

2/12/07

OVERVIEW:

DGGS - AK

GAS COOK

INLET

ALASKA STATE LEGISLATURE  
House Resources Committee

**Carl Gatto, Co-Chair**

State Capitol Building, Room 108  
Juneau, AK 99801-1182  
(907) 465-3743  
FAX (907) 465-2381  
Rep\_Carl\_Gatto@legis.state.ak.us



**Craig Johnson, Co-Chair**

State Capitol Building, Room 126  
Juneau, AK 99801-1182  
(907) 465-4993  
FAX (907) 465-3872  
Rep\_Craig\_Johnson@legis.state.ak.us

**FAX**

To: TIM BRADNER From: DEBRA HIGGINS  
Fax: 563-4744 Phone: 465-3715  
Date: 3/26/07 CC:  
Re: HOUSE RESOURCES PRESENTATION FROM 2/12/07  
Pages With Cover: 26

Urgent  For Review  Please Comment  Please Reply  Please Recycle

**•Comments:**

TIM,  
ATTACHED IS A COPY OF THE PRESENTATION THAT  
BOB SWENSON FROM THE AIC, DIVISION OF GEOLOGICAL  
& GEOPHYSICAL SURVEY MADE ON 2/12/07.

IF THIS DOESN'T WORK, SHARON LONG BY SENATE  
RESOURCES @ 465-4709 MIGHT HAVE A PDF COPY  
SHE CAN SEND YOU FROM THEIR 1/31/07 HEARING.  
THANKS.

# Committee Meetings



(S)RESOURCES  
Jan 29 Monday 3:30 PM  
\*+ SB 46

STANDING COMMITTEE \*  
BUTROVICH 205  
COASTAL MANAGEMENT PROGRAM  
Moved CSSB 46(RES) Out of Committee  
-- Public Testimony --

TELECONFERENCED

(S)RESOURCES  
Jan 31 Wednesday 3:30 PM  
+

STANDING COMMITTEE \*  
BUTROVICH 205  
Presentation: by Division of Geological  
& Geophysical Surveys  
Cook Inlet Gas: Reality & Exploration  
Potential  
-- Testimony <Invitation Only> --

TELECONFERENCED

(S)RESOURCES  
Feb 02 Friday 3:30 PM

STANDING COMMITTEE \*  
BUTROVICH 205  
No Meeting Scheduled

Bill Root:  Display Bill Root

To Report Problems with Basis Inquiry

Live KTOO Streams 

Return to Basis Main Menu (25 Legislature)

Return to Legislature Home Page

*Tim Bradner -  
Pres*

*o U.S.G.S.*

*tim.bradner@alaskajournal.com*

*Ask Shane*

*Fax: Tim  
563-4744*

**Debra Higgins**

---

**From:** Melanie Lesh [melanie\_lesh@dnr.state.ak.us]  
**Sent:** Friday, February 09, 2007 3:51 PM  
**To:** Debra Higgins  
**Subject:** House Resources Attachment

Debbie,

Here are directions on how to download to your desktop (or the Print Shop's) this very large file. Open Internet Explorer to this website: ftp.state.ak.us you don't need to use "http" or "www". You should see a window with two folders: INCOMING and TRANSFER. Double click on TRANSFER and you should see a bunch of files. Look for my presentation--it is called "CI Expl Potential\_House07". Now just drag this file onto your desktop, and it should copy over. It will take a few minutes. Please wait a couple minutes for me to quit fiddling with it before you try this!

=====  
Melanie Lesh  
Legislative Liaison  
Alaska Department of Natural Resources  
Office of the Commissioner  
400 Willoughby Ave., Suite 500  
Juneau, AK 99801  
ph: 907.465.4730 | fax: 907.465.3886  
=====

Note: This communication may contain confidential information. If you are not the addressee, you may not read, copy, or distribute this e-mail. If you receive this e-mail in error, please advise by return e-mail and delete the message from your system. Thank you.

*Printing - Cook ... and license?*  
*Retention of records to facilitate priority?*  
*Flights - change of policy to reflect current mission*  
*Retention?*  
*10% of operating budget target*  
*85% account*  
*Total Budget for public response*

*Bob Swenson*

# Alaska Gas Exploration Potential The Cook Inlet and Other Basins

Alaska Division of Geological & Geophysical Surveys  
House Resources

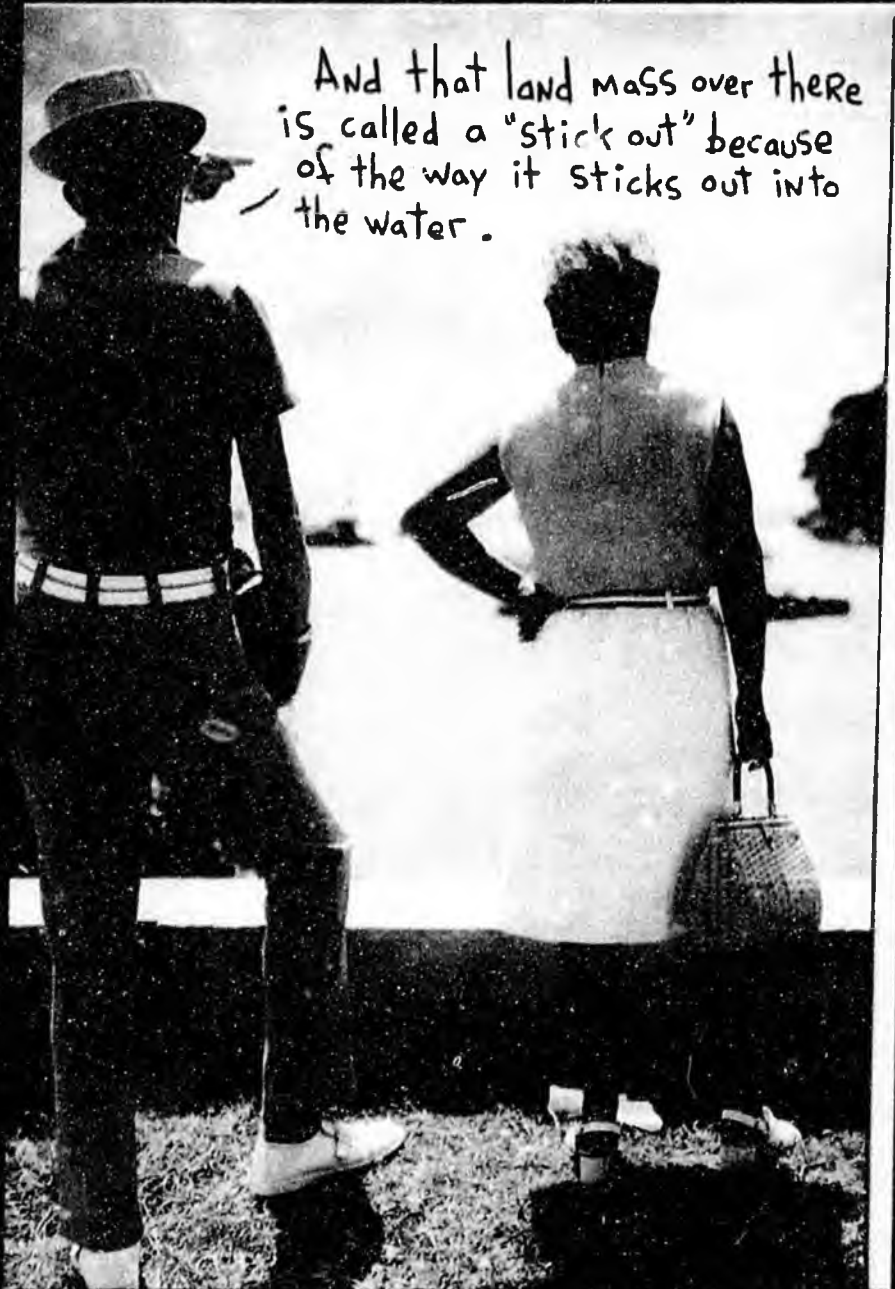


**Bob Swenson**  
**State Geologist**  
*Monday, February 12, 2007*

# Take Home Points

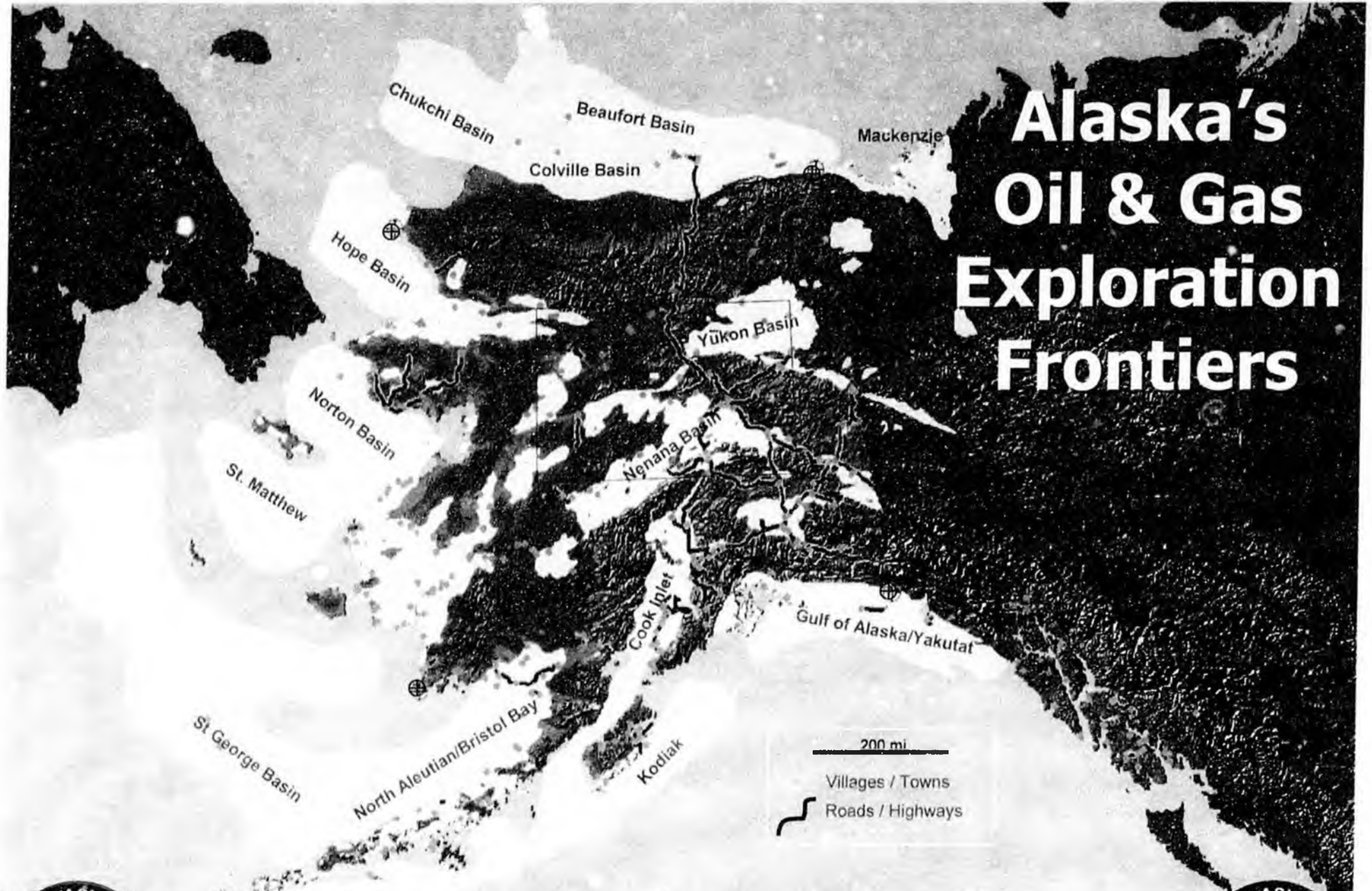
- ▶ Because of market issues, focused exploration for natural gas in Alaskan basins is in its infancy
- ▶ Of the 36+ TCF of gas reserves, nearly all was discovered while looking for oil
- ▶ Published resource assessments often have very large associated 'error bars'
- ▶ Significant exploration potential exists in a number of basins across the state, however economics and access to market will play key role in level of activity
- ▶ In the Cook Inlet, most of the "easy" (inexpensive) gas has been found and delineated

# Things You Should Know About Geologists



- They know how to dress for any occasion
- They are usually at the back of the crowd, constantly throwing out trivial geologic information that no-one else cares about
- Are never at a loss for descriptive jargon to show their extreme grasp of the natural world
- There will be many "stick outs" in this presentation

# Alaska's Oil & Gas Exploration Frontiers



## Sedimentary Basins of Alaska

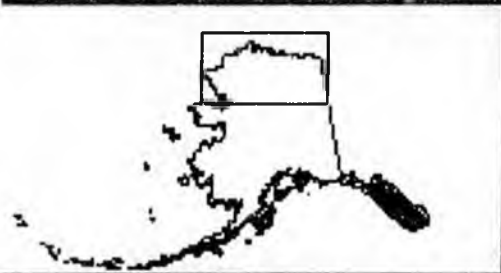
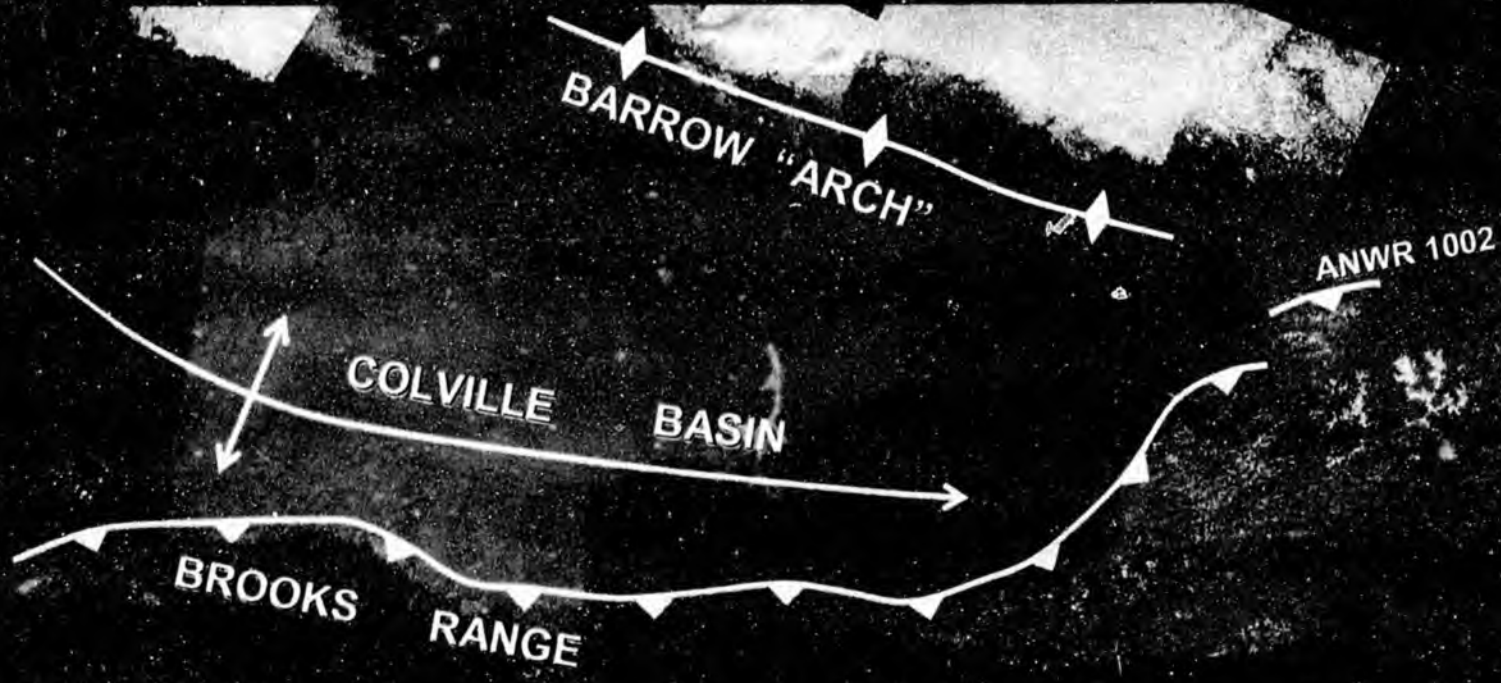
Alaska Division of Geological & Geophysical Surveys

