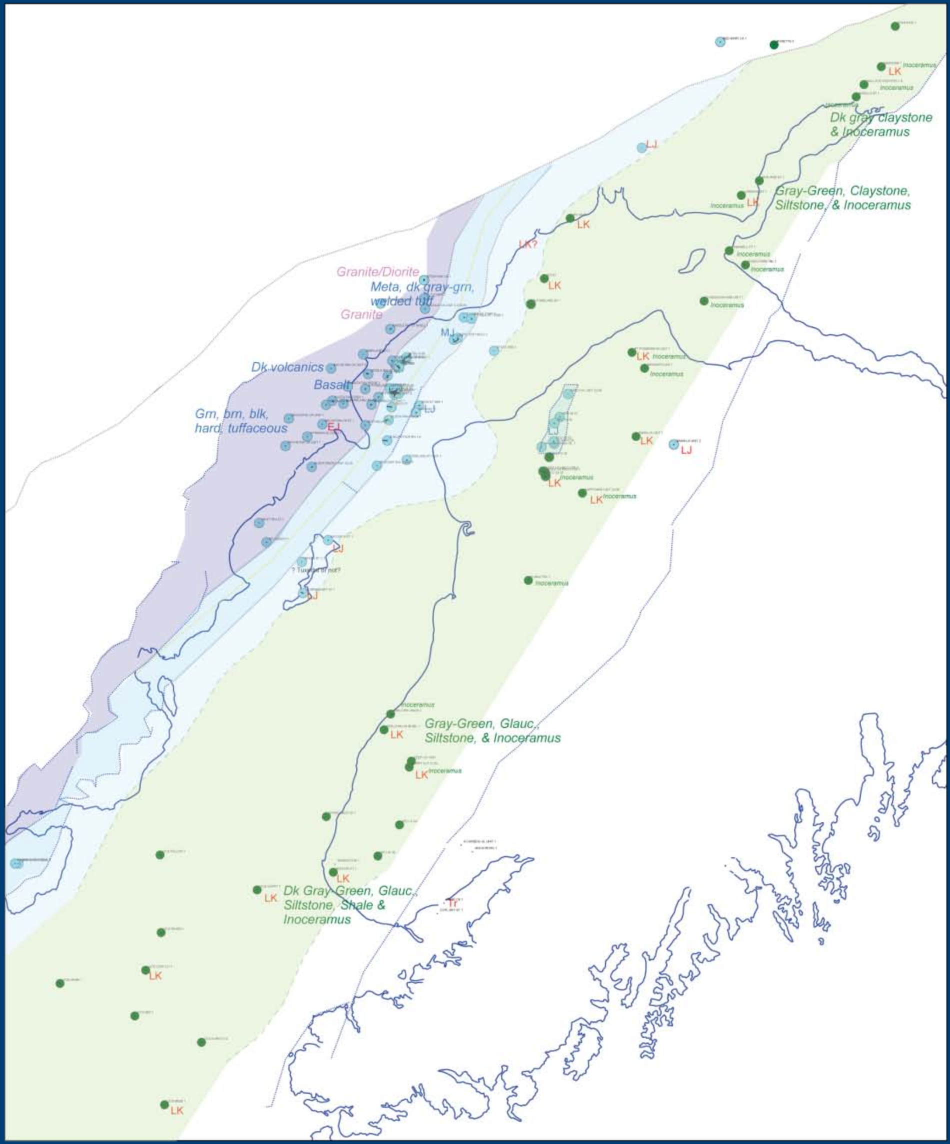
Progress on Developing a Cook Inlet Mesozoic Subcrop Map



Laura Gregersen
&
Diane Shellenbaum

Alaska Department of Natural Resources, Division of Oil and Gas

USGS Technical Meeting, September 22, 2010

Author(s) and affiliations:
Laura Gregersen and Diane Shellenbaum
Alaska Division of Oil and Gas

Date presented:
September 22, 2010

Presentation Forum:
U. S. Geological Survey Cook Inlet Geology Review
BP Energy Center, Anchorage, Alaska

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Robert Swenson, David LePain, Marwan Wartes, and Robert Gillis
Alaska Division of Geological & Geophysical Surveys (ADGGS)
Paul Decker
Alaska Division of Oil and Gas (ADOG)
Dan Seamount and Art Saltmarsh
Alaska Oil and Gas Conservation Commission (AOGCC)
Rick Stanley
U.S. Geological Survey (USGS)

Goal: Present our current thoughts and receive feedback!

1. Data incorporated into Base Tertiary and Mesozoic Subcrop Maps
2. Rock Descriptions of Mesozoic Section
3. Existing Subcrop Maps
4. Cross Sections
5. DNR’s Preliminary Subcrop Map(s) & Supporting Evidence
6. Seismic Analysis and Impact on Subcrop Interpretation

