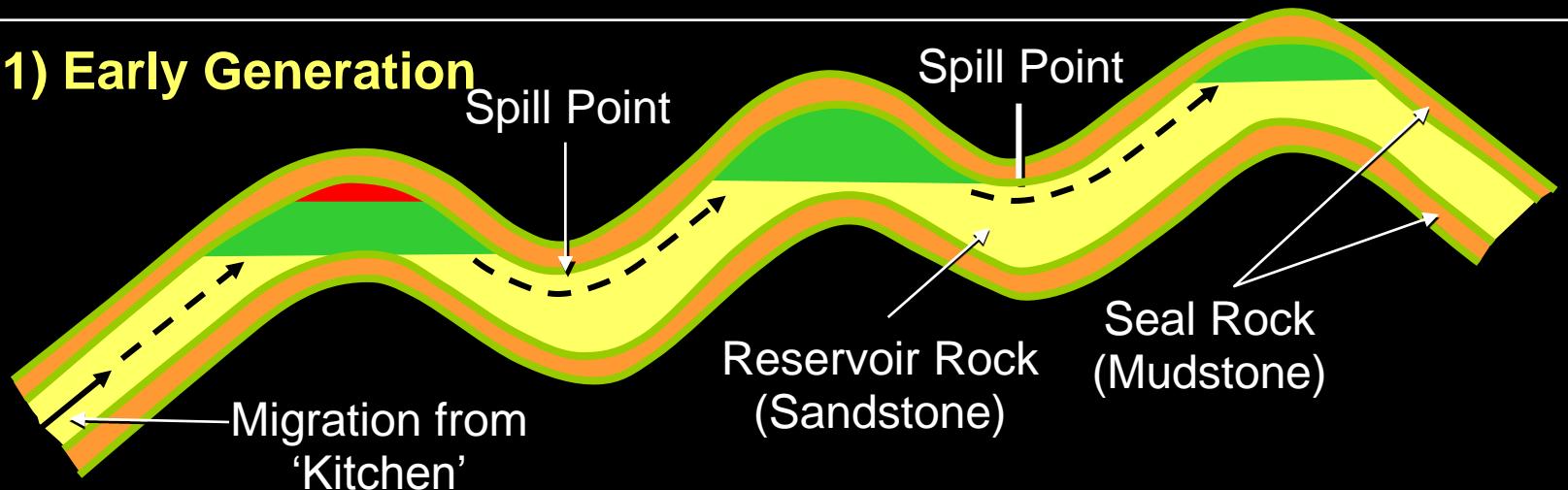
Only found oil stained sands.