[www.dggs.dnr.state.ak.us](http://www.dggs.dnr.state.ak.us)



# North Slope

## Overview of Regional Geology



# Brooks Range Geologic Mapping

Alta Layer

Alta Layer

Panorama Foot

Coldestone

Upper Panhandle

Lower Panhandle

Alta

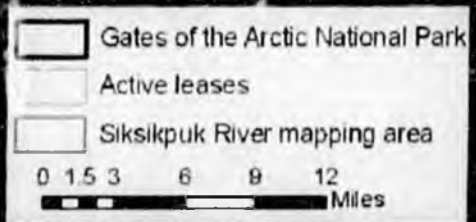
Alta

Alta

Alta

DGGS ENERGY SECTION  
GEOLOGIC MAPPING  
Eastern Brooks Range Foothills

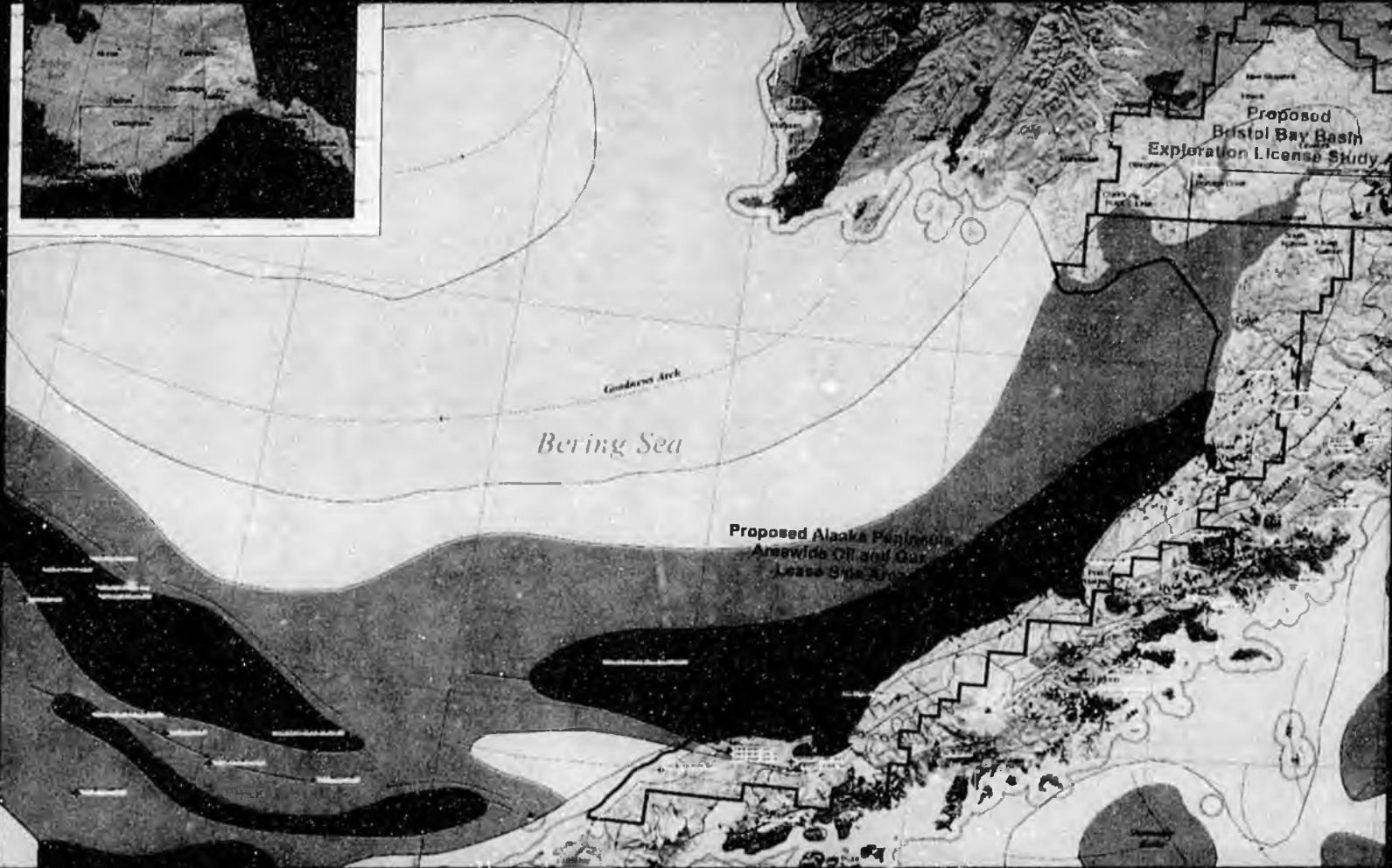
2,053,606



Anaktuyuk Pass

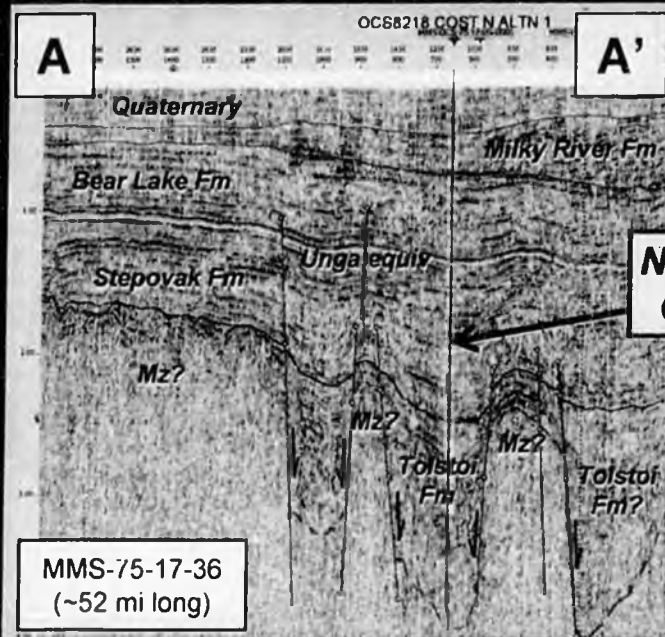
# North Aleutian Basin (Bristol Bay)

Deep water ports  
Actively Promoted by State  
Abundant Seismic Data Exists  
Good Reservoirs likely

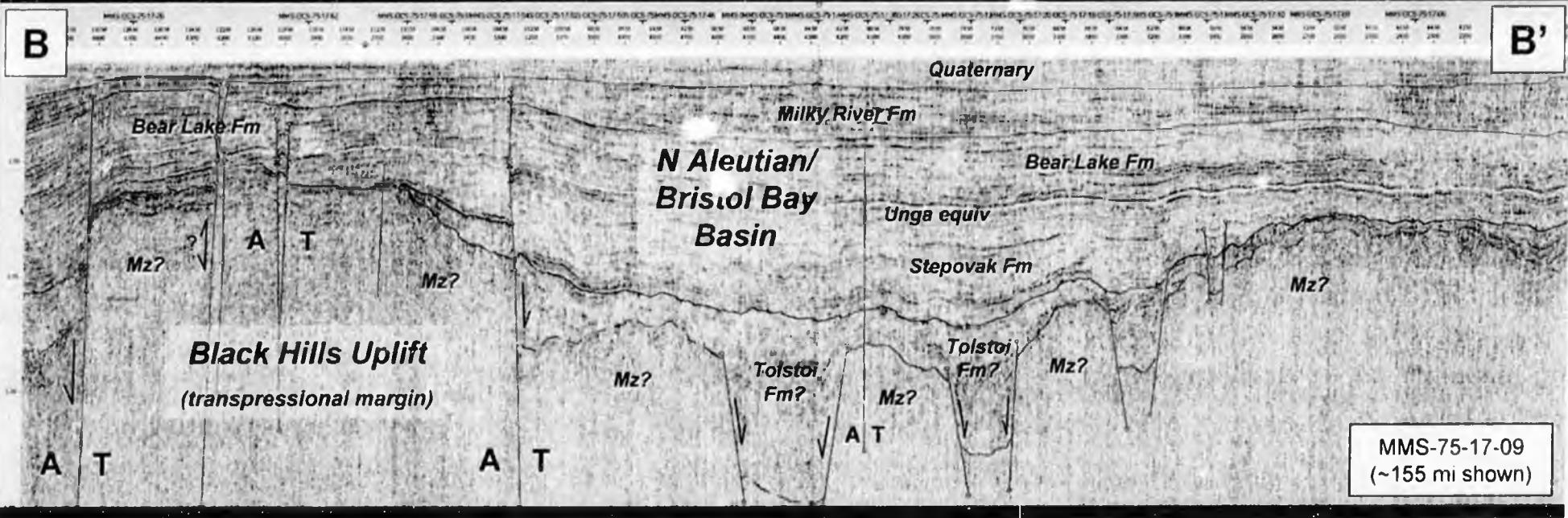
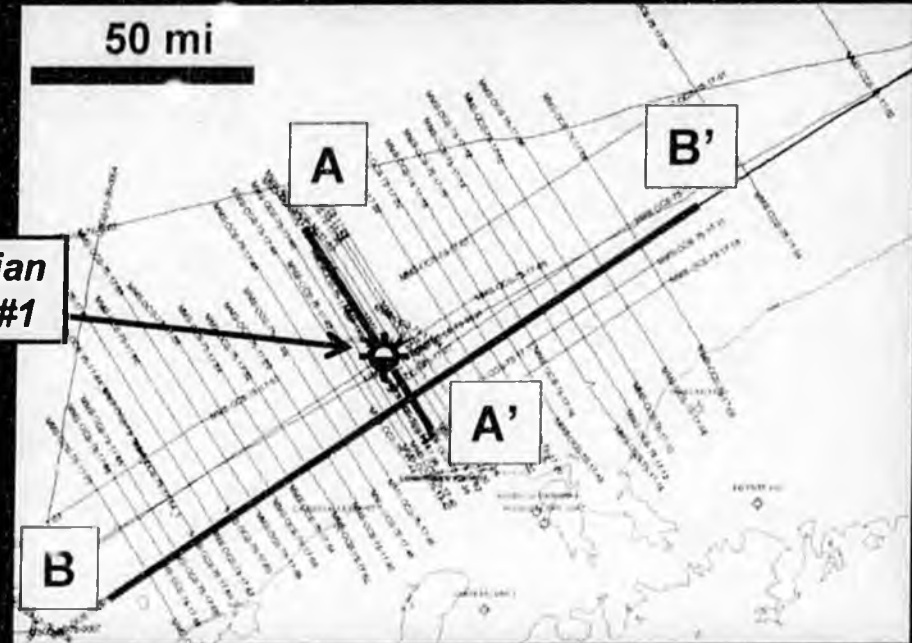