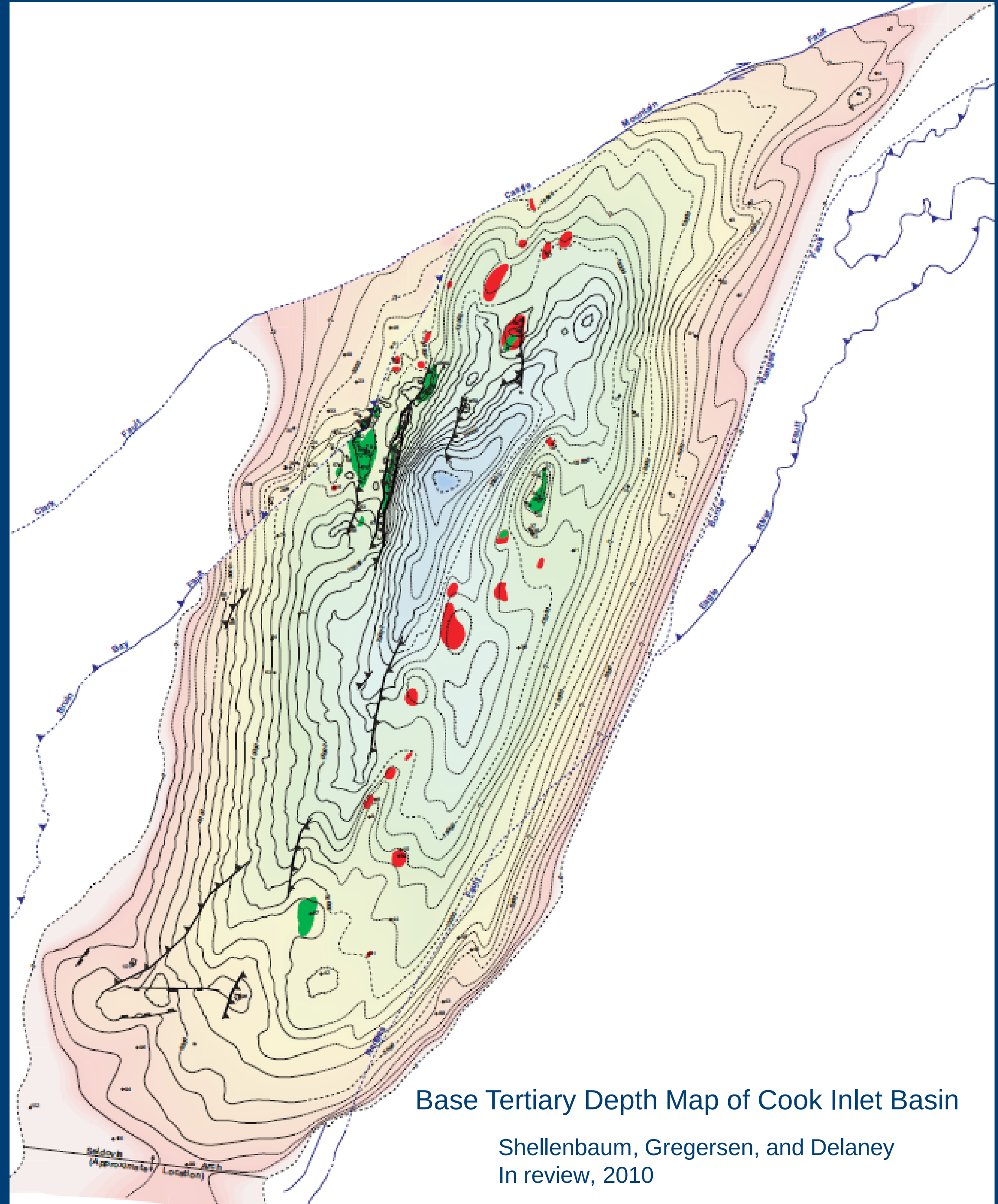
Base Tertiary Depth Map:

•Reviewed all wells that penetrated base Tertiary
--102 wells had confident base Tertiary pick

•Seismic interpretation of CGGVeritas data set
- marine only

•Magoon and others -fold axes, Castle Mtn-Lake Clark, Bruin Bay, Border Ranges faults.

•AOGCC field structure maps



Base Tertiary Depth Map of Cook Inlet Basin

Shellenbaum, Gregersen, and Delaney
In review, 2010

Data Incorporated into Mesozoic Subcrop Map:

1. Lithologic descriptions from drill cuttings and core chips (AMSTRAT)
2. Rock descriptions from measured sections and published maps (i.e. DGGS & USGS)
3. Age calls and cross sections from published CI literature (i.e. Boss et al., 1976; Magoon et al., 1981; Kirshner & Lyon, 1973; Fisher & Magoon, 1978; AGS (1969,1970, 1985))
4. Public talks (i.e. Seamount)
5. Well log correlations in the Mesozoic
6. Age calls from Zippi CI Biostratigraphy Study (EJ, MJ, LJ, LK)
7. Seismic interpretation of CGGVeritas marine dataset over CI