Oil passed through this area 30 millions years...oops

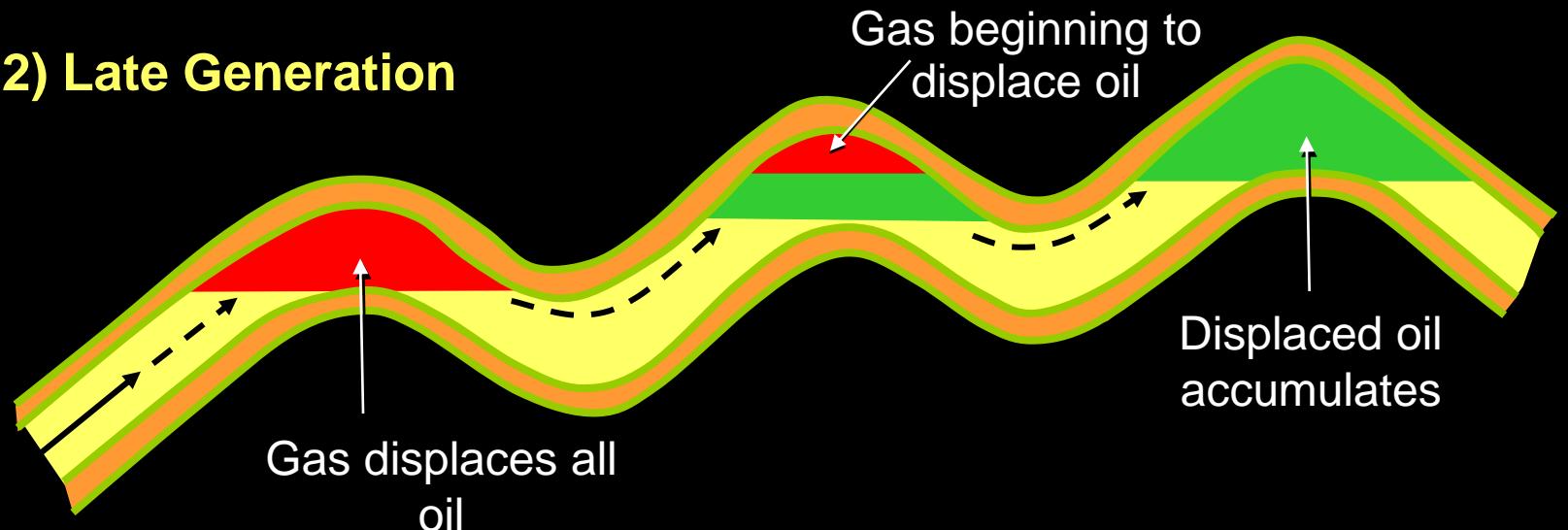
Petroleum System

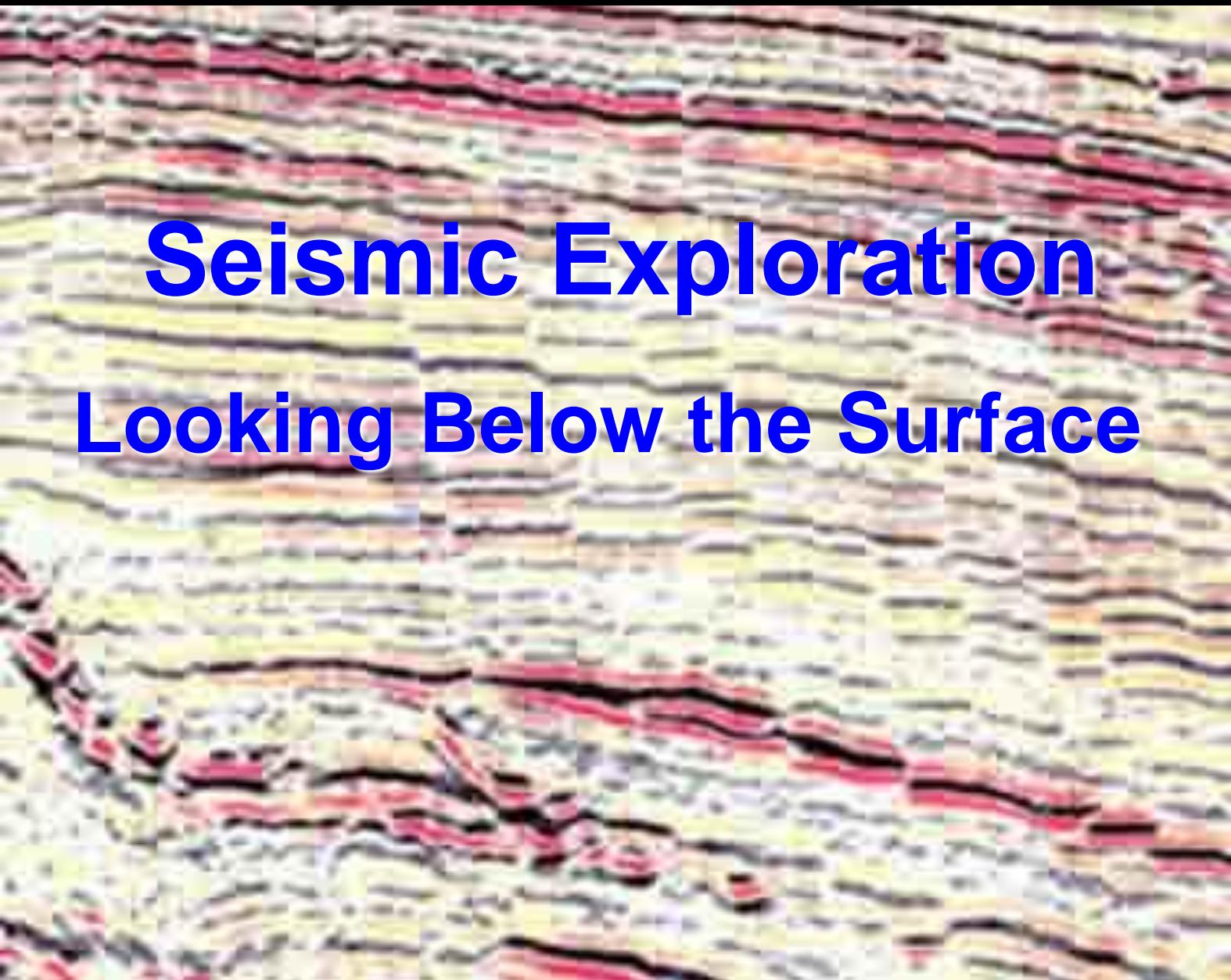
A Dynamic Entity

1) Early Generation



2) Late Generation





A seismic reflection profile image showing subsurface geological layers. The image consists of numerous horizontal, slightly wavy, colored bands representing different rock types and depths. The colors range from light yellow and green to dark red and black. The top portion of the image is more densely layered, while the bottom shows larger, more distinct, and irregularly shaped geological features.

Seismic Exploration

Looking Below the Surface

Field Exploration

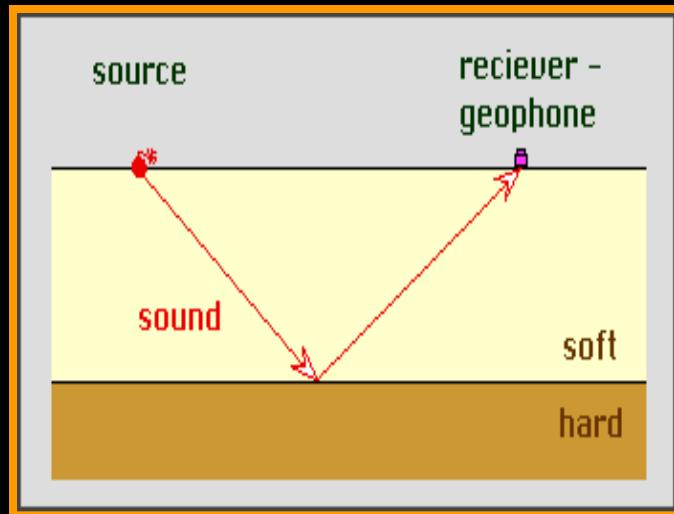
Surface field work:

Geologist: prepares geologic maps and collects rock samples for analysis.

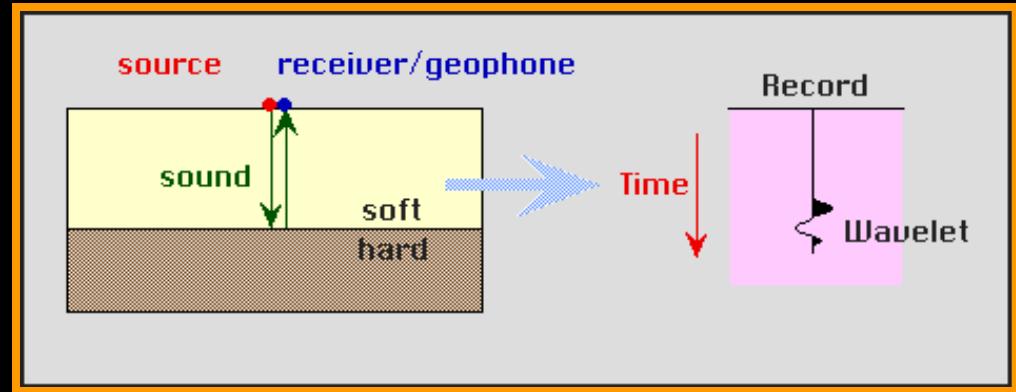
Subsurface field work:

Geophysicists carry out seismic profiling to obtain subsurface data.