# Regional Seismic Interpretation

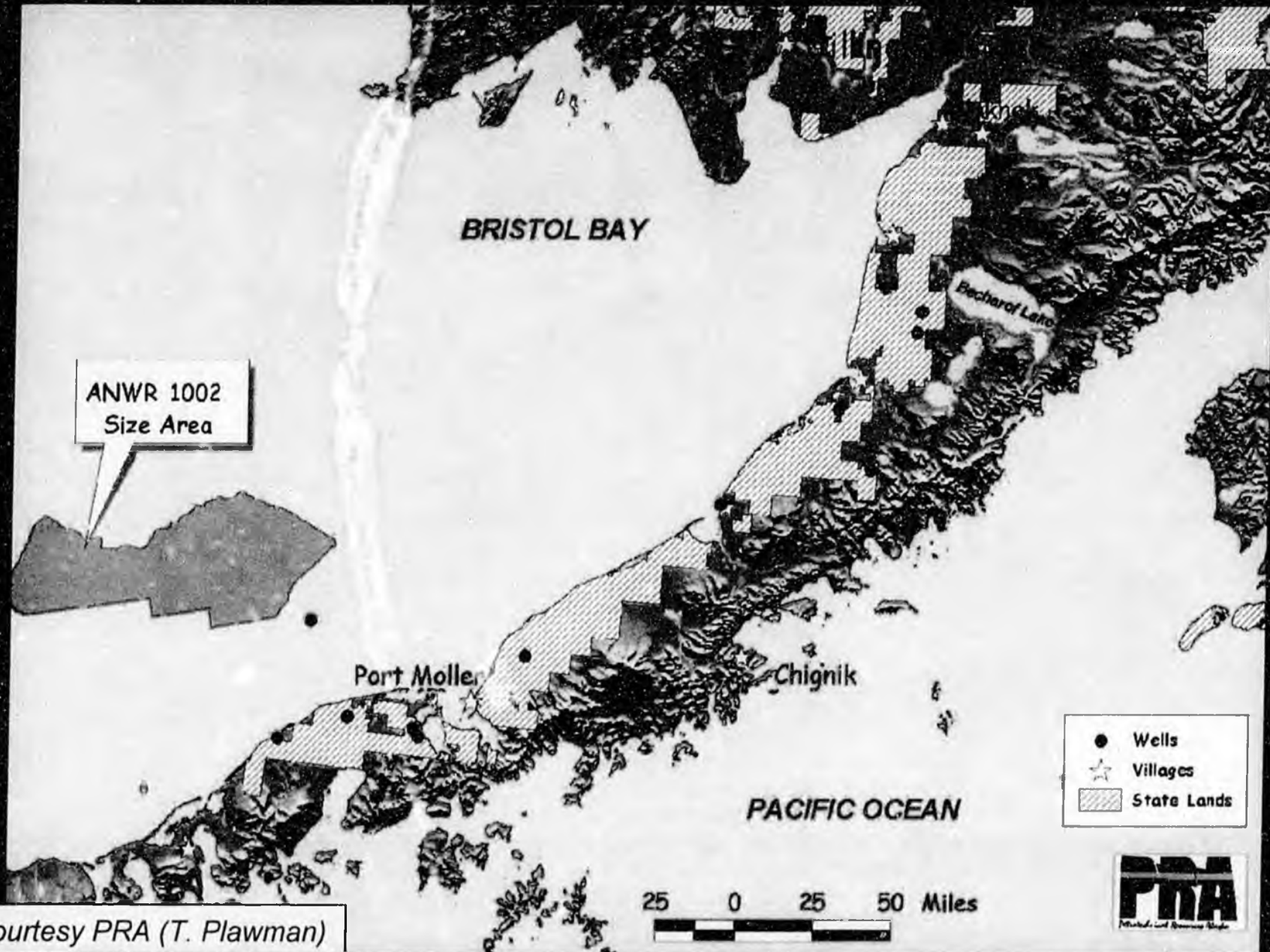
Bristol Bay offshore



**N Aleutian  
COST #1**



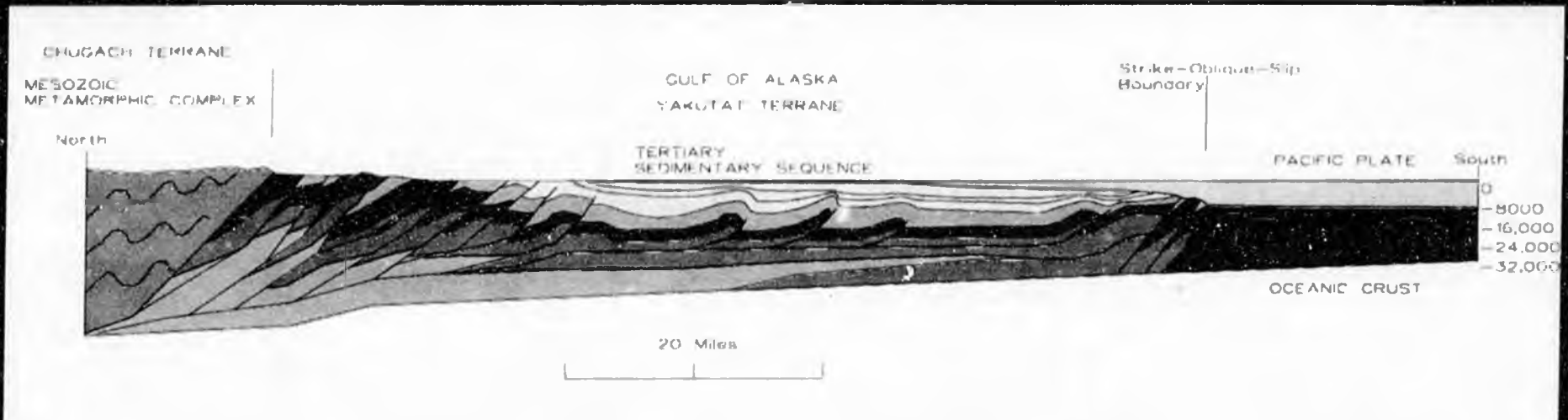
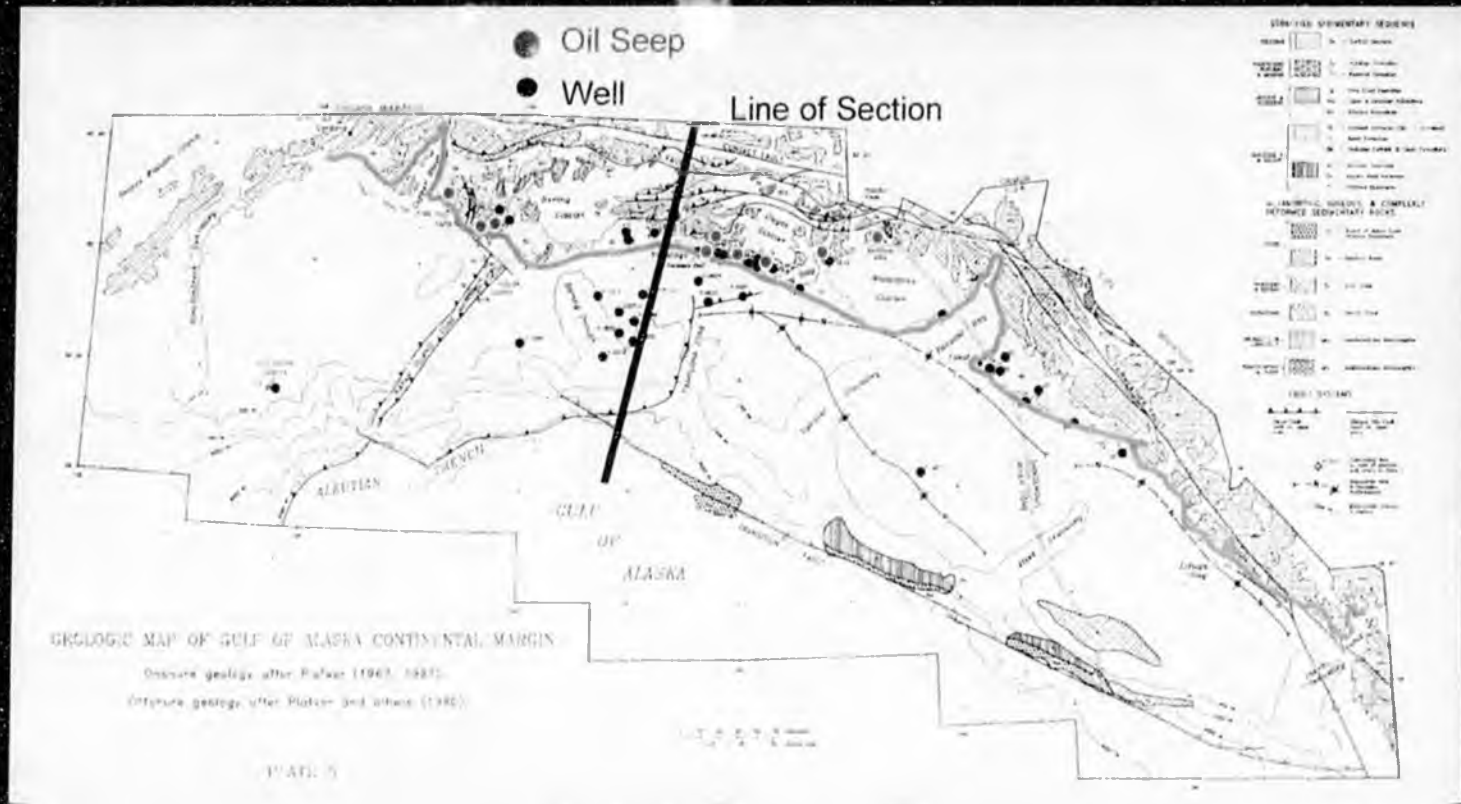
# Size Comparison with ANWR 1002



courtesy PRA (T. Plawman)



# Gulf of Alaska







# Alaska Natural Gas Resources

USGS Estimates of Onshore and State Offshore Natural Gas Resources

68

## Northern Alaska

- >33 tcf reserves
- mean estimate >150 tcf undiscovered, conventional gas onshore & offshore
- additional nonconventional resources (hydrates, coalbed gas, shale gas, etc.)

Numbers posted are for technically recoverable, undiscovered volumes of conventional natural gas resources

## Central Alaska

- mean estimate ~9 tcf undiscovered, conventional gas onshore & offshore
- additional nonconventional resources (coalbed gas, etc.)

## Southern Alaska

- 2 tcf reserves in Cook Inlet
- mean estimate ~20 tcf undiscovered, conventional gas onshore & offshore
- additional nonconventional resources (coalbed gas, etc.)

**Chukchi Sea OCS**  
Range 13.6 - 154.3 tcf  
Mean 60.1 tcf

**Beaufort Sea OCS**  
Range 12.9 - 63.3 tcf  
Mean 32.1 tcf

**NPRA**  
Range 40.4 - 85.3 tcf  
Mean 61.4 tcf

**Non-Federal Area**  
Oil & Gas updates  
in progress

**ANWR 1002 Area**  
Range 0.0 - 10.9 tcf  
Mean 3.8 tcf

**Hope Basin OCS**  
Range 0.0 - 11.1 tcf  
Mean 3.4 tcf

**Norton Basin OCS**  
Range 0.0 - 8.7 tcf  
Mean 2.7 tcf

**Central Alaska**  
Range 0.5 - 7.3 tcf  
Mean 2.8 tcf

**St. Matthew-Hall OCS**  
Range 0.0 - 0.7 tcf  
Mean 0.2 tcf

**St. George Basin OCS**  
Range 0.0 - 9.7 tcf  
Mean 3.0 tcf

**North Aleutian Basin OCS**  
Range 0.0 - 17.3 tcf  
Mean 6.8 tcf

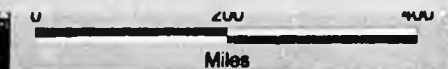
**Cook Inlet OCS**  
Range 0.7 - 2.5 tcf  
Mean 1.4 tcf

**Southern Alaska**  
Range 0.7 - 4.3 tcf  
Mean 2.1 tcf

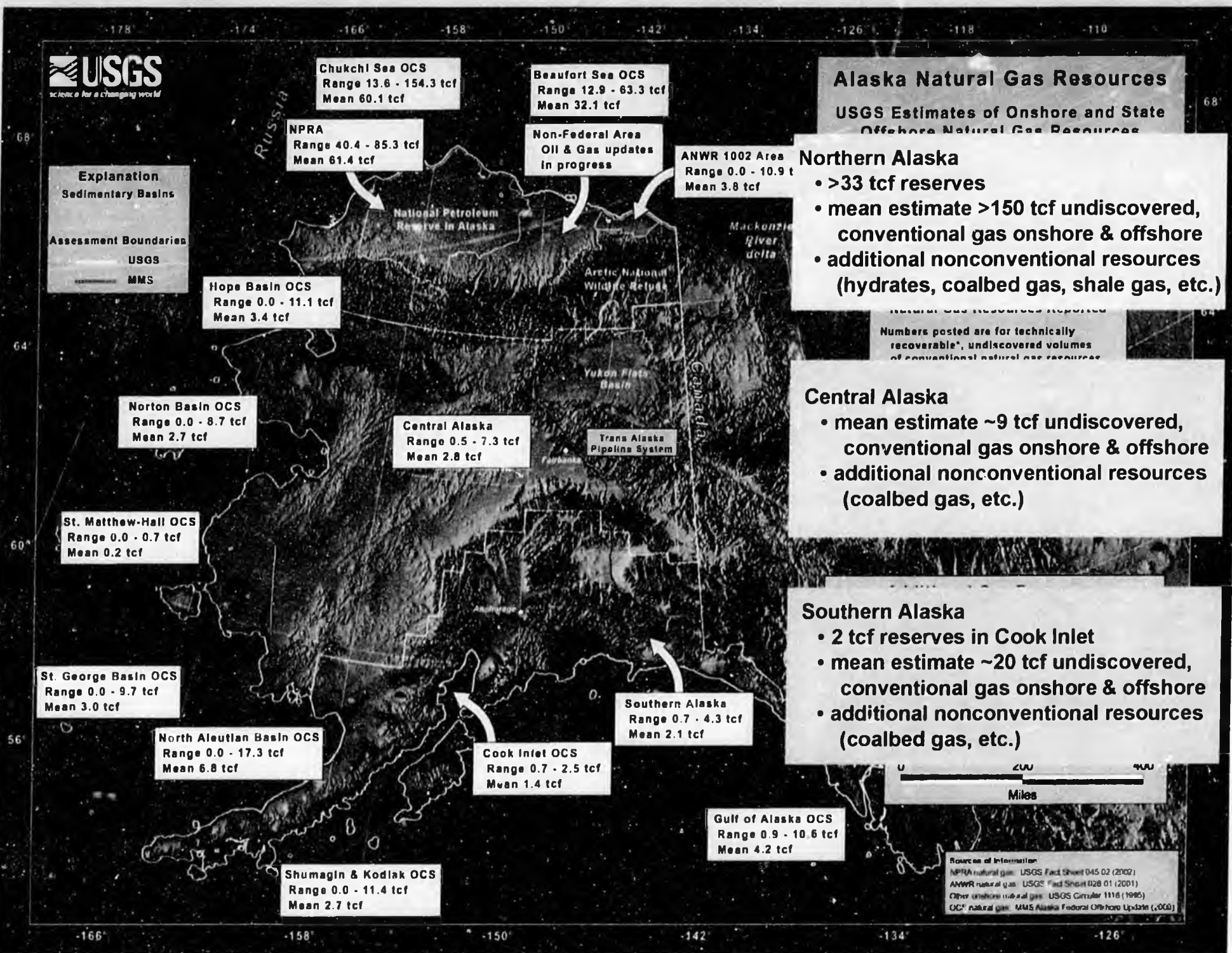
**Gulf of Alaska OCS**  
Range 0.9 - 10.6 tcf  
Mean 4.2 tcf

**Shumagin & Kodiak OCS**  
Range 0.0 - 11.4 tcf  
Mean 2.7 tcf

**Explanation**  
Sedimentary Basins  
Assessment Boundaries  
USGS  
MMS



**Source of Information:**  
NPRA natural gas: USGS Fact Sheet 045 02 (2002)  
ANWR natural gas: USGS Fact Sheet 028 01 (2001)  
Other onshore natural gas: USGS Circular 1116 (1995)  
OCS\* natural gas: MMS Alaska Federal Offshore Update (2003)



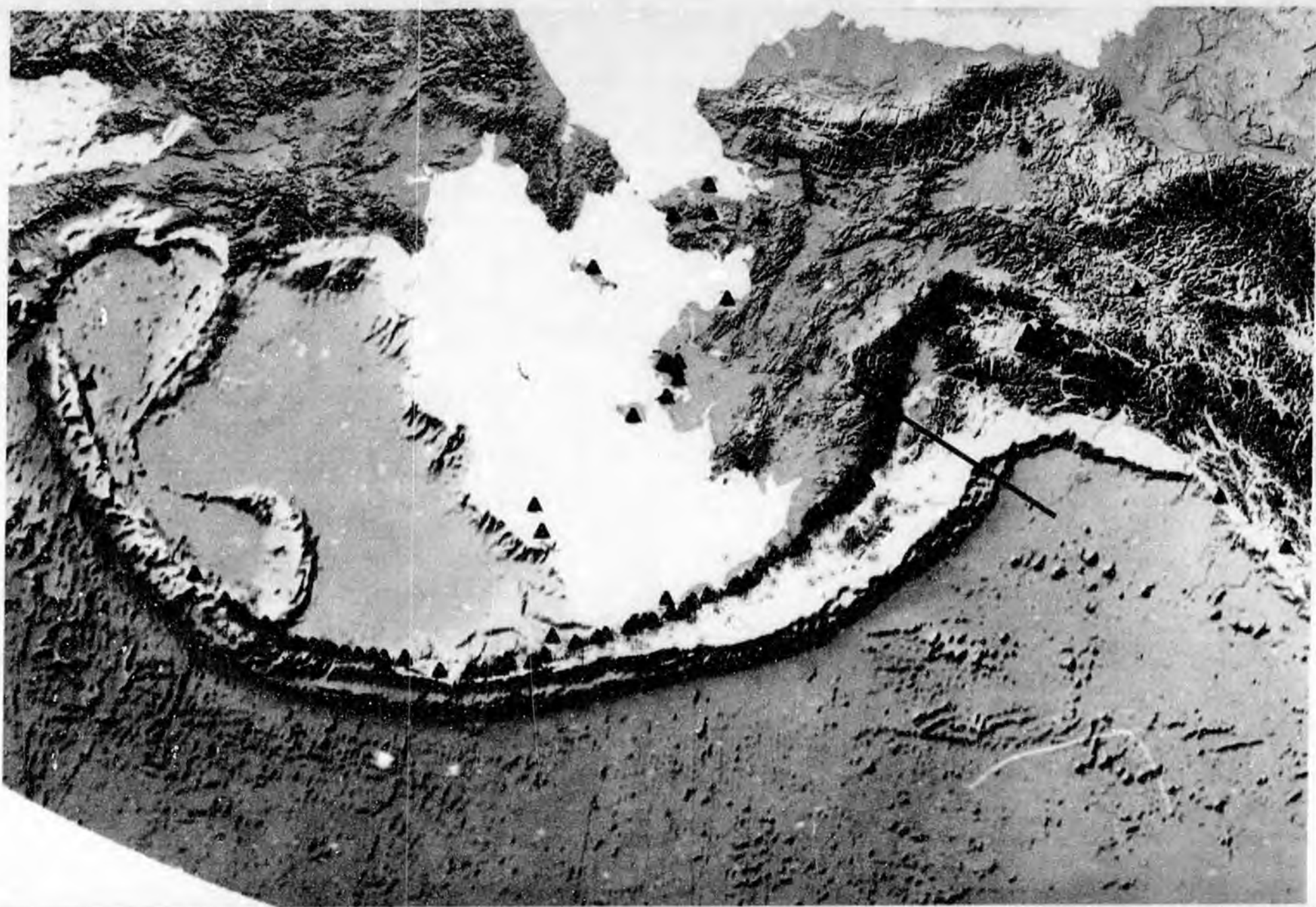
# Proven Gas Reserves

*Gas Reserves*

## North Slope *(BCF)*

Badami Unit	39	
Barrow	34	
Colville River Unit	60	
Duck Island Unit	843	
Kuparuk River Unit	611	
Milne Point Unit	14	
North Star	450	
Prudhoe Bay Unit	23,879	
Other Undeveloped	8,000	
<b>TOTAL North Slope</b>	<b>33,930</b>	<b>94%</b>
<b>Cook Inlet</b>	<b>2,240</b>	<b>6%</b>
<b>TOTAL STATE</b>	<b>36,170</b>	