Mesozoic Section that Underlies Base Tertiary

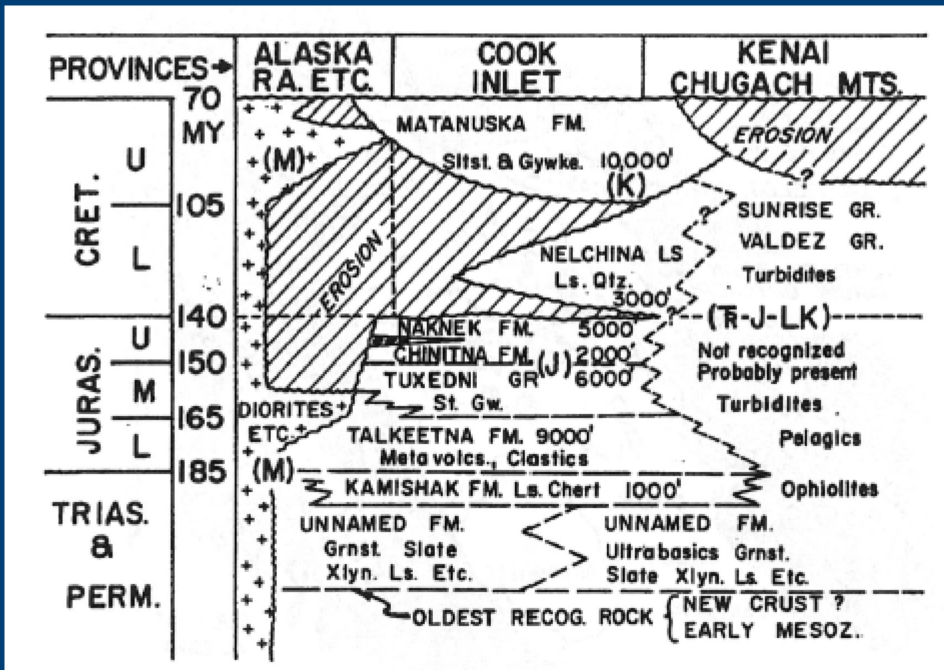
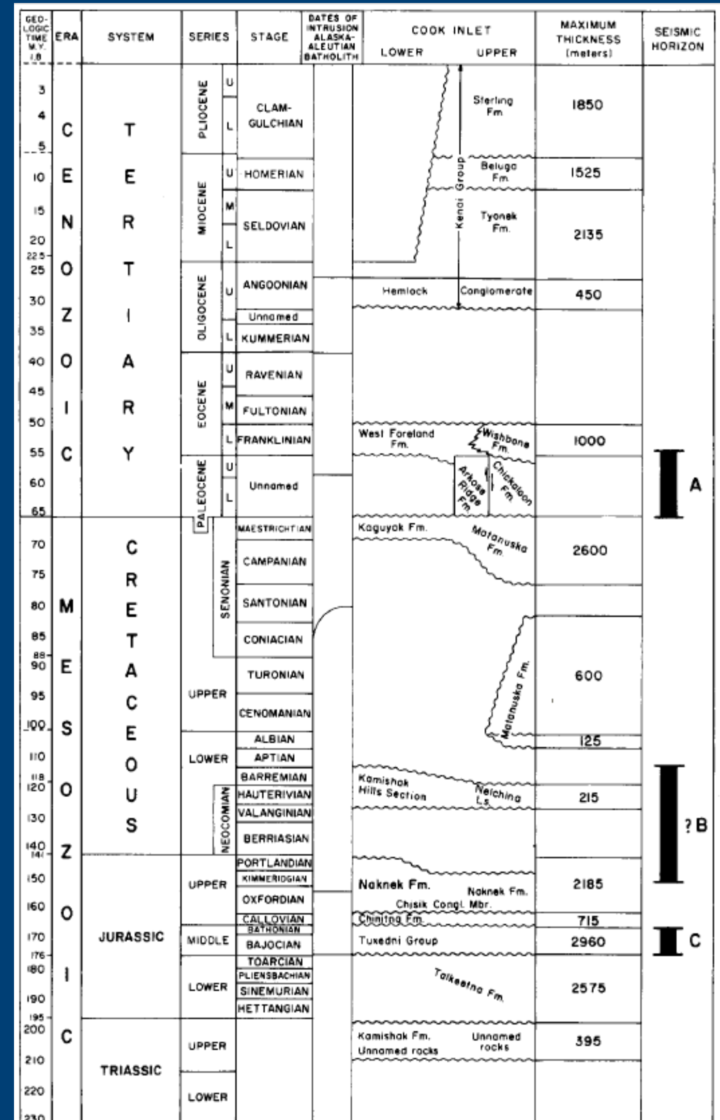


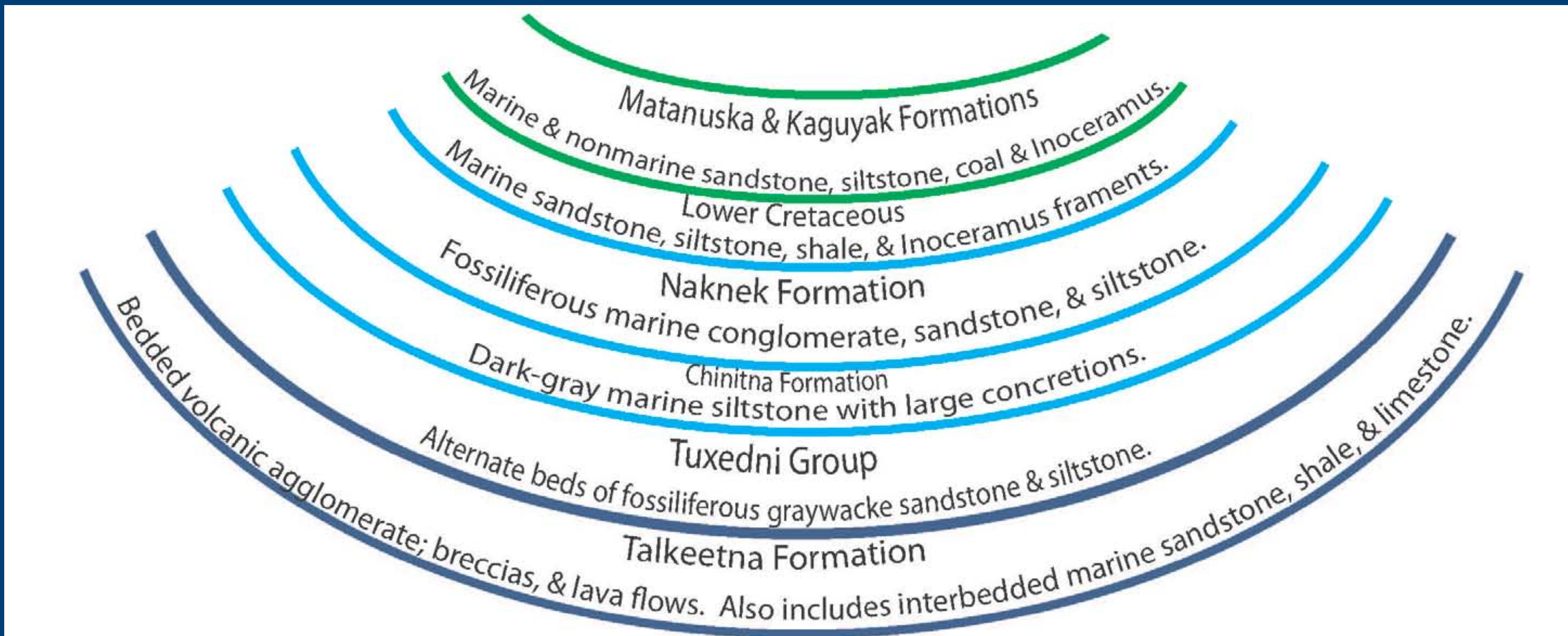
FIG. 4—Mesozoic correlation chart of Cook Inlet basin.