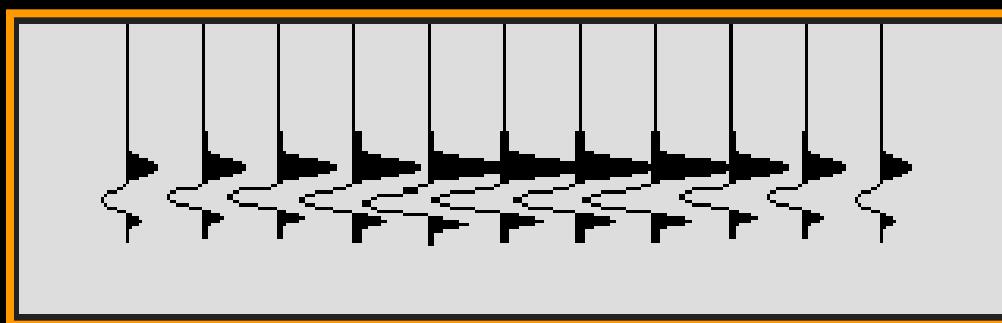
Reflection of Sound Waves



Propagation of sound wave



Reflection produces a wavelet

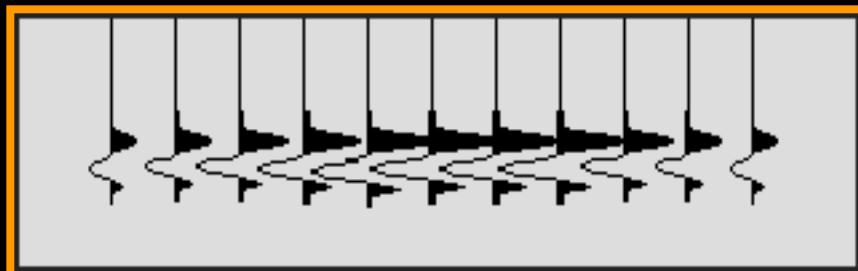
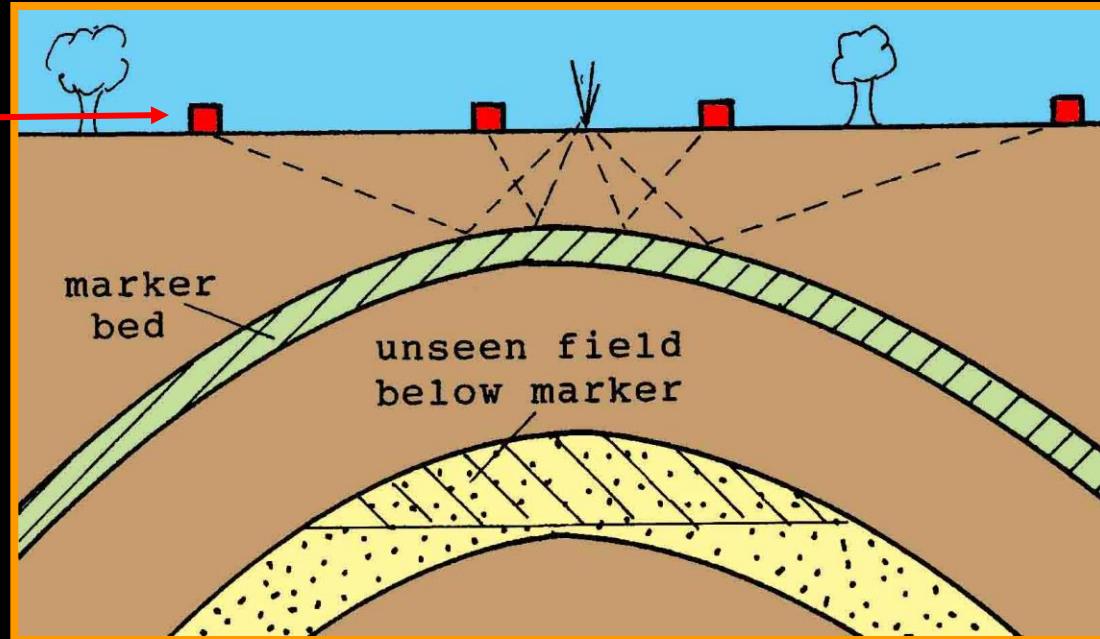