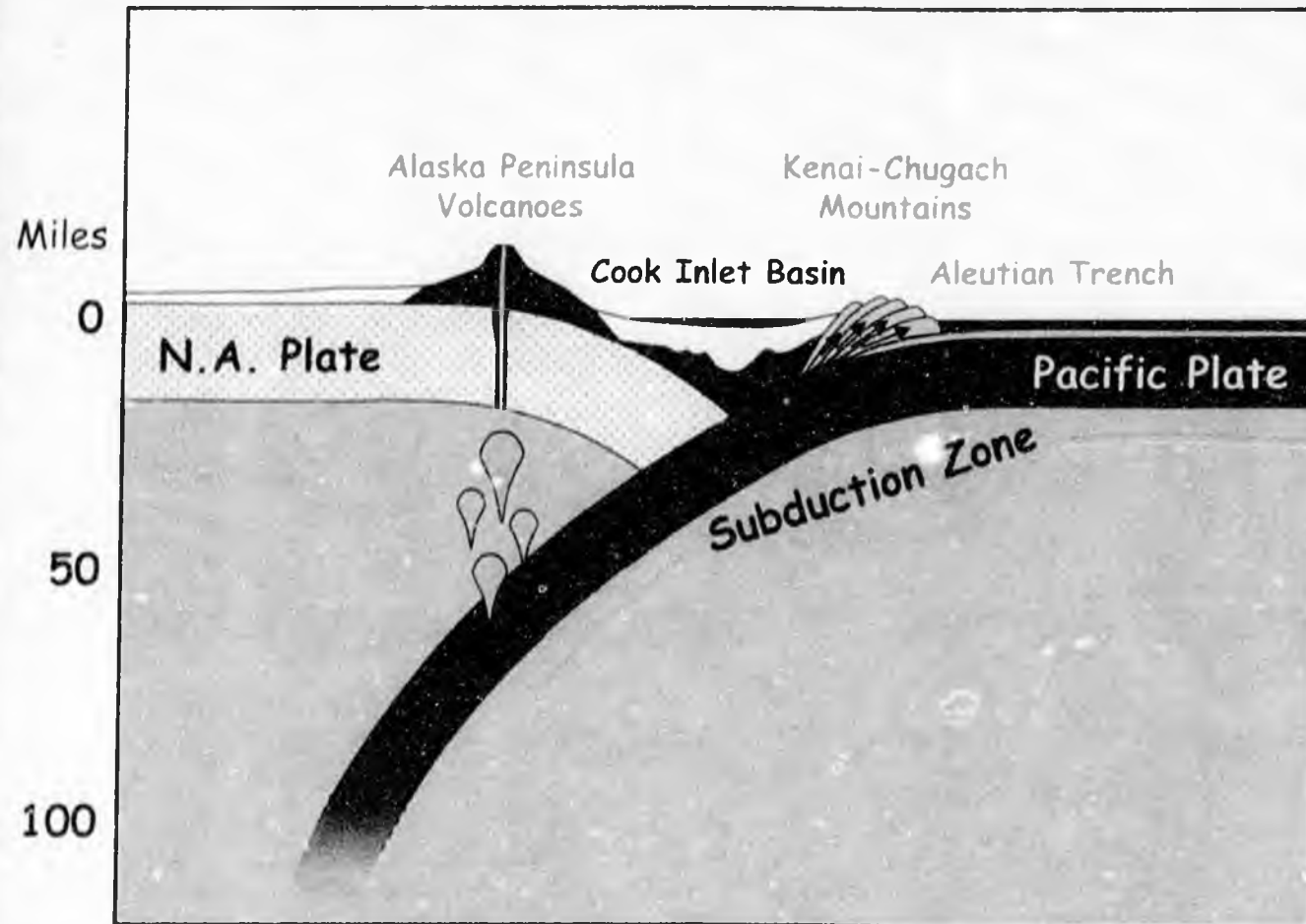


# UPPER COOK INLET BASIN

## Basin / Reservoir Origins

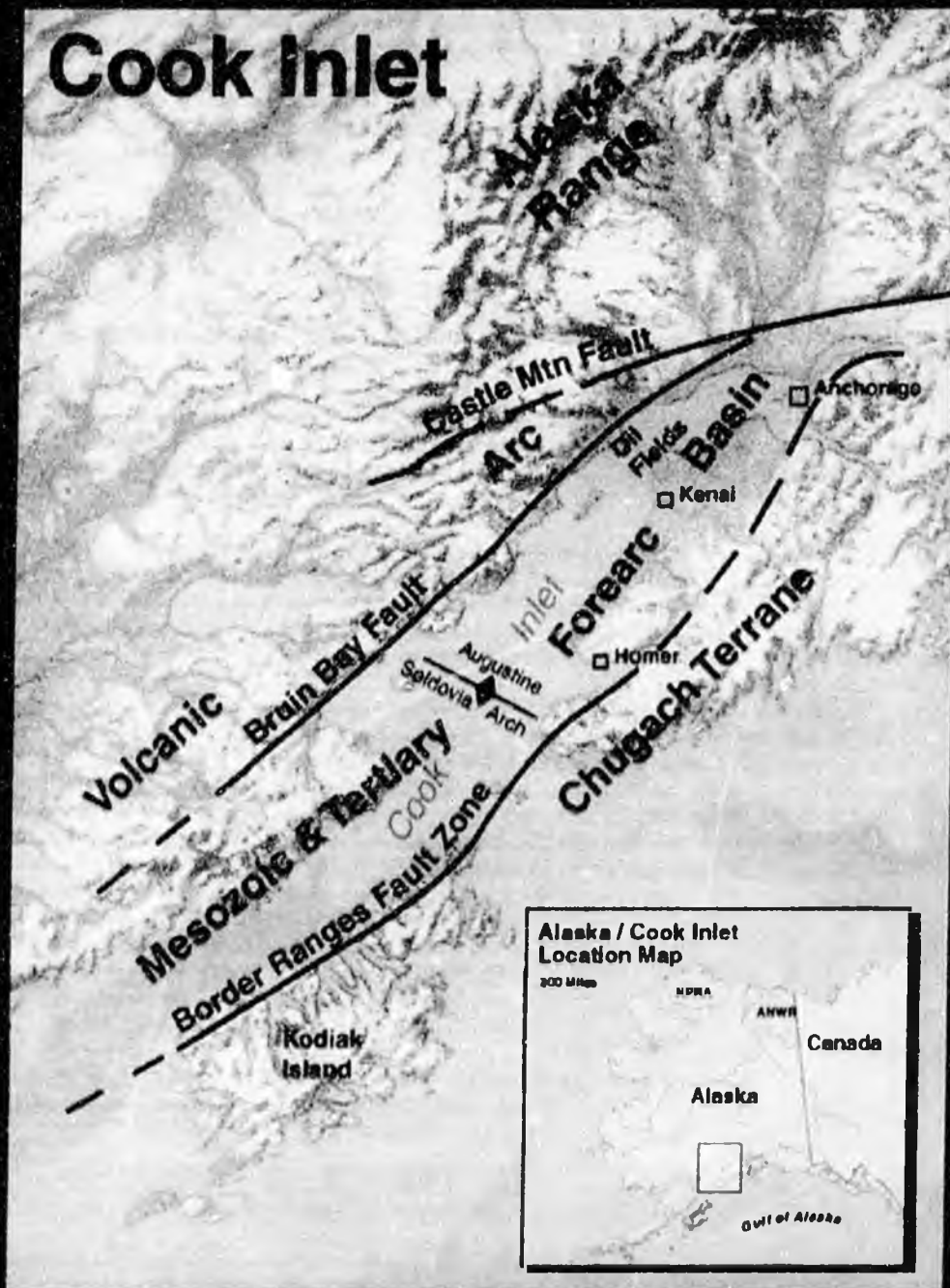
NW

SE

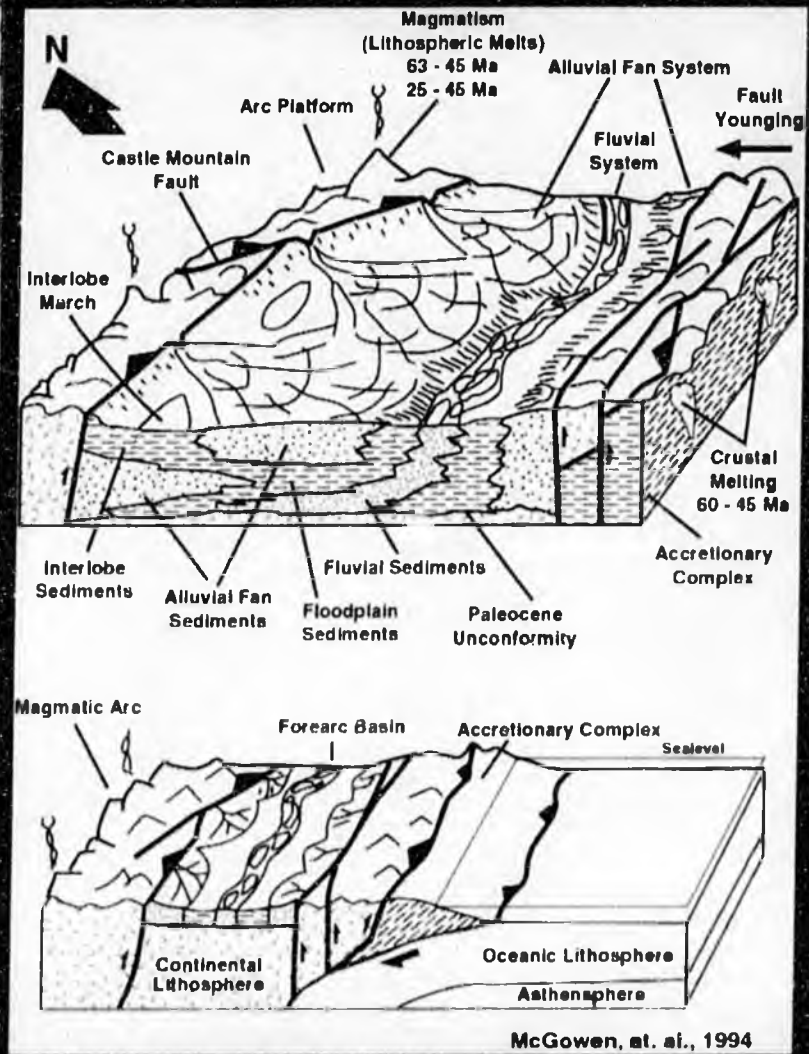


Modified from:  
Tornqvist, T., 2005, Principles of Sedimentology and Stratigraphy, University of Chicago,  
<http://www.uic.edu/classes/geol/eaes350/>

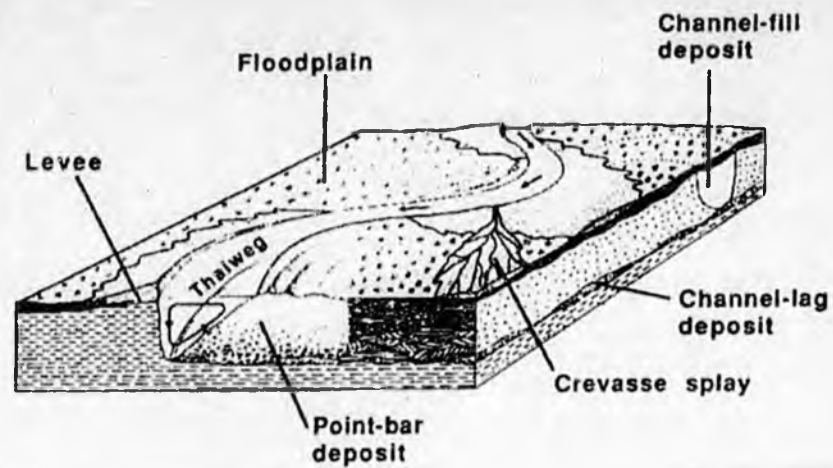
# Cook Inlet



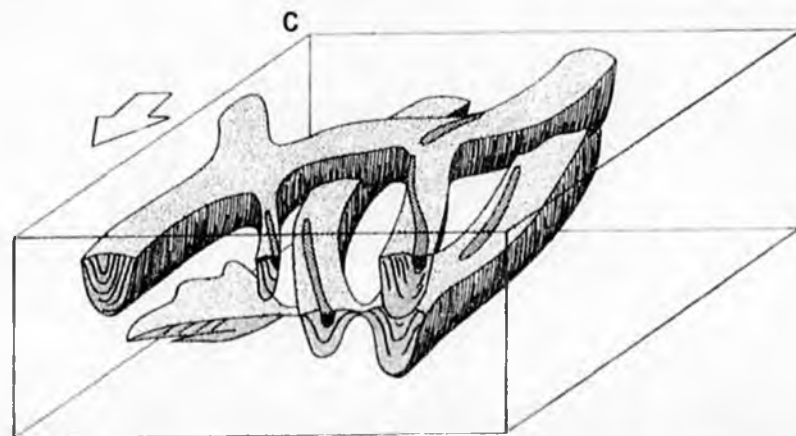
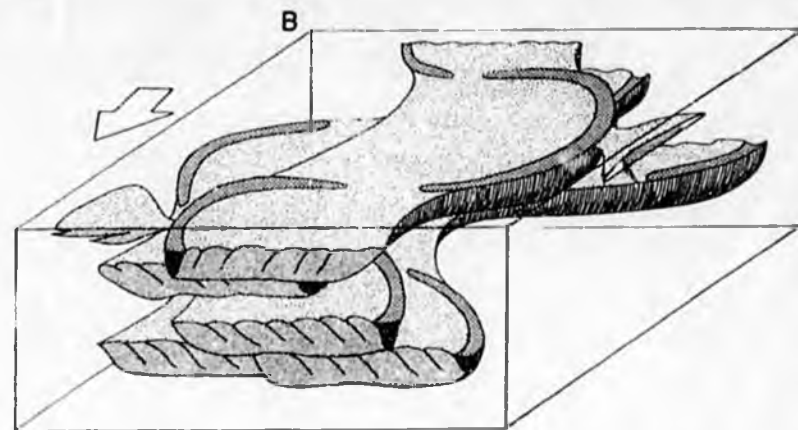
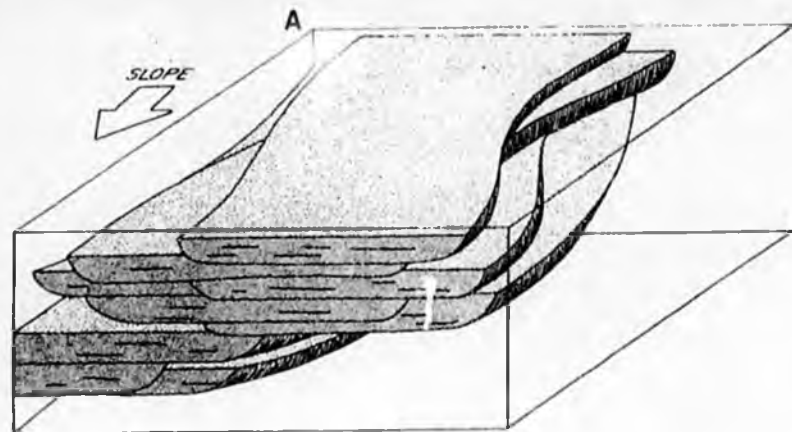
# Importance of Provenance