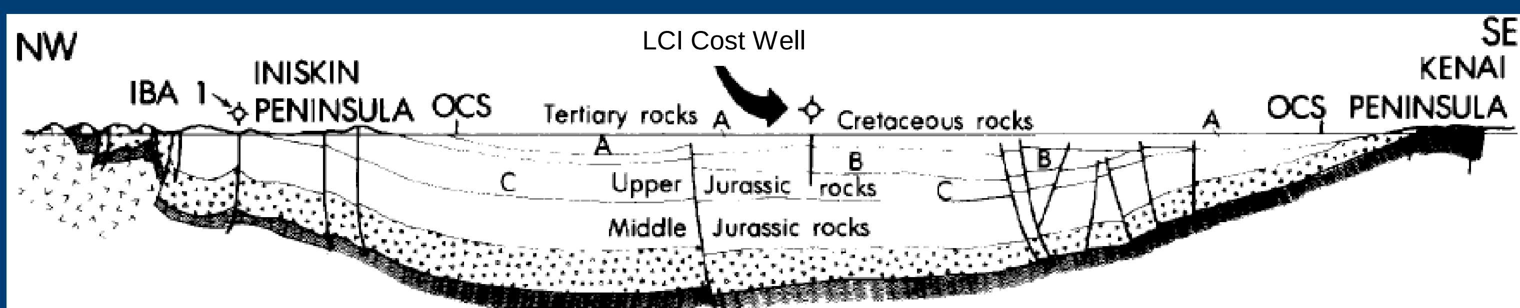
Stratigraphic and Tectonic Development of Cook Inlet Petroleum Province
Kirschner and Lyon, 1973
Standard Oil Company of California



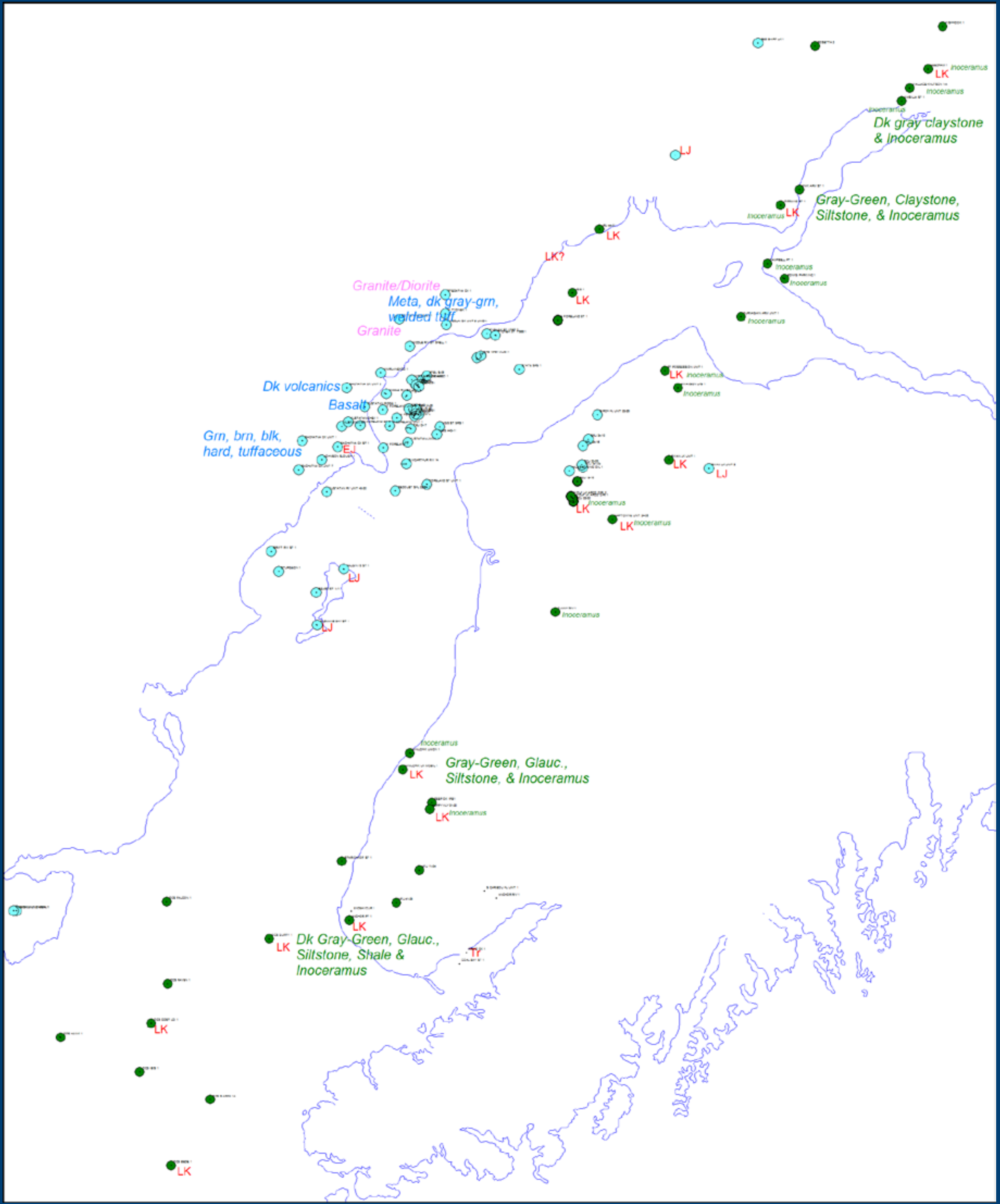
Geologic Framework of Lower Cook Inlet, AK
Fisher and Magoon, 1978
USGS