Horizontal layer

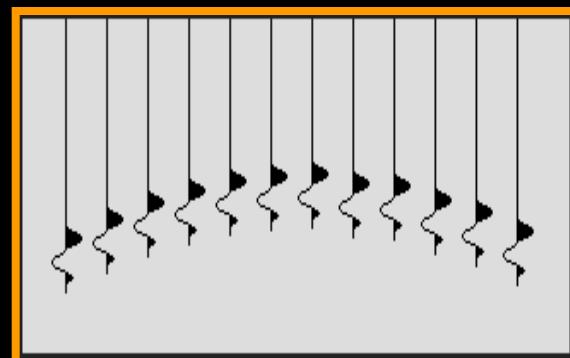
Geophone Array



Geophone

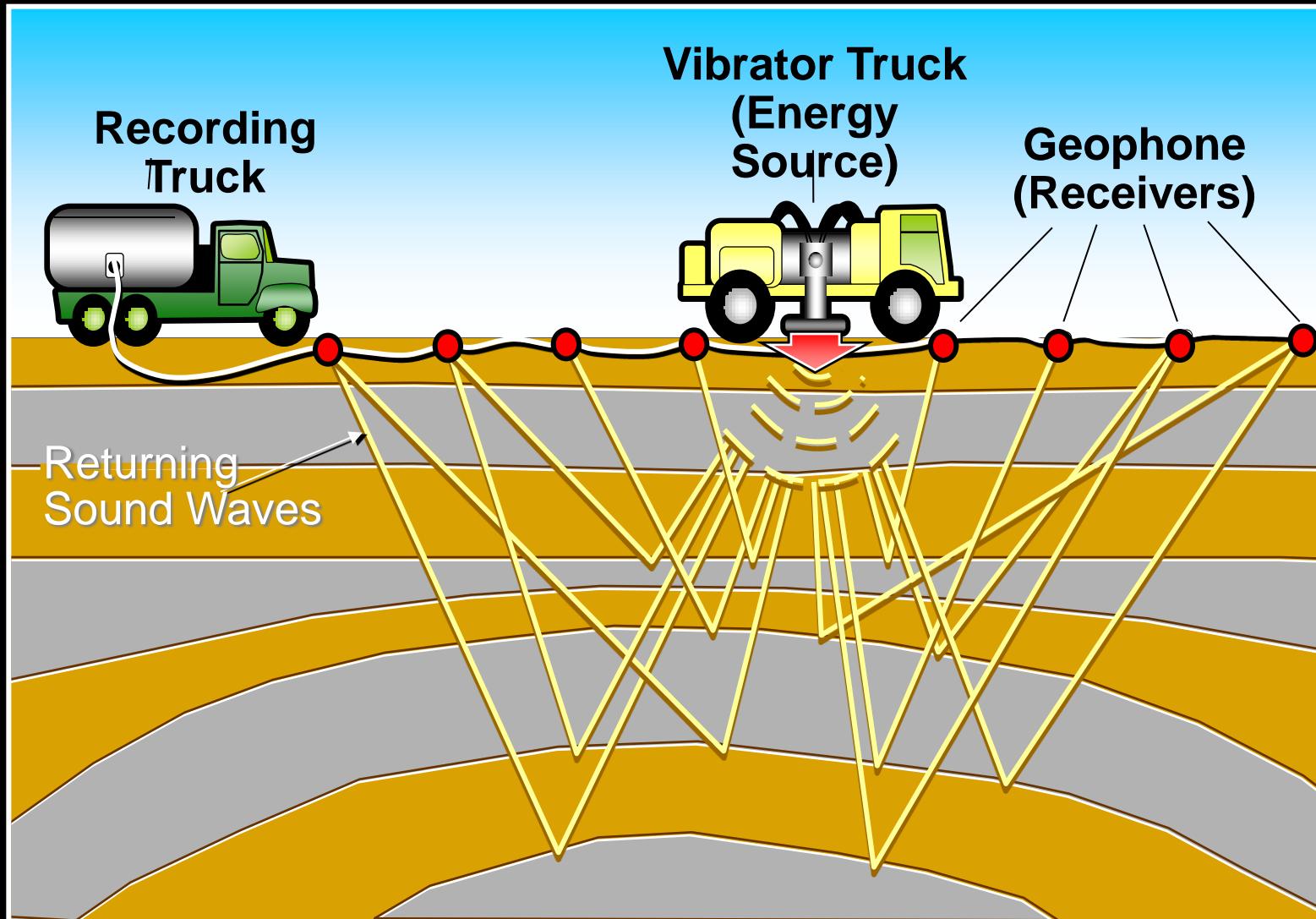


Horizontal layer



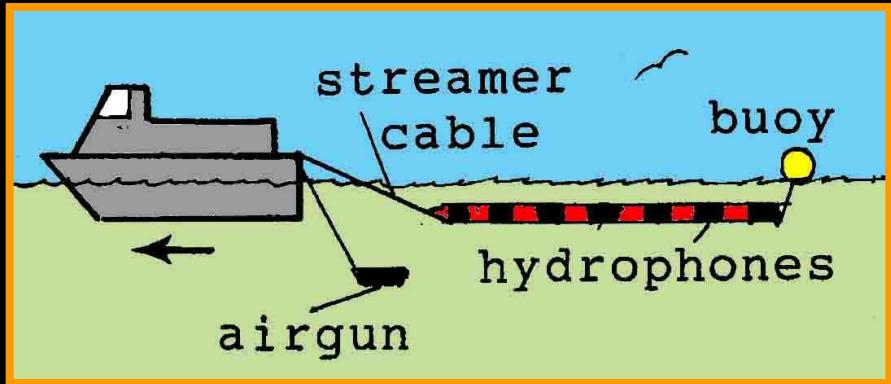
Seismic profile of an anticline