# Tertiary Basin Depositional Systems



# Fluvial Channel Geometry

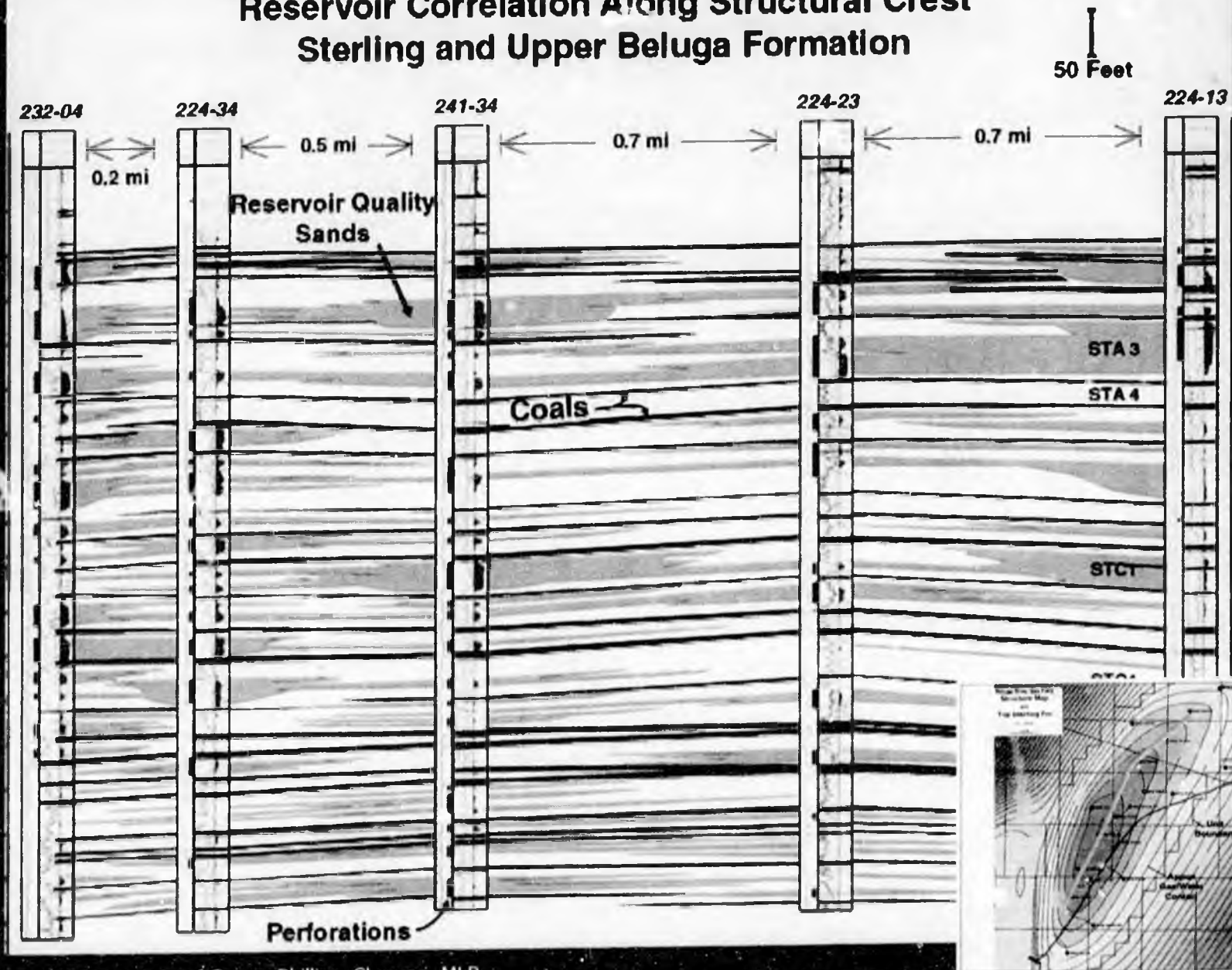


# Outcrop of Tertiary Non-Marine Sediments



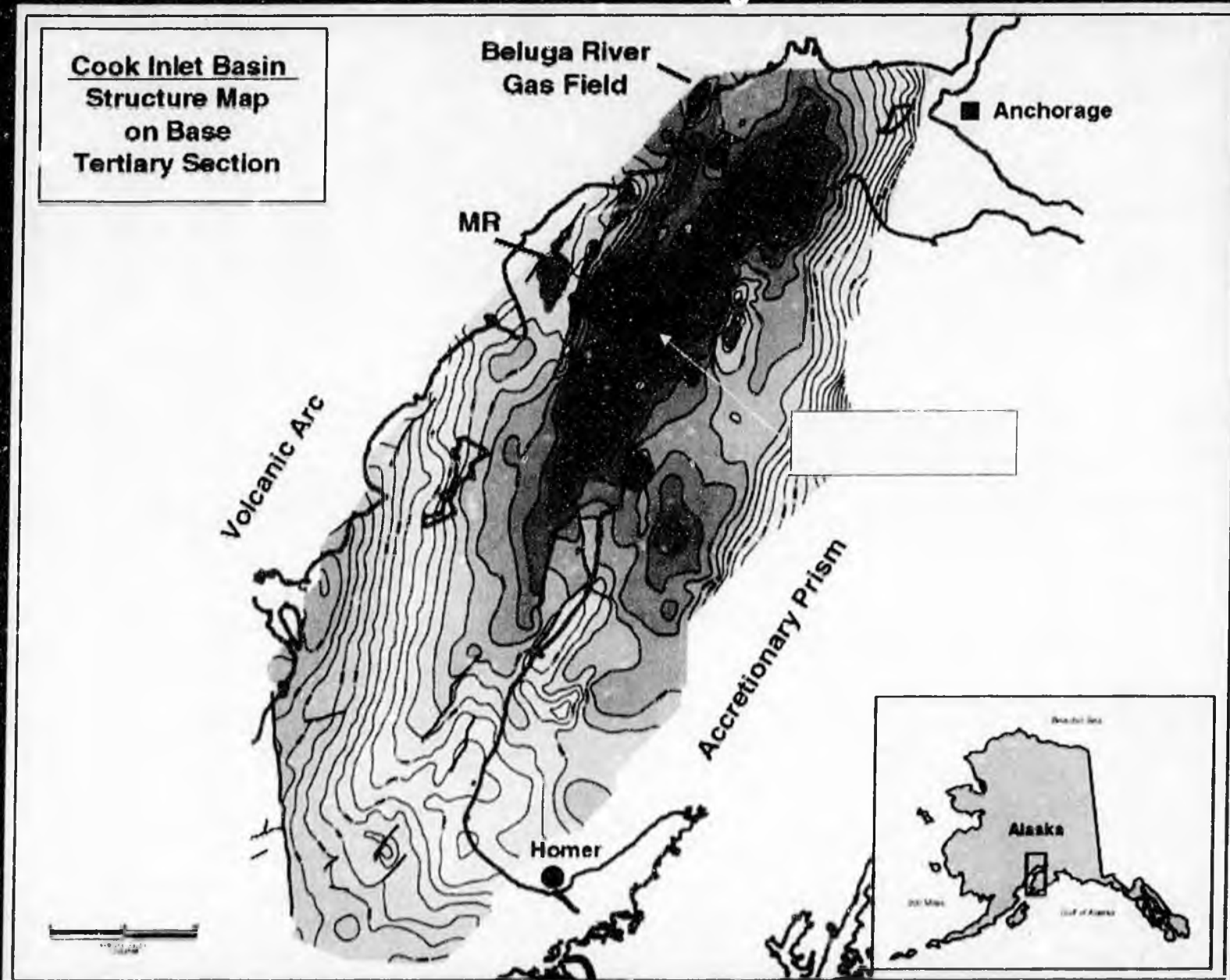
# Sand Distribution in a Fluvial System

## Beluga River Gas Field Reservoir Correlation Along Structural Crest Sterling and Upper Beluga Formation



From Swenson, 1997, courtesy of ConocoPhillips, Chevron, MLP

# Tertiary Reservoir Section



# Cook Inlet Oil & Gas Activities & Discoveries

## Map Legend

-  Units
-  Oil Accumulations\*
-  Gas Accumulations\*
-  Recent Oil Discoveries
-  Recent Gas Discoveries
-  2004 Active and Proposed Exploration Wells
-  2003 Exploration Wells
-  Platforms
-  Road
-  Alaska Railroad



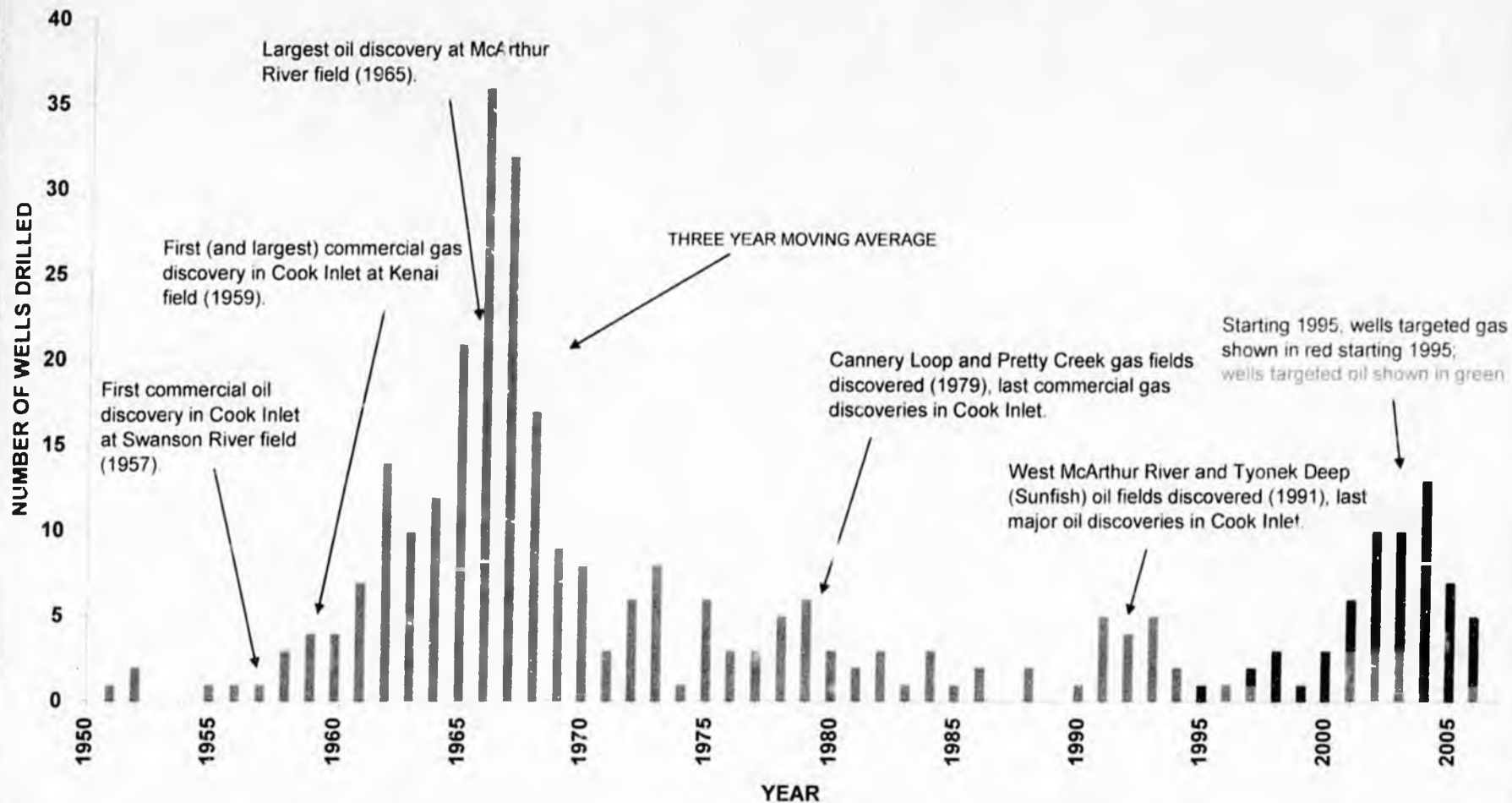
\*Oil and Gas Accumulations are Approximate



Gulf of Alaska

DOMU 1/2004

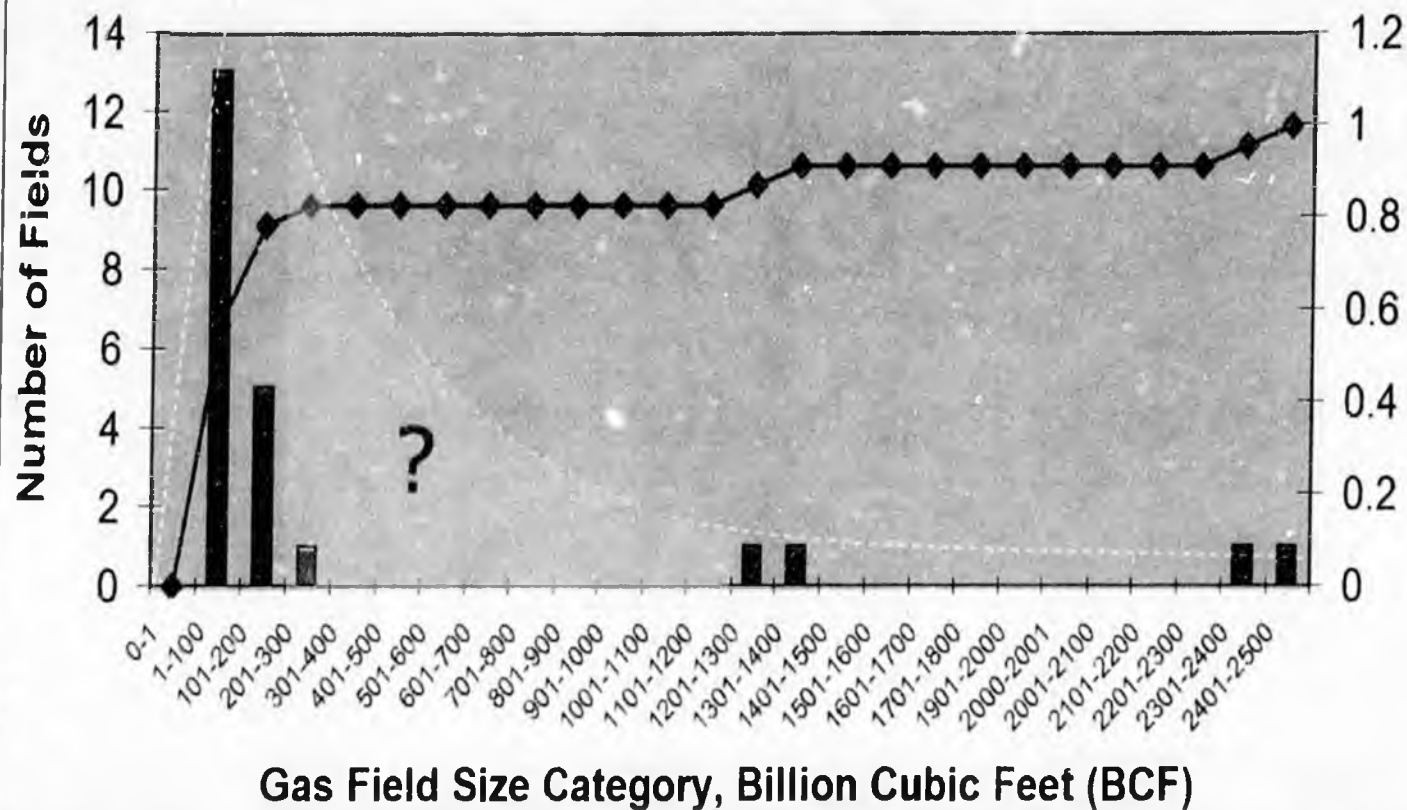
# Cook Inlet Exploration Wells Drilled, 1950 - 2006