Rock Descriptions





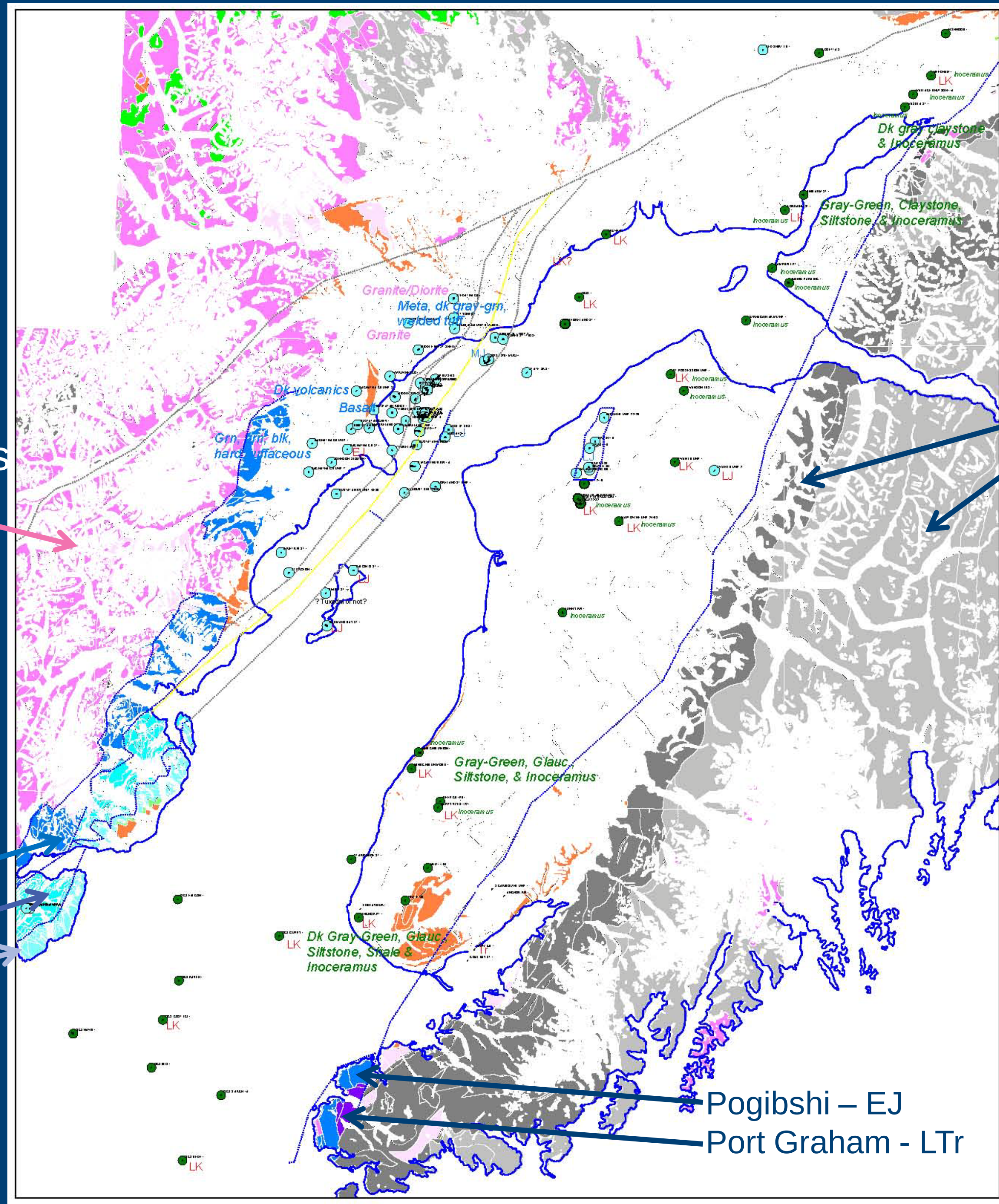
Lower figure modified from Magoon and Claypool, 1981
Jurassic - surface outcrops (Detterman & Hartsock, 1966; Martin et al, 1915; Magoon et al, 1976; Forbes & Lanphere, 1973)
Cretaceous – LCI COST well and Trop & Plawman, 2006


Dk gray claystone
& Inoceramus
Gray-Green, Claystone,
Siltstone, & Inoceramus
Granite/Diorite
Meta, dk gray-grn,
welded tuff
Granite
Dk volcanics
Basalt
Grn, brn, blk,
hard, tuffaceous
Gray-Green, Glauc.,
Siltstone, & Inoceramus
Dk Gray-Green, Glauc.,
Siltstone, Shale &
Inoceramus
LK
LJ
LK?
EJ
Tr
Inoceramus