Surface Seismic Imaging

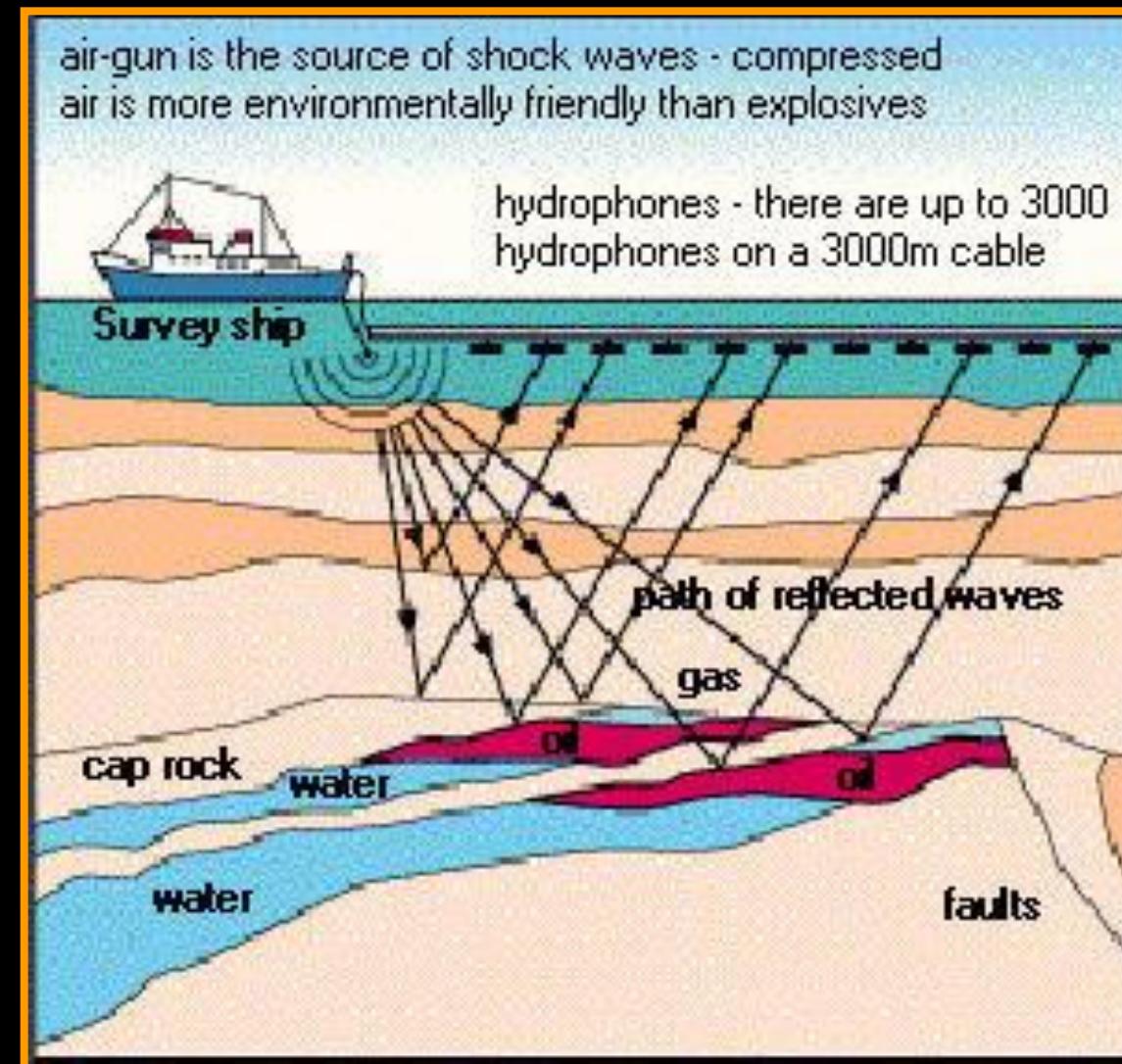


American Petroleum Institute,
1986

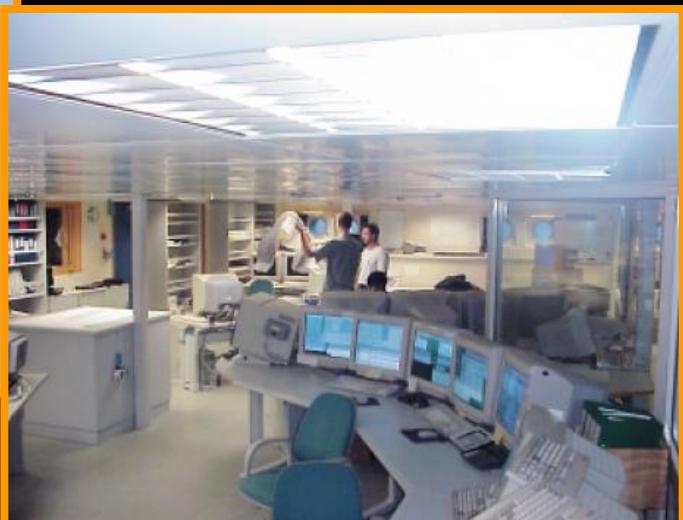
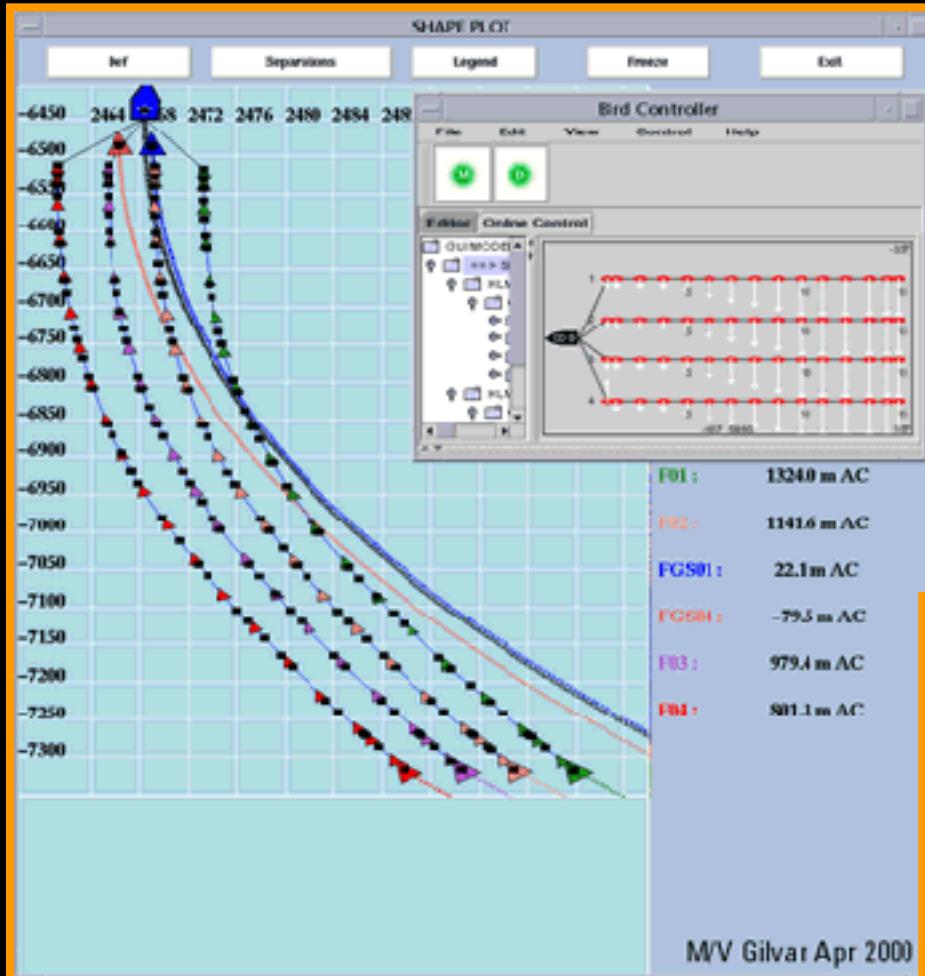
Shipboard Seismic Surveys