# Gas Field Size Distribution – Cook Inlet

## EUR-Field Size Distribution

### Cumulative Frequency



Nicoli Creek	3
Stump Lake	6
Pretty Creek	6
West Fork	7
Lewis River	9
North Fork	12
Falls Creek	13
Birch Hill	22
Sterling	26
N Trading Bay Ur	30
Moquakie	43
Wolf Lake	50
Trading Bay	90
Ivan River	104
M G S	112
Cannery Loop	118
Granite Point	137
Swanson River	145
Beaver Creek	242
BRU	1266
McAurther River	1384
NCI	2328
Kenai	2425

**TOTAL= 8576 bcf**  
**Mean = 373 tcf**

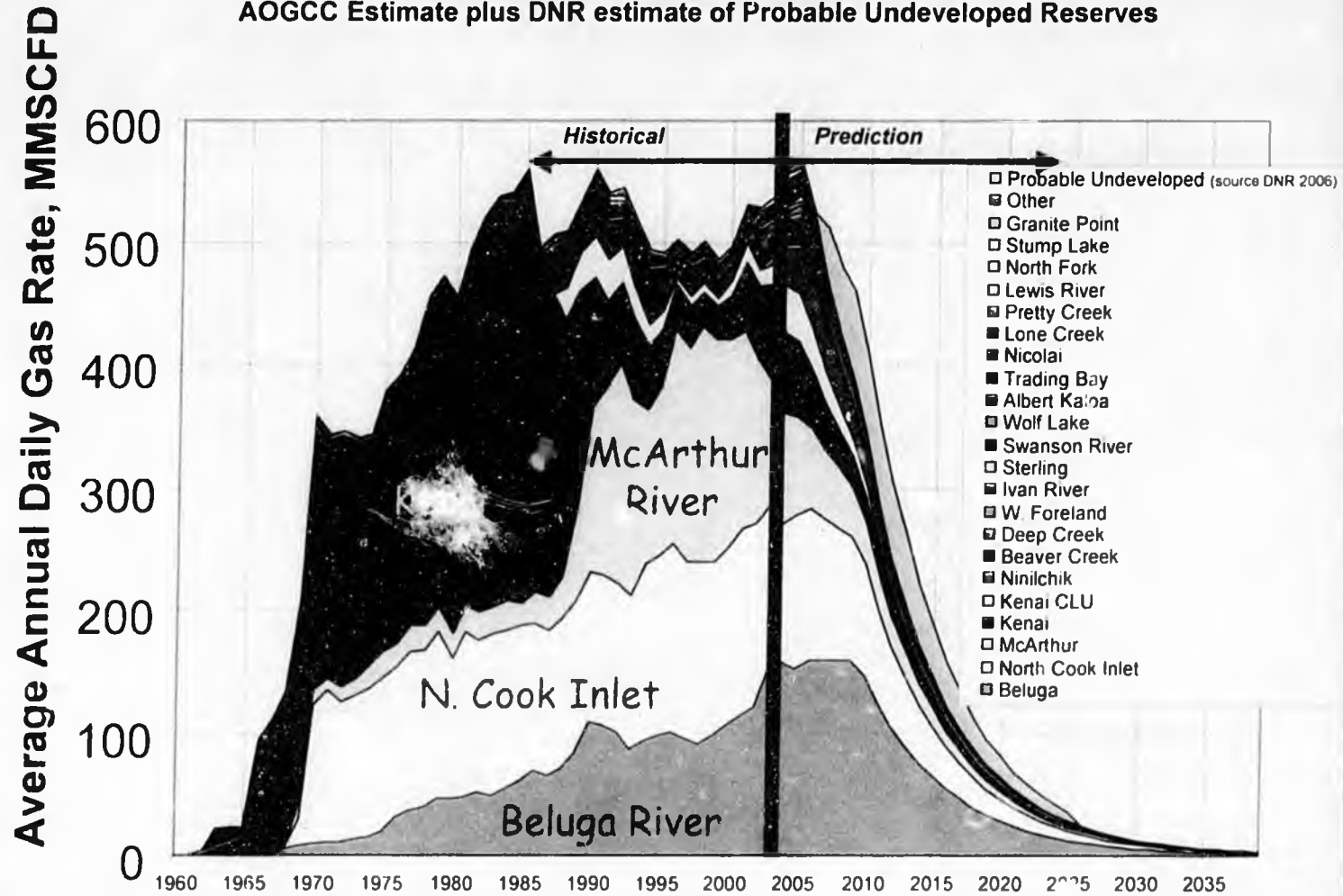
# Cook Inlet Gas Pools Rates

## Historic & Forecast

### Cook Inlet Historical and Projected Production

Proved Non-associated Gas

AOGCC Estimate plus DNR estimate of Probable Undeveloped Reserves



# Is there more gas out there?

- ▶ Yes

## Where will it be found?

- ▶ In existing fields
- ▶ In new exploration play types

## What are the hurdles?

- ▶ Expensive data and drilling costs
- ▶ Limited market
- ▶ Complicated land access

# Cook Inlet Gas Exploration Potential

Only structural traps have been explored for or developed  
– stratigraphic trap potential untapped

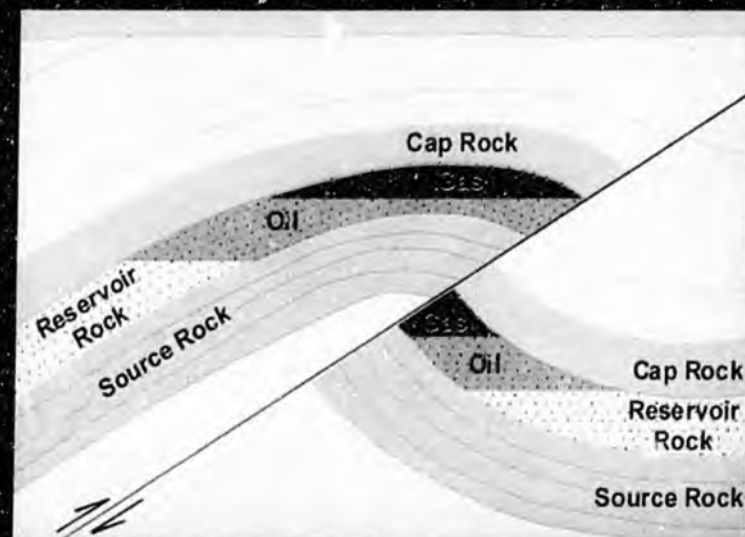
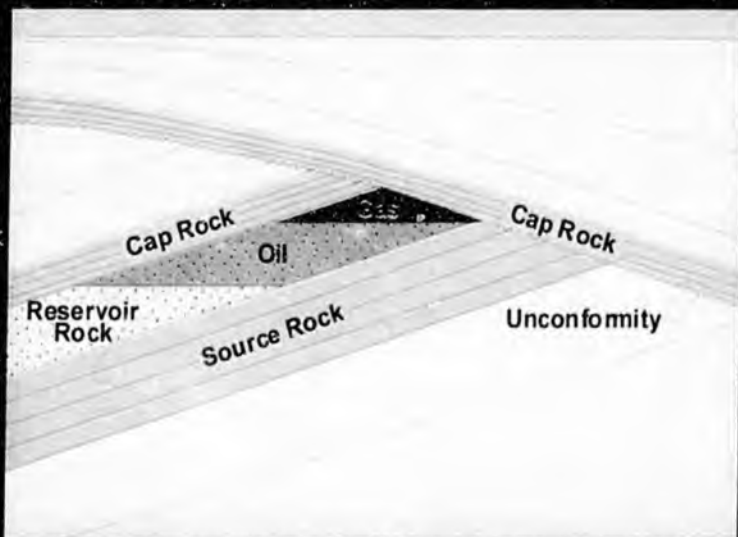
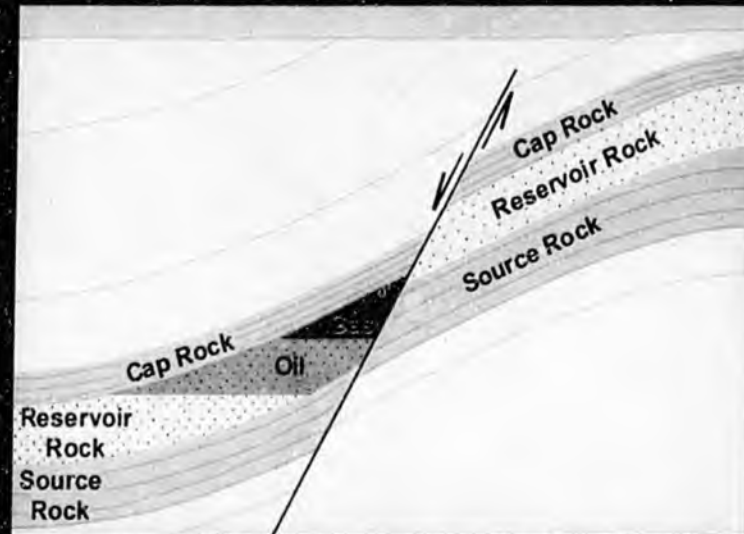
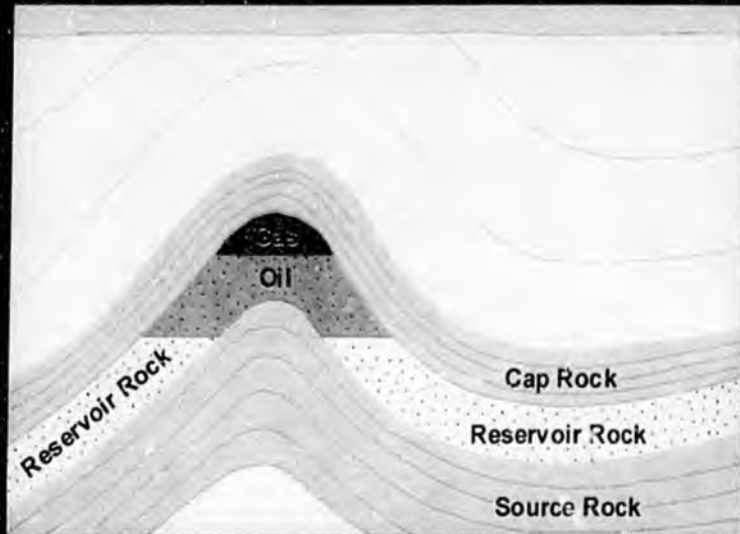
85% of gas discovered early in exploration cycle while drilling for oil

Only 70 exploration wells drilled strictly for gas

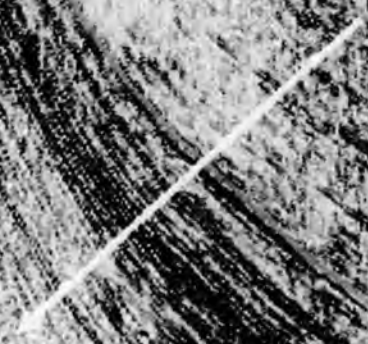
Nearly one in ten fields >2 tcf

- 4 largest fields have 86% of reserves
- Field-size distribution lacks discoveries in 300-1300 bcf range → yet to be discovered?

# Oil and Gas Trapping Mechanisms



EW 1 - Granite pt



0  
300  
1000  
1500  
2000  
2500  
3000  
3500  
4000

Seismic Data provided courtesy of  
Veritas Geophysical Corporation

NCI field

"Low Hanging Fruit"



0  
500  
1000  
1500  
2000  
2500  
3000  
3500  
4000

Seismic Data provided courtesy of  
Veritas Geophysical Corporation

NCI field  
"Flat Spots"



Seismic Data provided courtesy of  
Veritas Geophysical Corporation



Subtle Stratigraphic Traps

Seismic Data provided courtesy of  
Veritas Geophysical Corporation

What is the State Geological Survey  
Doing to Help?