Matanuska - LK

Granitic Intrusives

McHugh
Valdez

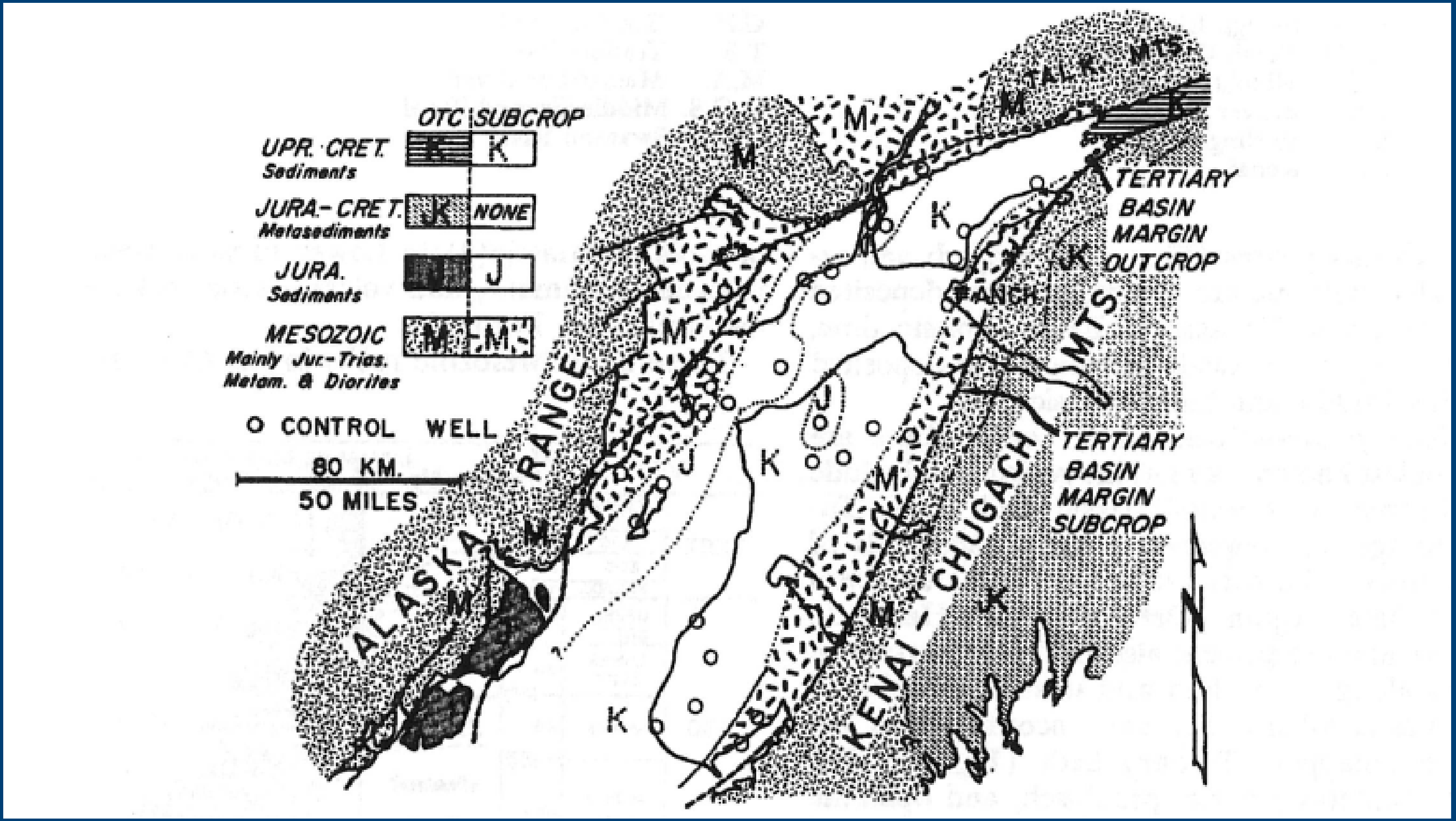


Talkeetna-EJ
Tuxedni-MJ
Naknek-LJ

Pogibshi – EJ
Port Graham - LTr

Outcrop shading from USGS OFR 2009-1108

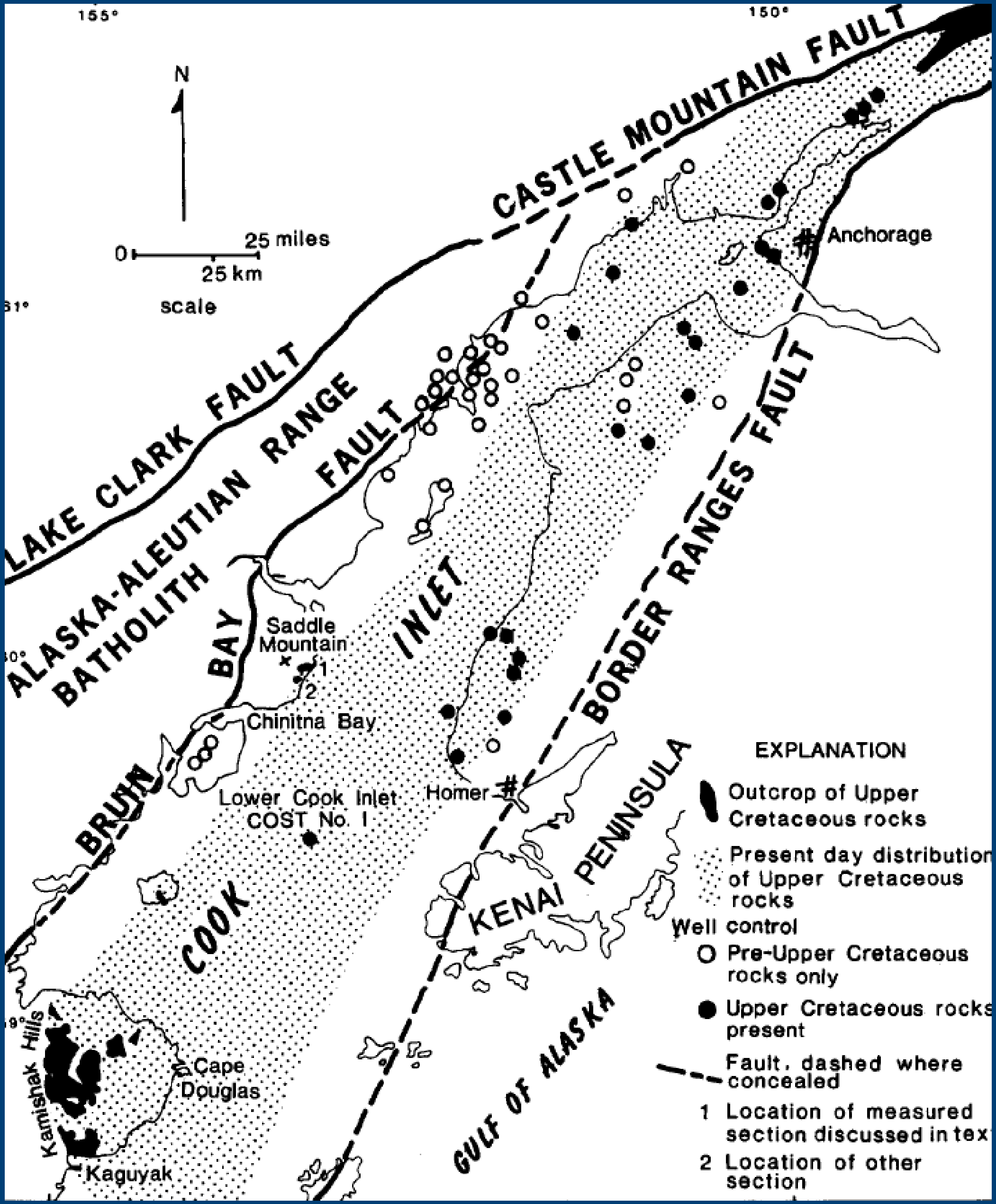
Existing Subcrop Maps in Public Literature



Stratigraphic and Tectonic Development of Cook Inlet Petroleum Province
Kirschner and Lyon, 1973
Standard Oil Company of California