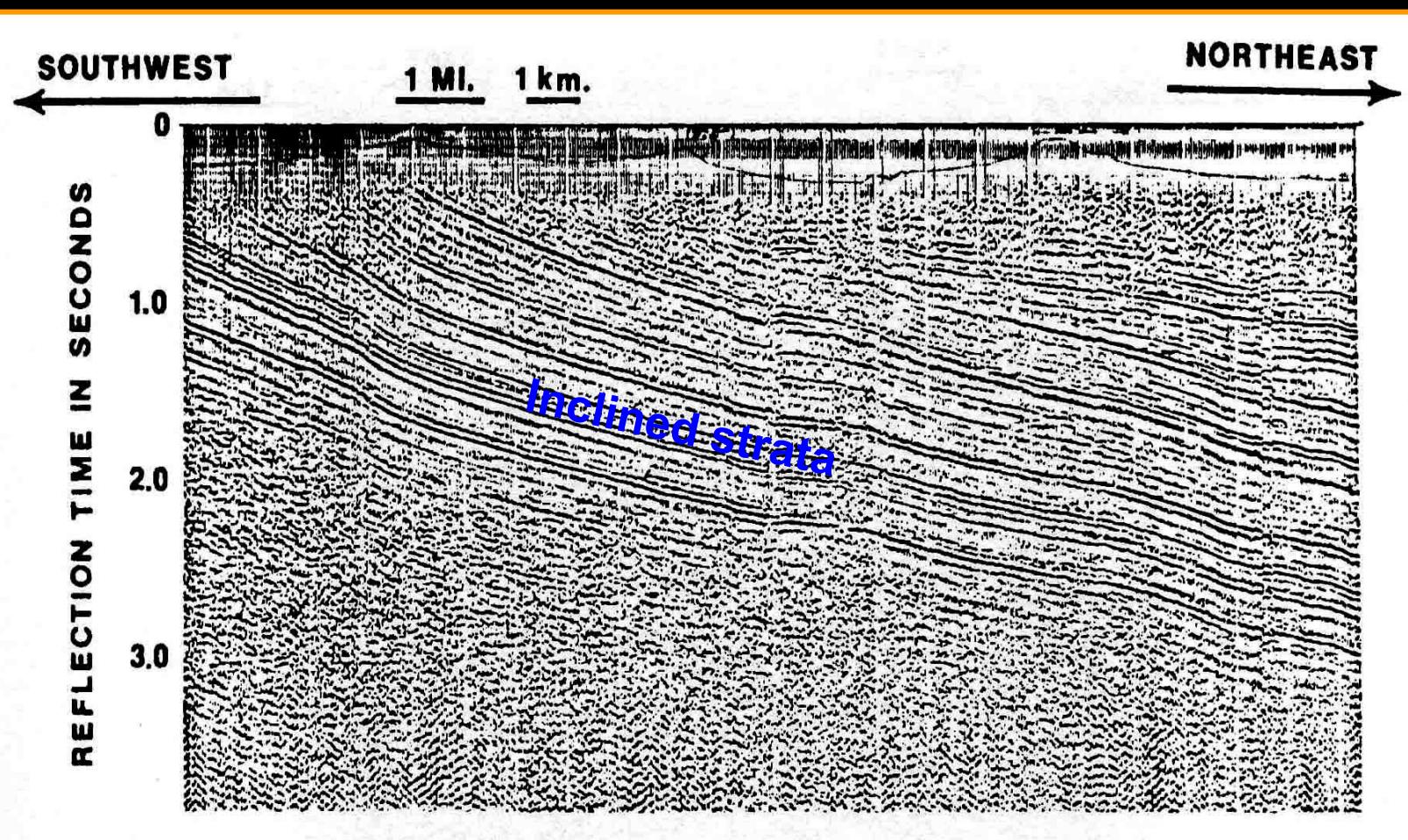
Shipboard Seismic Surveys



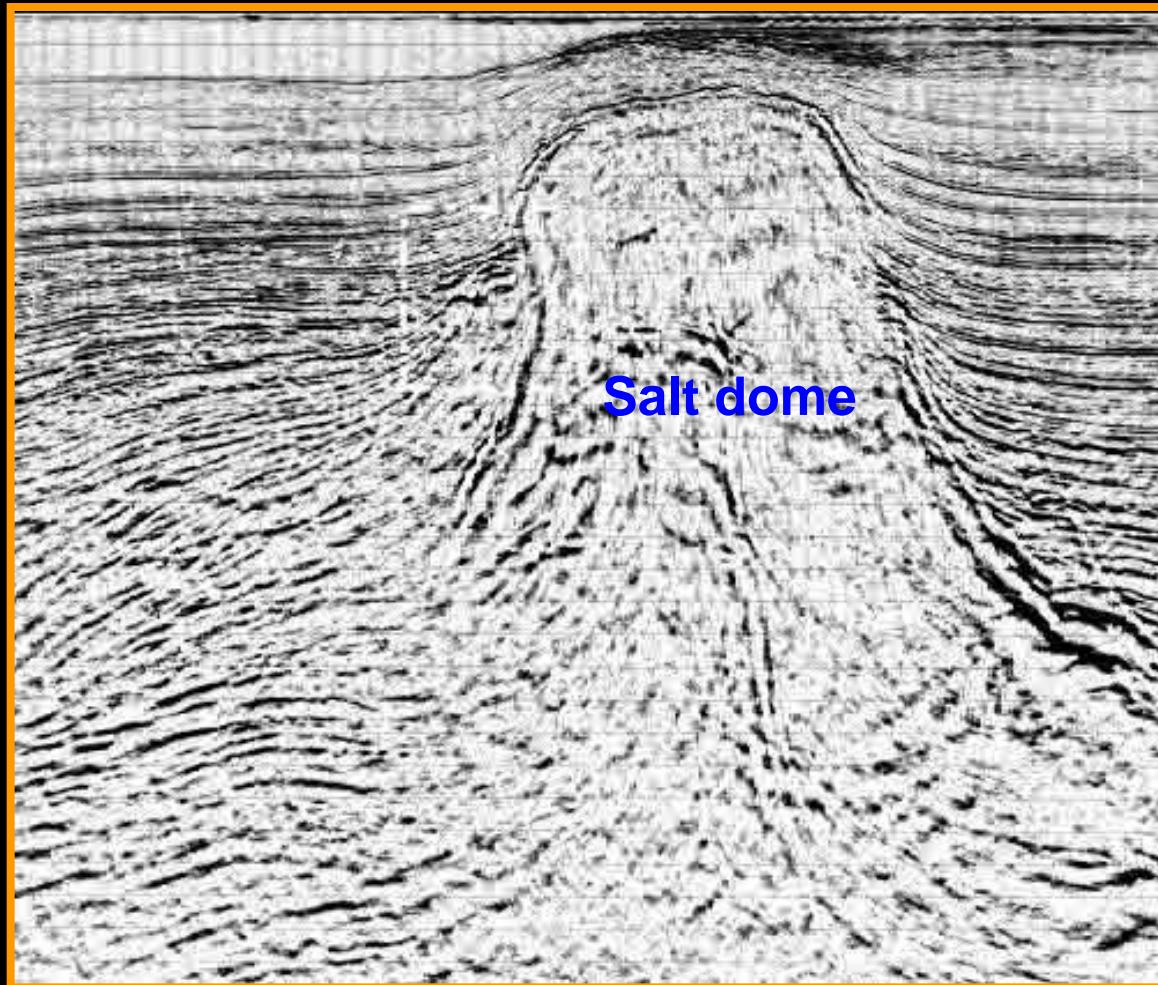
Offshore Seismic Data Processing



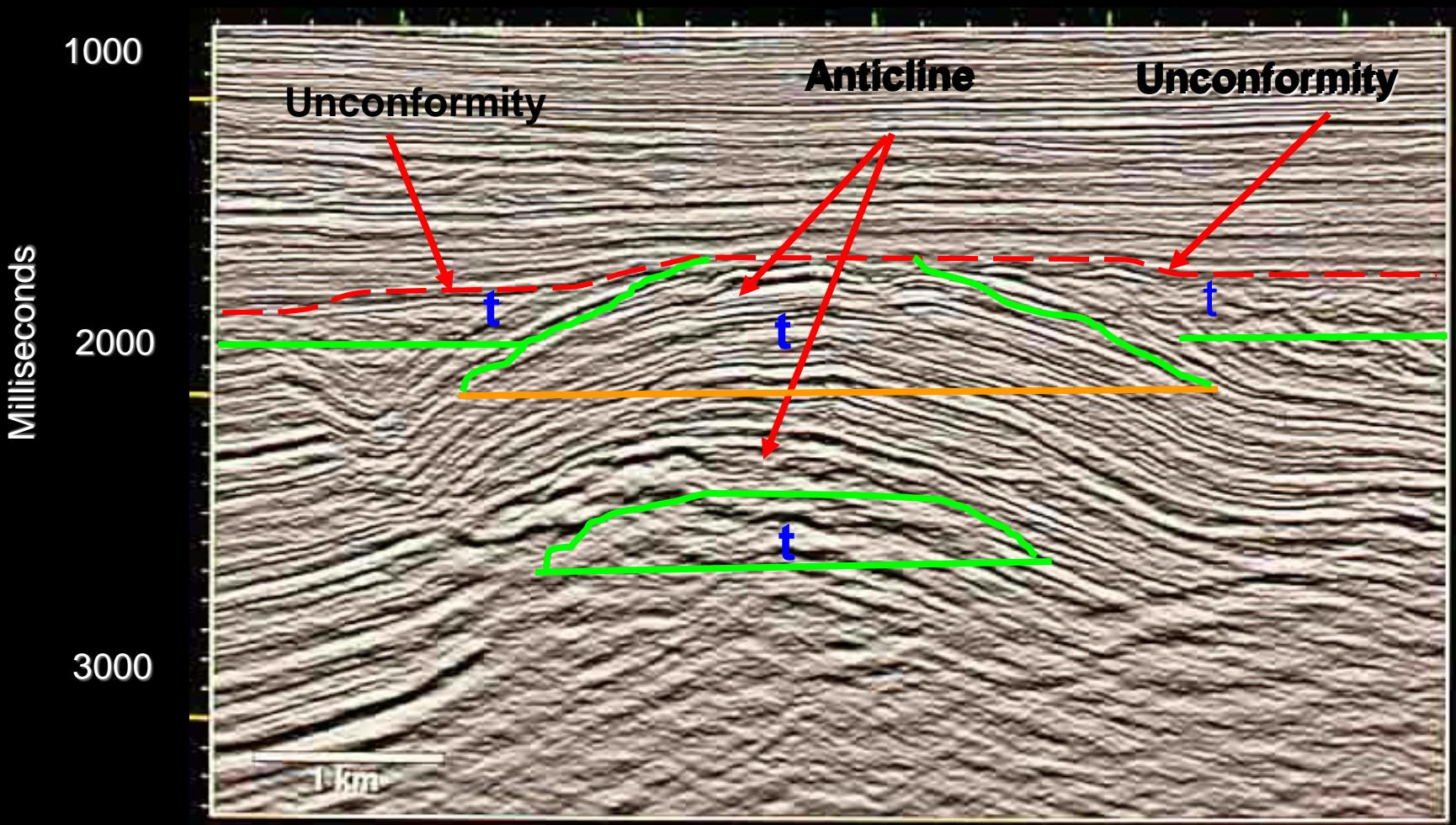
Seismic Profile of Inclined Rocks



Seismic Profile of a Salt Dome



Seismic Reflection Profile of Possible Traps



Spread Cost of Exploration

Play = area being explored for gas or oil.

Cost of modern major offshore or foreign plays are substantial.

Major oil companies frequently form partnerships to spread out exploration and drilling costs.

Share the loss or split the profits, if the play is successful.

Drilling Stage = The Crap Shoot

Two stages:

Wildcat drilling of exploratory wells:

If there is no oil, drill another well or go someplace else.