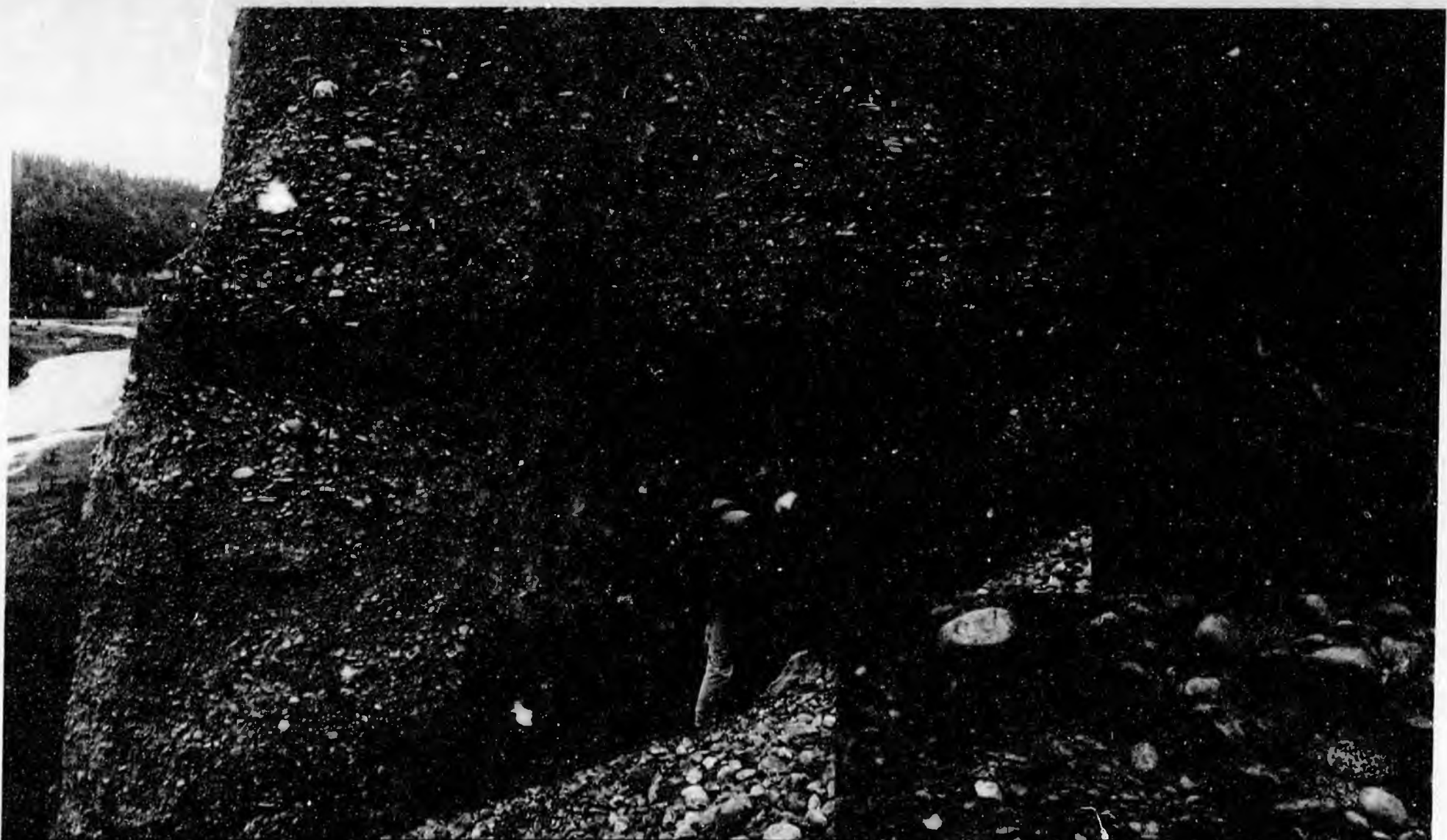
# Beluga Formation Near Fritz Creek



Moderate- to high  
sinuosity meandering  
fluvial system

Channels flanked by levees  
and floodplains

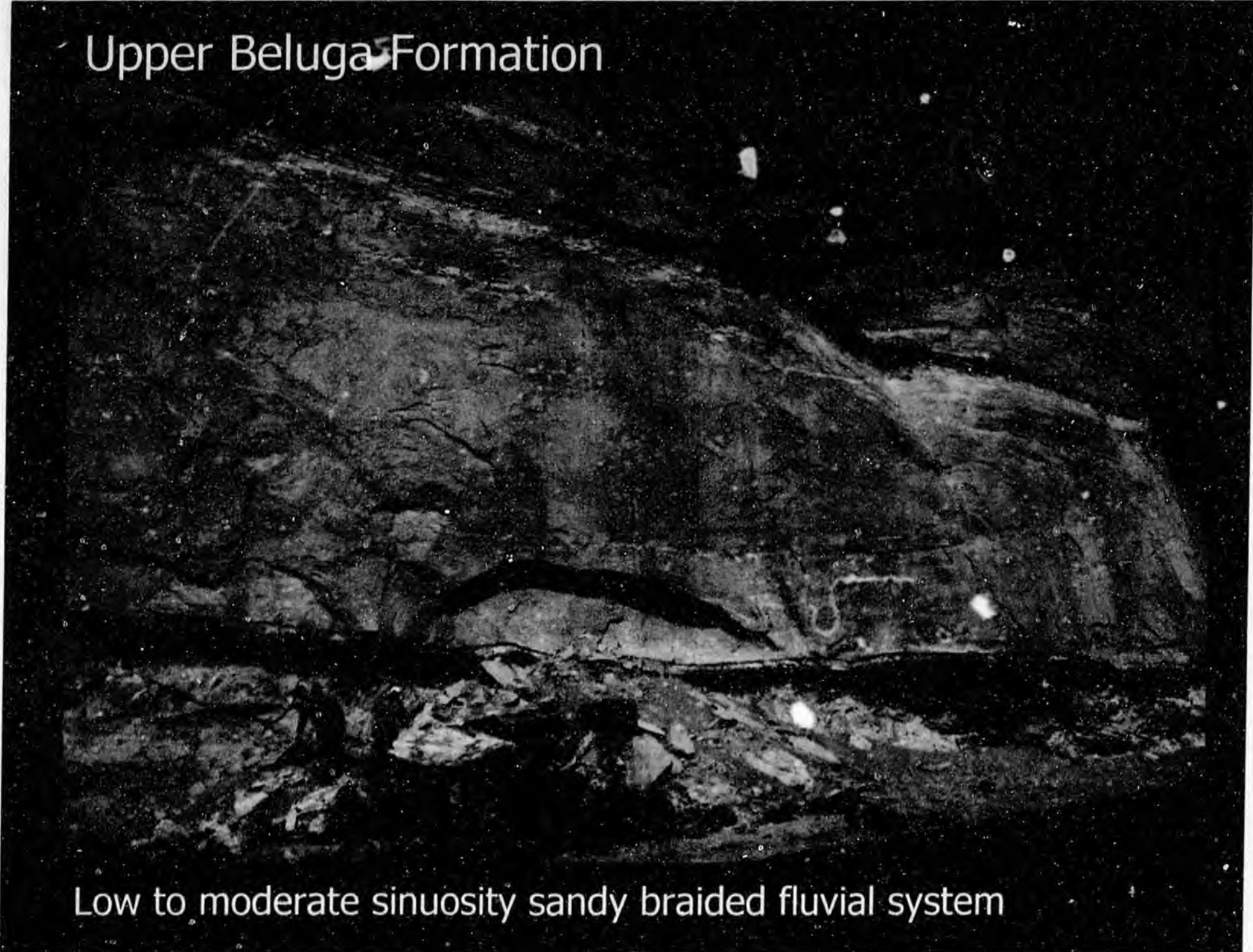
Anastomosed  
fluvial system



Sterling Formation (?) along the Fox River

Crudely stratified pebble-cobble conglomerates  
and lenticular sandstones

Upper Beluga Formation

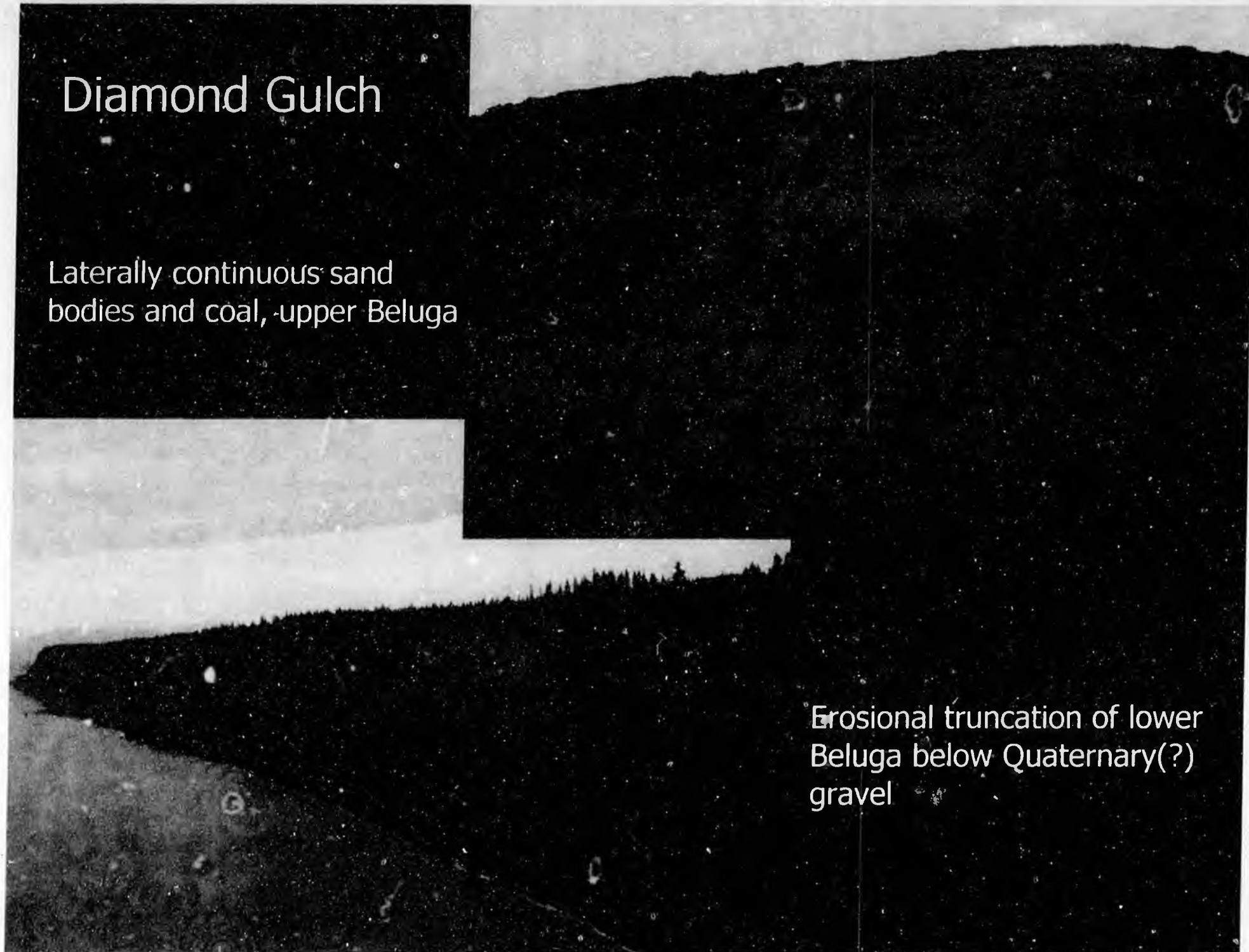


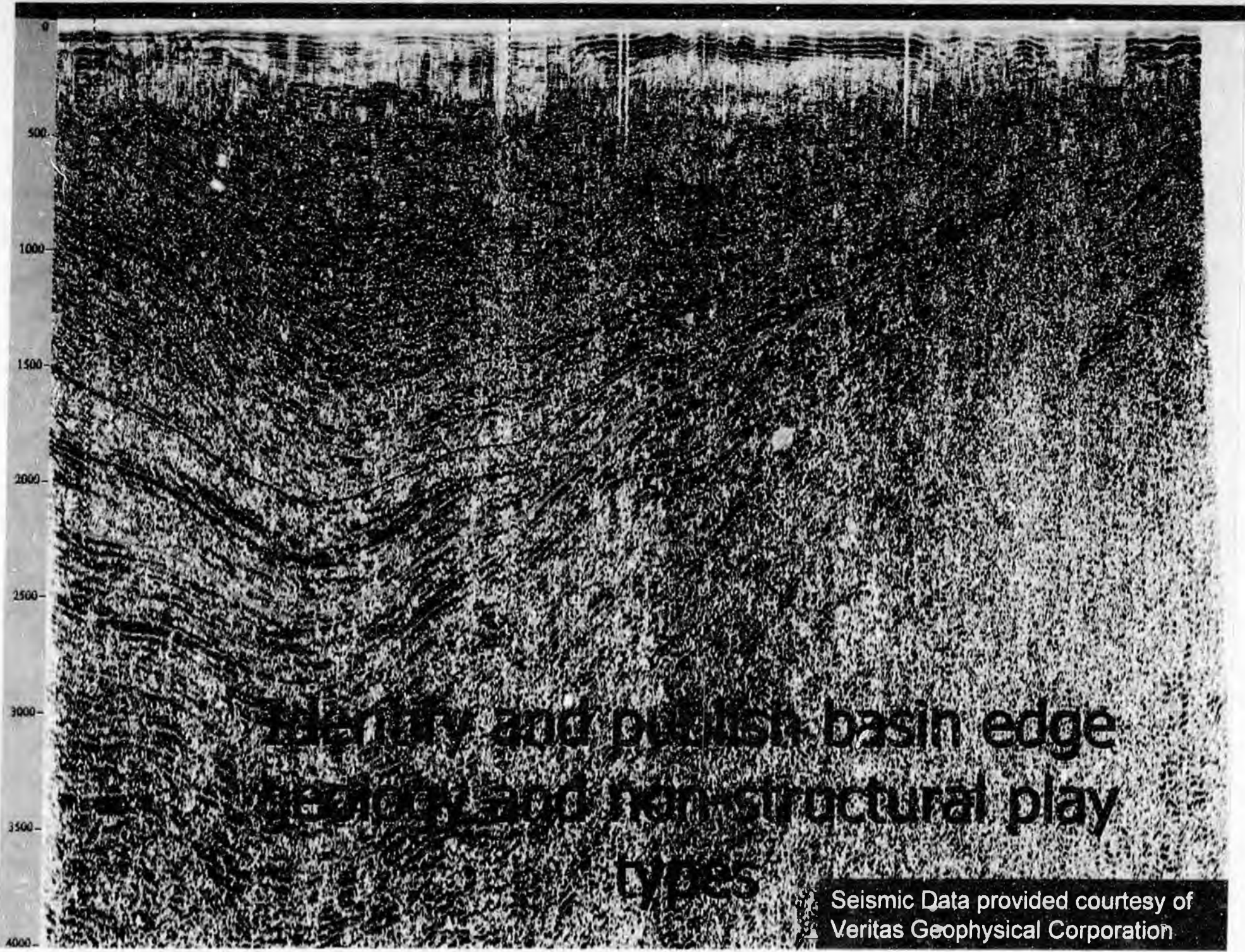
Low to moderate sinuosity sandy braided fluvial system