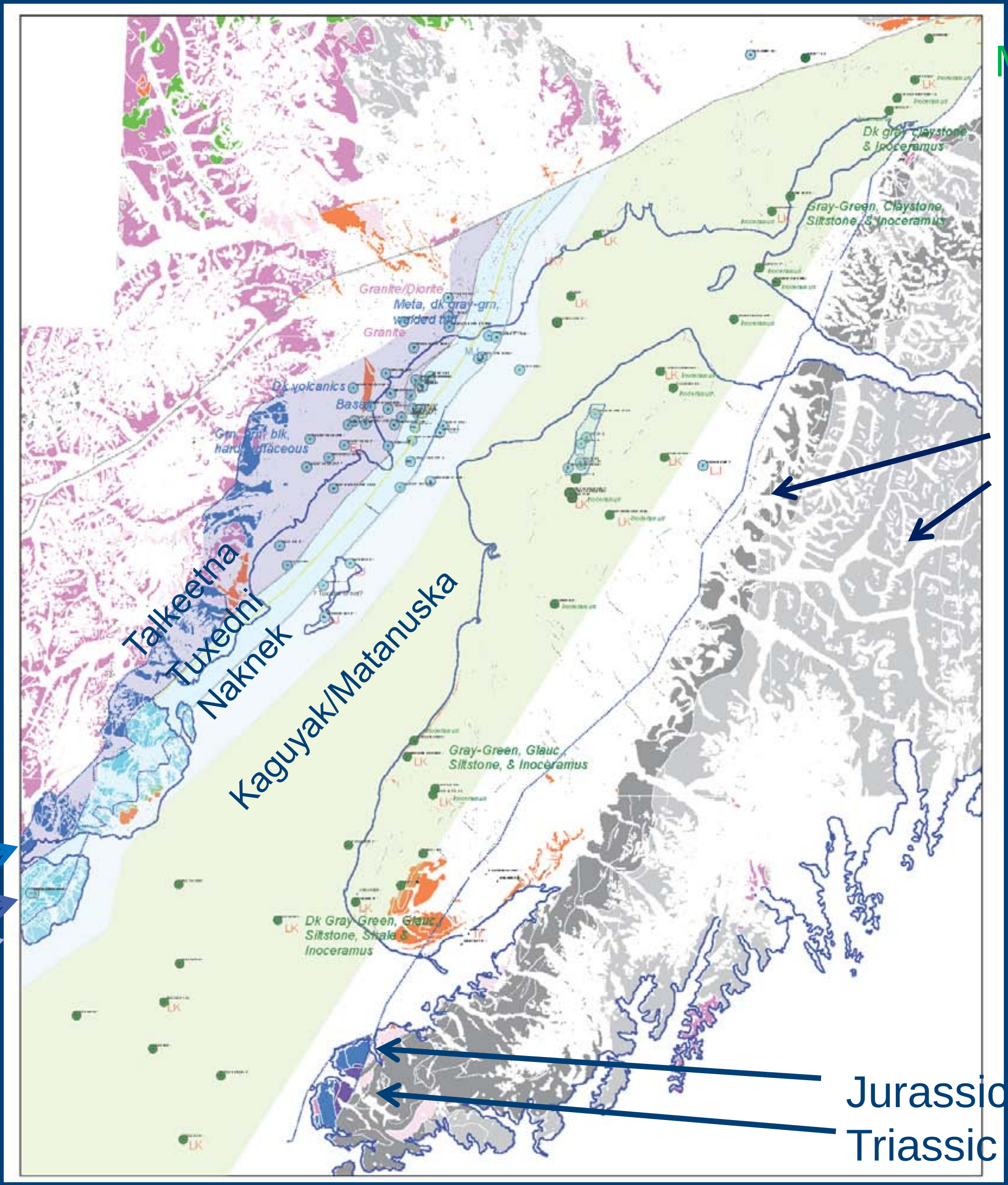
Existing Subcrop Maps in Public Literature

Nonmarine Upper Cretaceous Rock, Cook Inlet, AK
Magoon, Griesbach, and Egbert,1980
USGS and Shell