If you strike oil!

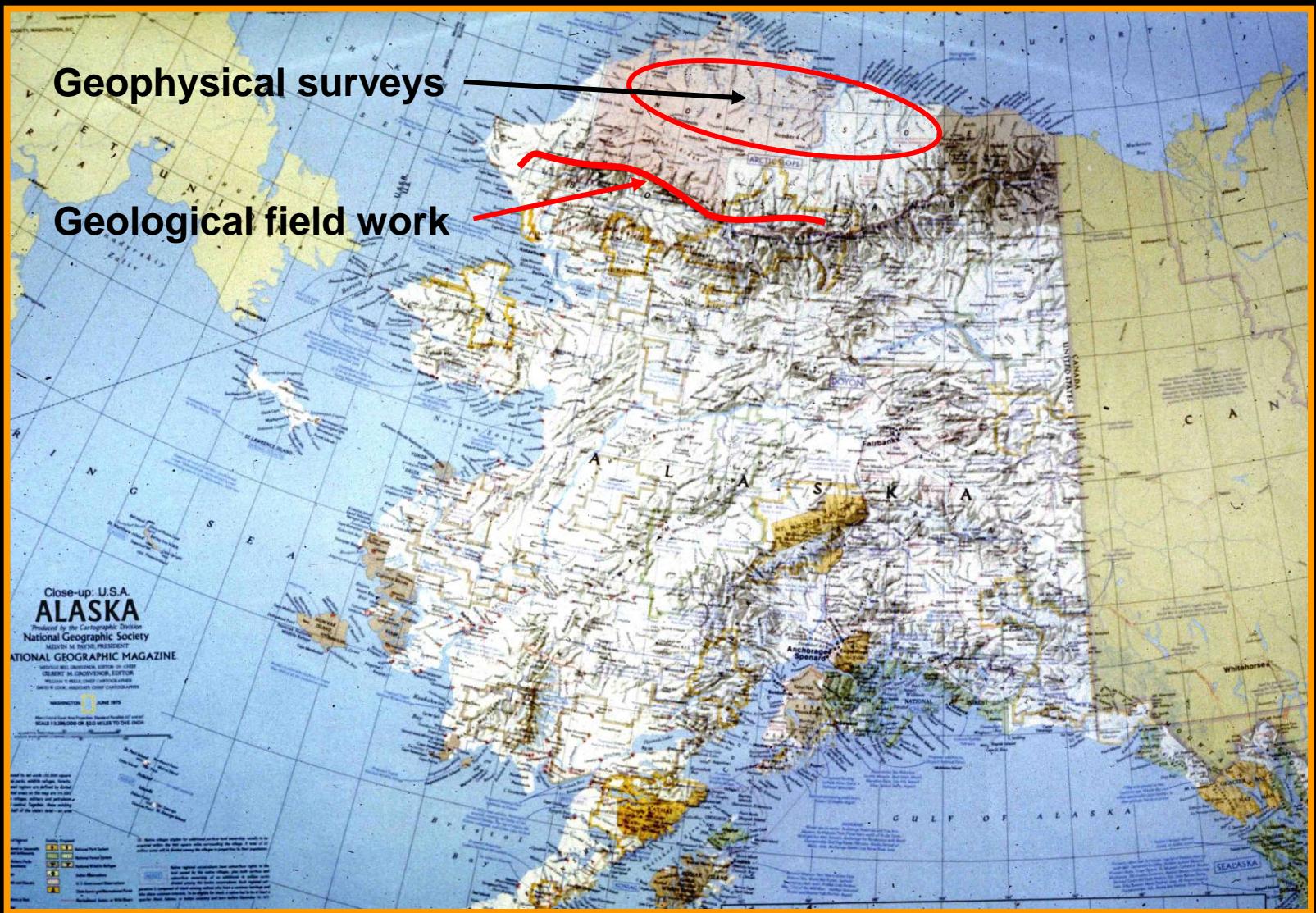
Additional wells are drilled to determine if the field can be further developed.

Drilling production wells maximizes the production and life of the oil field.

Major Petroleum Producing Regions In North America



Exploration on the North Slope



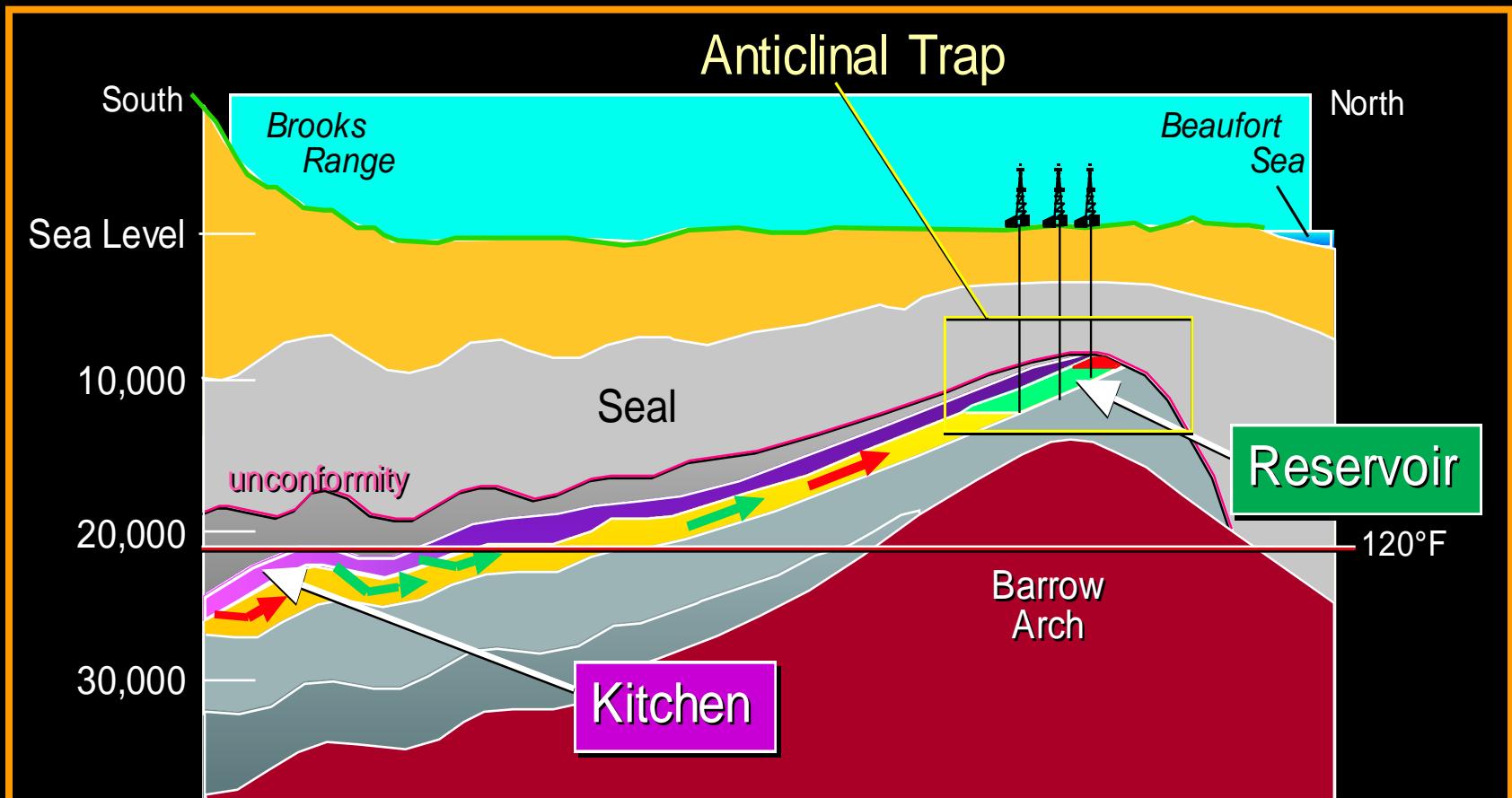
North Slope

What's below the surface?