# Diamond Gulch

Laterally continuous sand  
bodies and coal, upper Beluga

Erosional truncation of lower  
Beluga below Quaternary(?)  
gravel



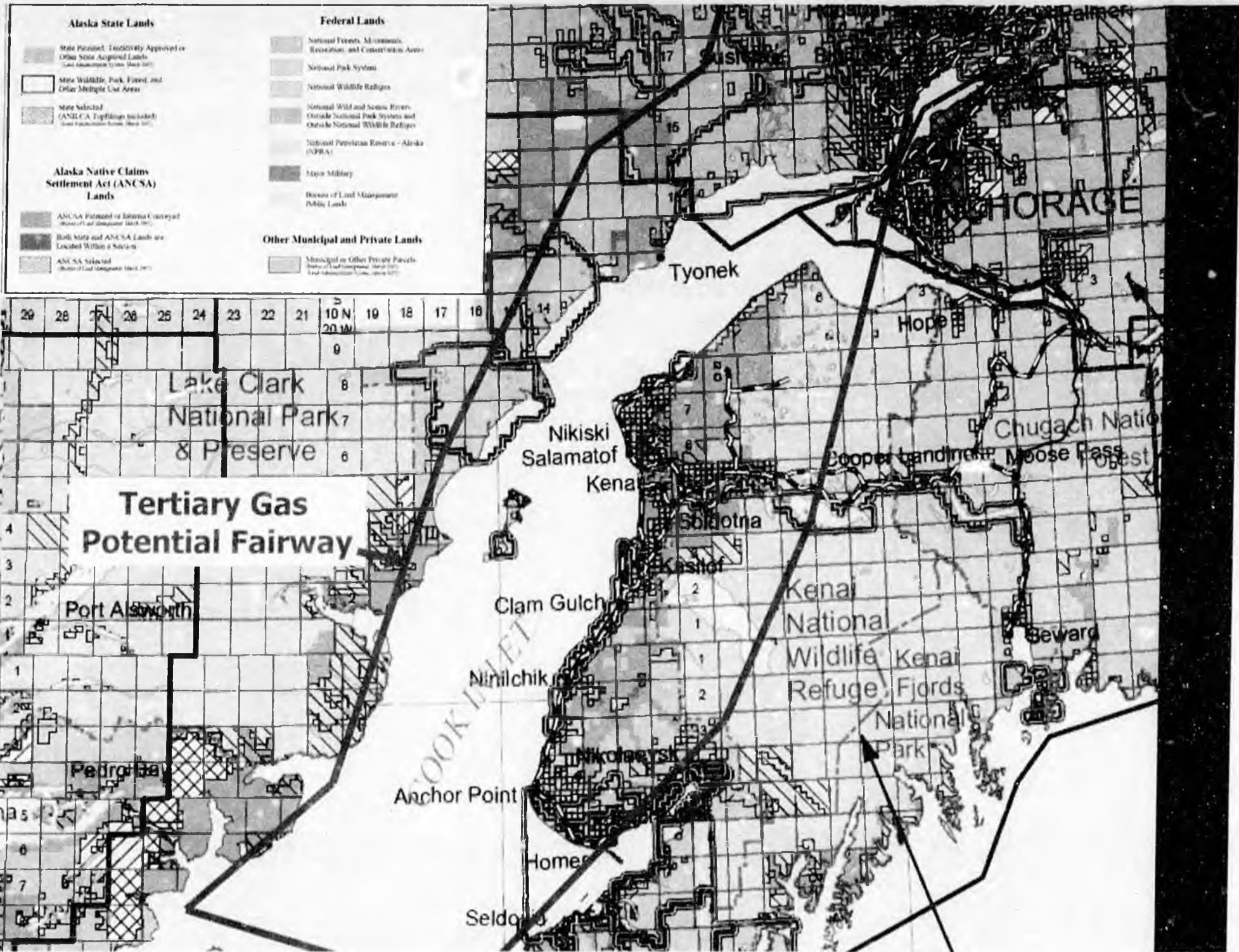


Identify and publish basin edge  
geology and non-structural play  
types

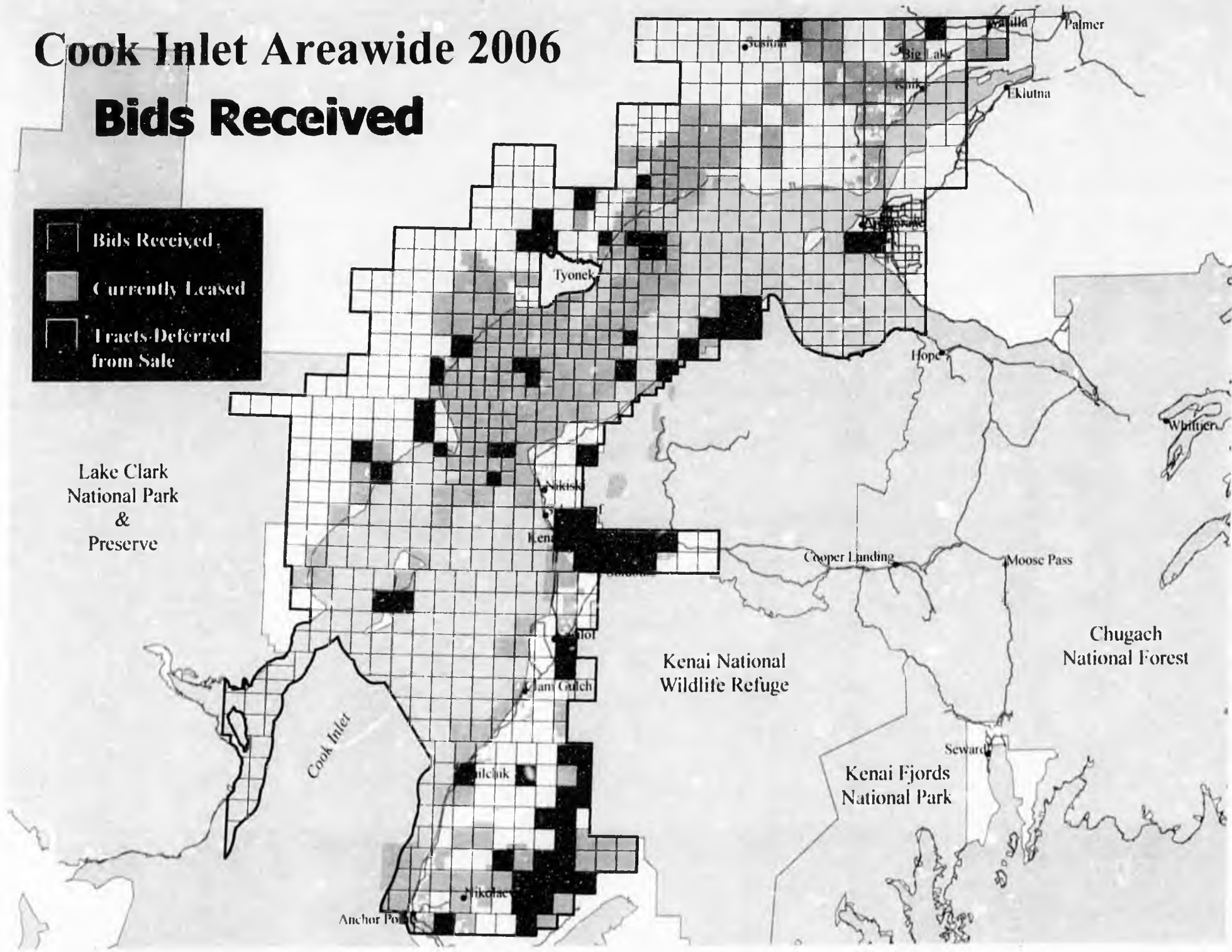
Seismic Data provided courtesy of  
Veritas Geophysical Corporation

- ▶ All Cook Inlet Seismic data included in this presentation was provided to the state as a courtesy from **Veritas Geophysical Corporation** through an agreement with the Department of Natural Resources.

Exploration Land Picture



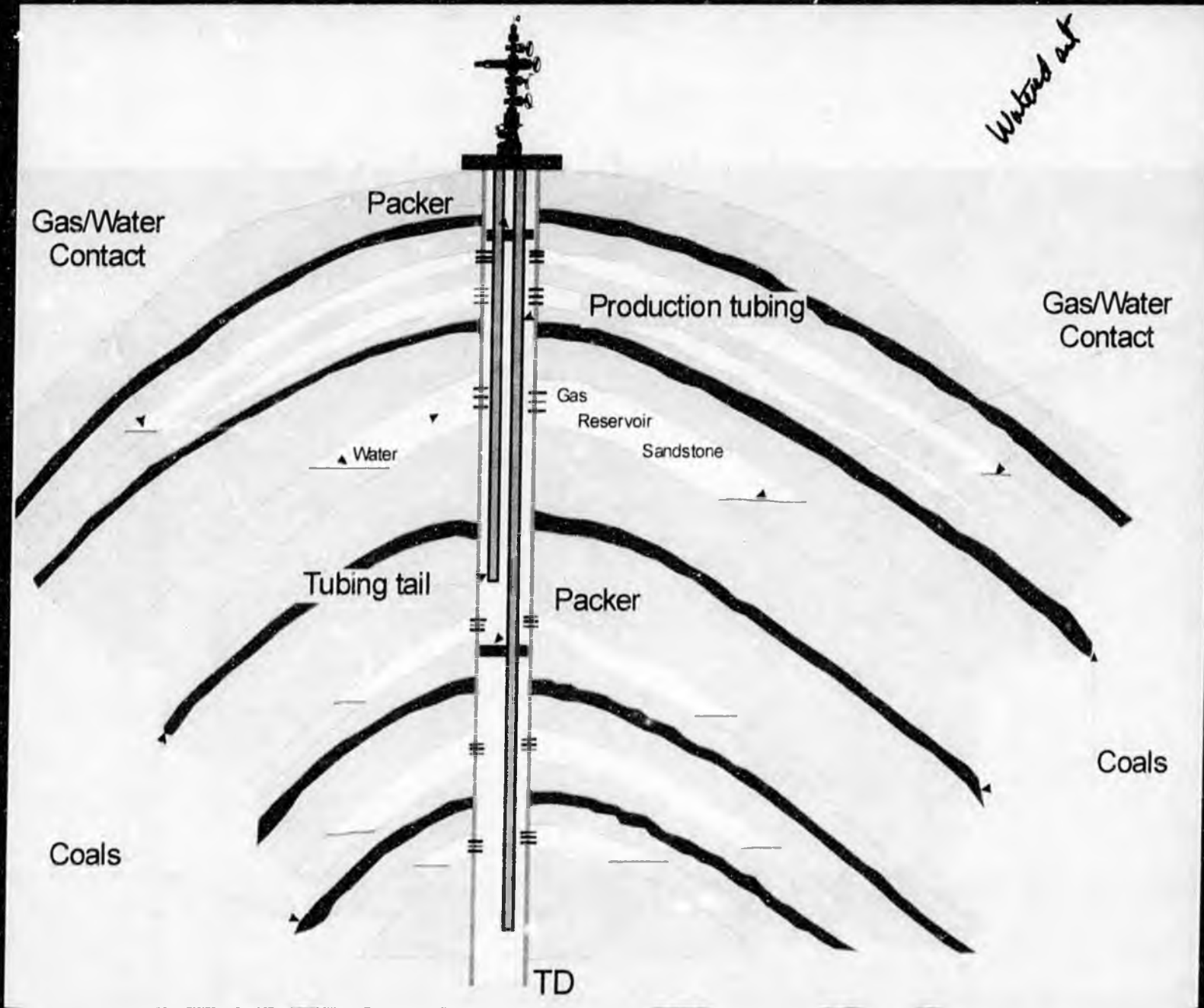
# Cook Inlet Areawide 2006 Bids Received



# Non- Conventional Exploration Gas

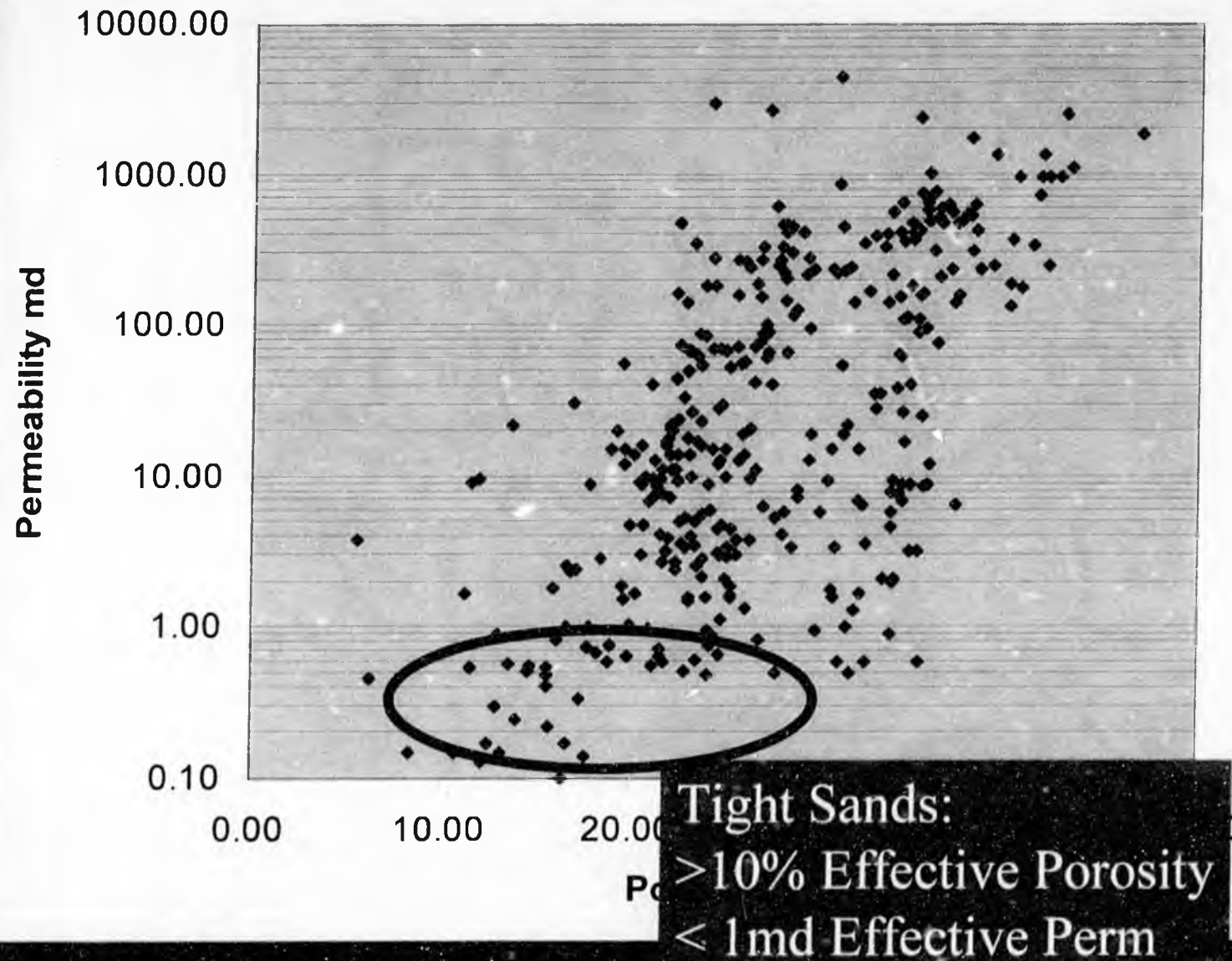
# Typical Production String Configuration

## Cook Inlet "Stacked Pay"



# Tight Gas Sands

## Porosity vs Permeability

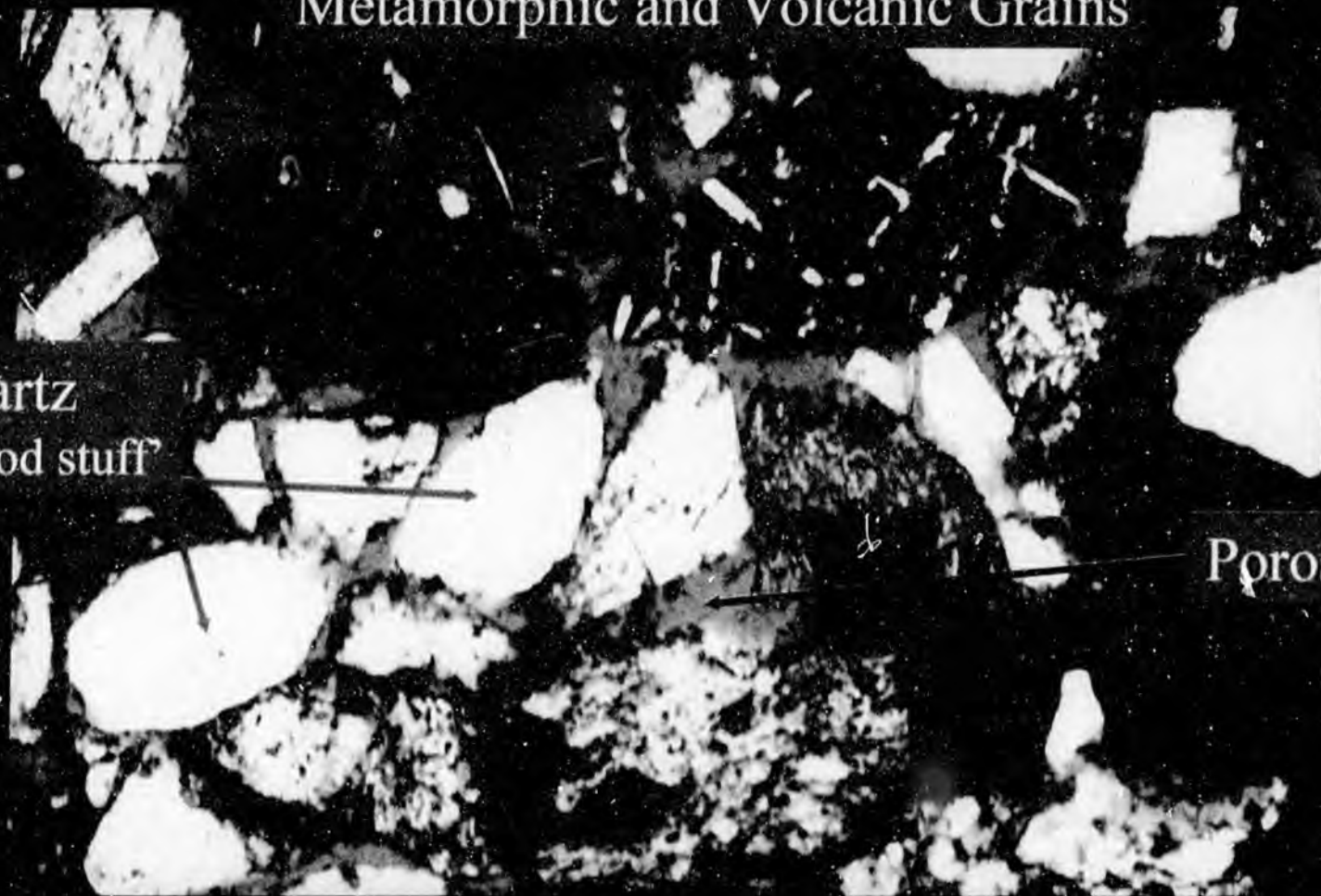


# Photomicrograph of Lithic-Rich Sandstone

Metamorphic and Volcanic Grains

Quartz  
'The good stuff'

Porosity



# Tight Gas Sands Summary

- Most Importantly
  - Don't Despair;
    - Tight Sands Have Potential to Reservoir Significant Resource
    - 10mmcf/d from Fractured Shale Inconceivable 20 Years Ago
    - Good Data Collection is Critical
    - Sound Interpretation & Diligent Application of New Technologies