Unconformity Trap

Prudhoe Bay, Alaska

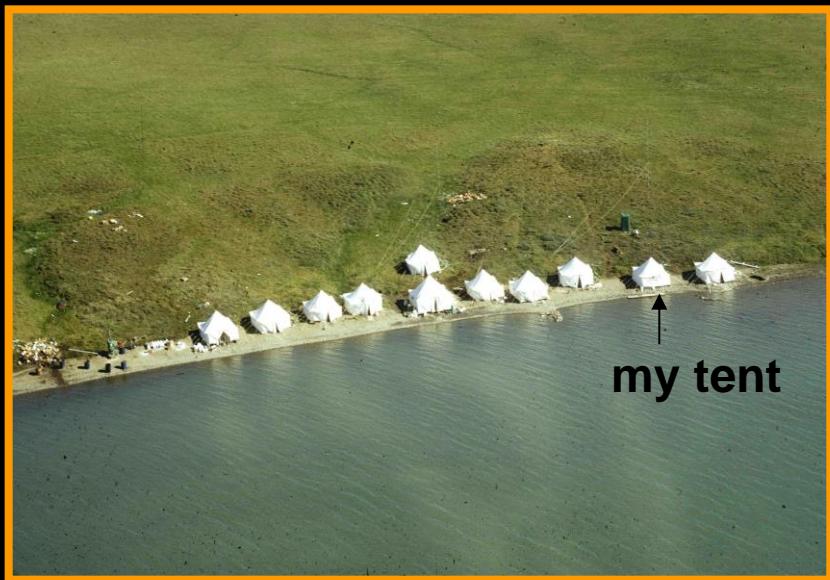


- Largest North American field
- More than 8 billion barrels recoverable

Brooks Range, Northern Alaska



Mobil Oil Field Camp (1972)



Day in the Field



Brooks Range



Hero picture

Early Exploration Practices on the North Slope



Abandoned camp site



Abandoned DC 3

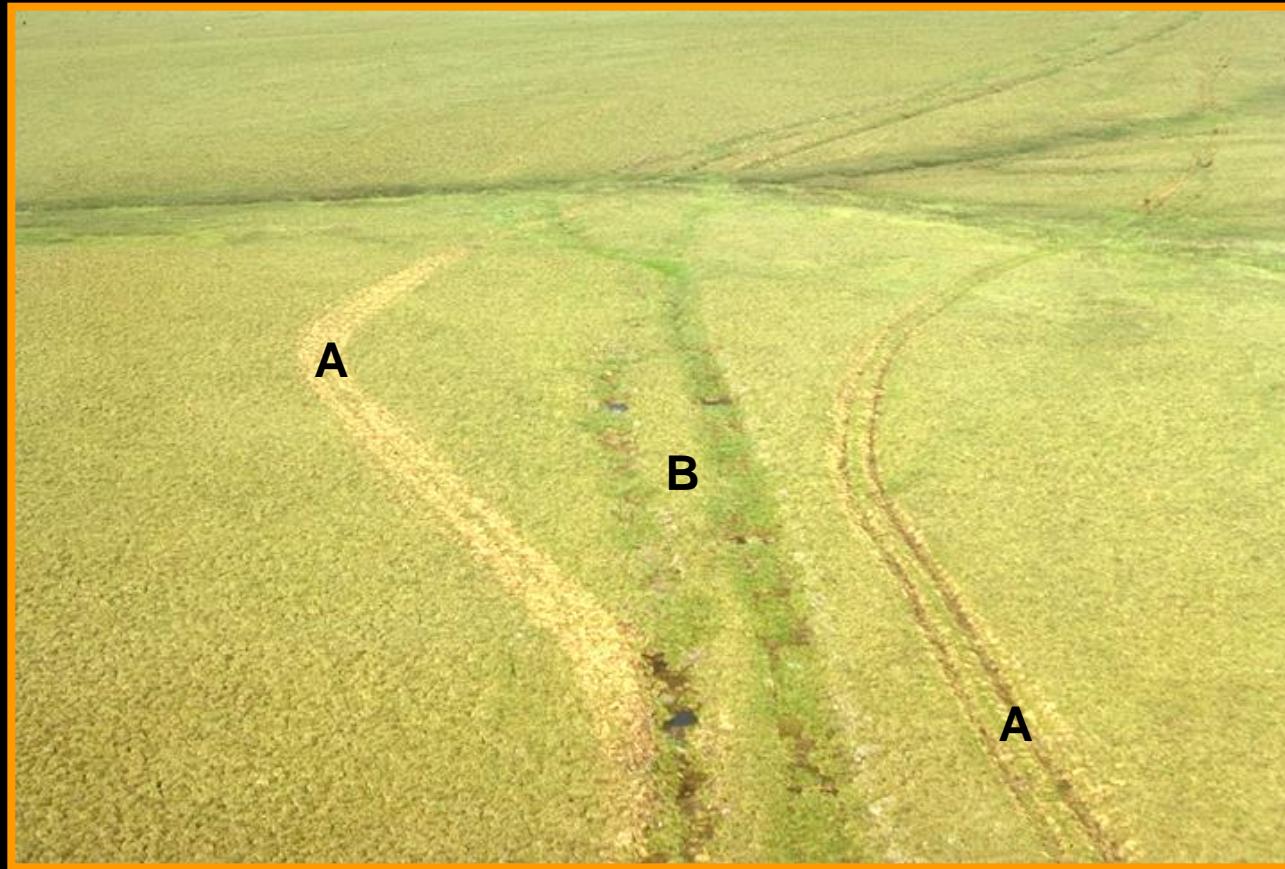
Noluk Lake, North Slope

Early Geophysical Survey Track Across the Tundra



Permanent disruption of tundra surface by track vehicles

Geophysical Surveys Only Allowed in Winter when Ground is Frozen



- A. Winter survey track
- B. Summer survey tracks

North Slope Geophysical Camp

Summer 1973



Turd Burner



North Slope Drilling Site



© Ron Niebrugge

Evening Relaxation



1:00 am in the morning

Everlasting Polar Sunset