Existing Subcrop Maps in Public Literature

Gregersen &
Shellenbaum
Previous version



Matanuska - LK

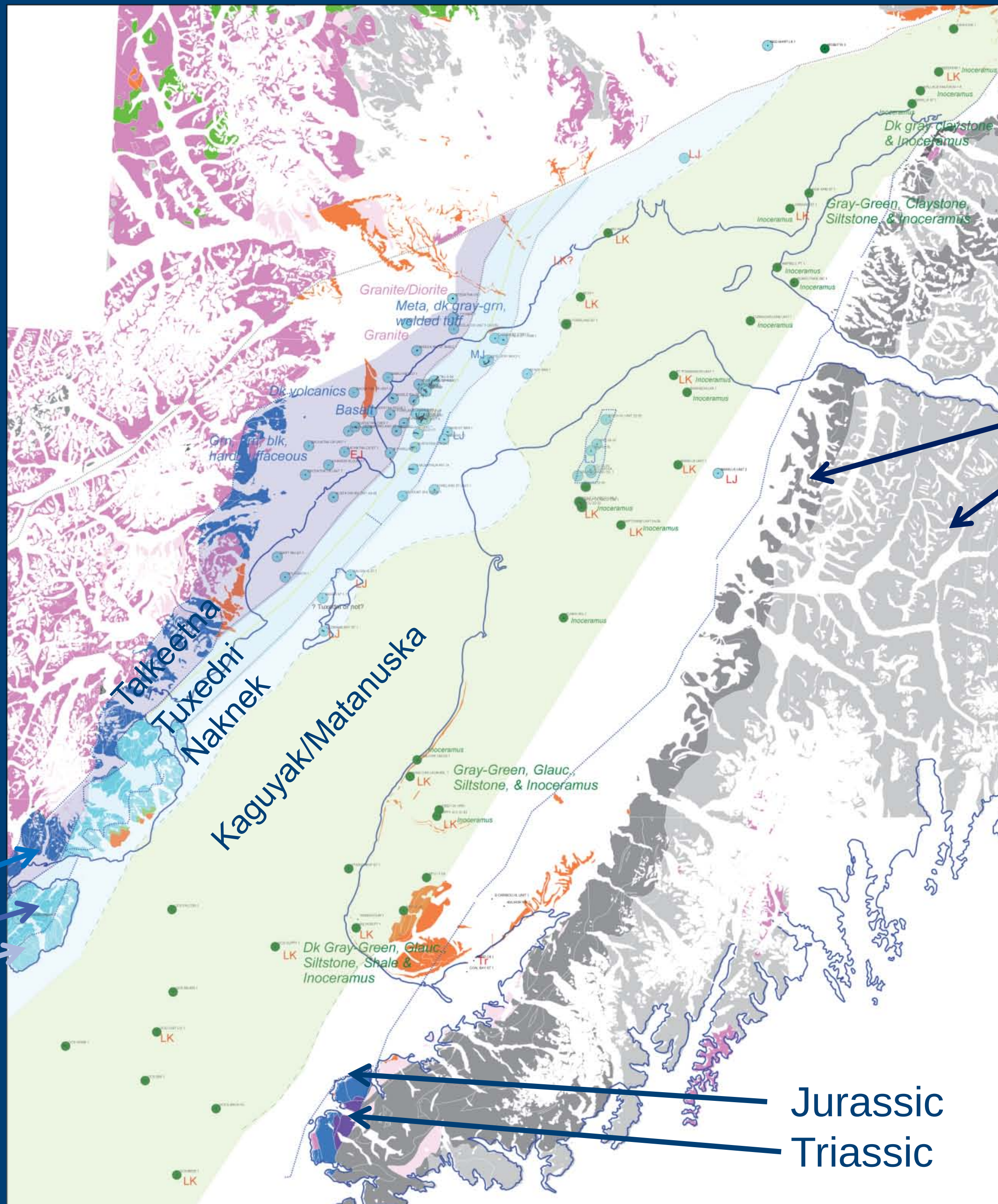
McHugh
Valdez

Talkeetna-EJ
Tuxedni-MJ
Naknek-LJ

Jurassic
Triassic

Matanuska - LK

Gregersen & Shellenbaum
USGS CI Meeting
September 2010



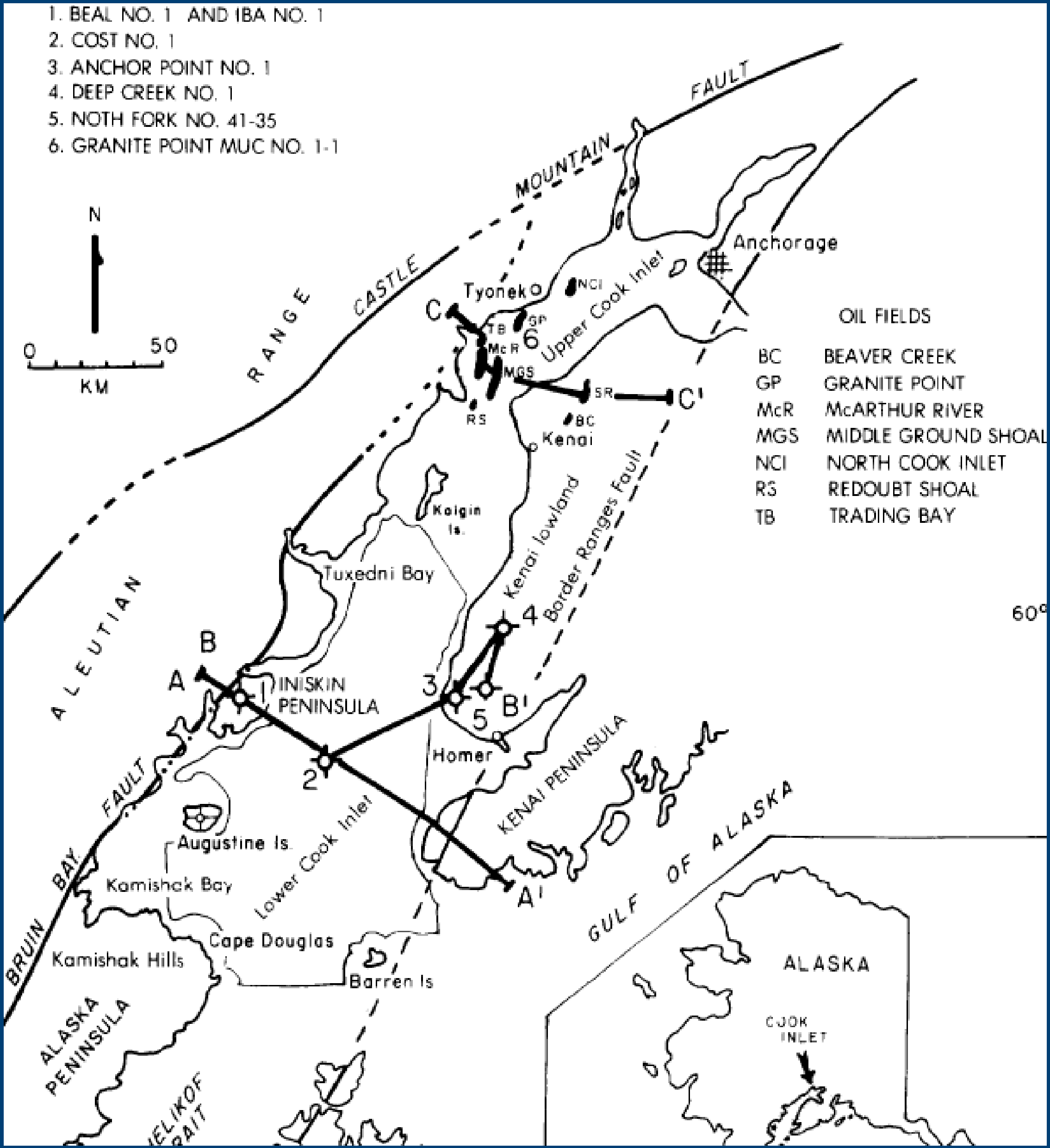
McHugh
Valdez

Talkeetna-EJ
Tuxedni-MJ
Naknek-LJ

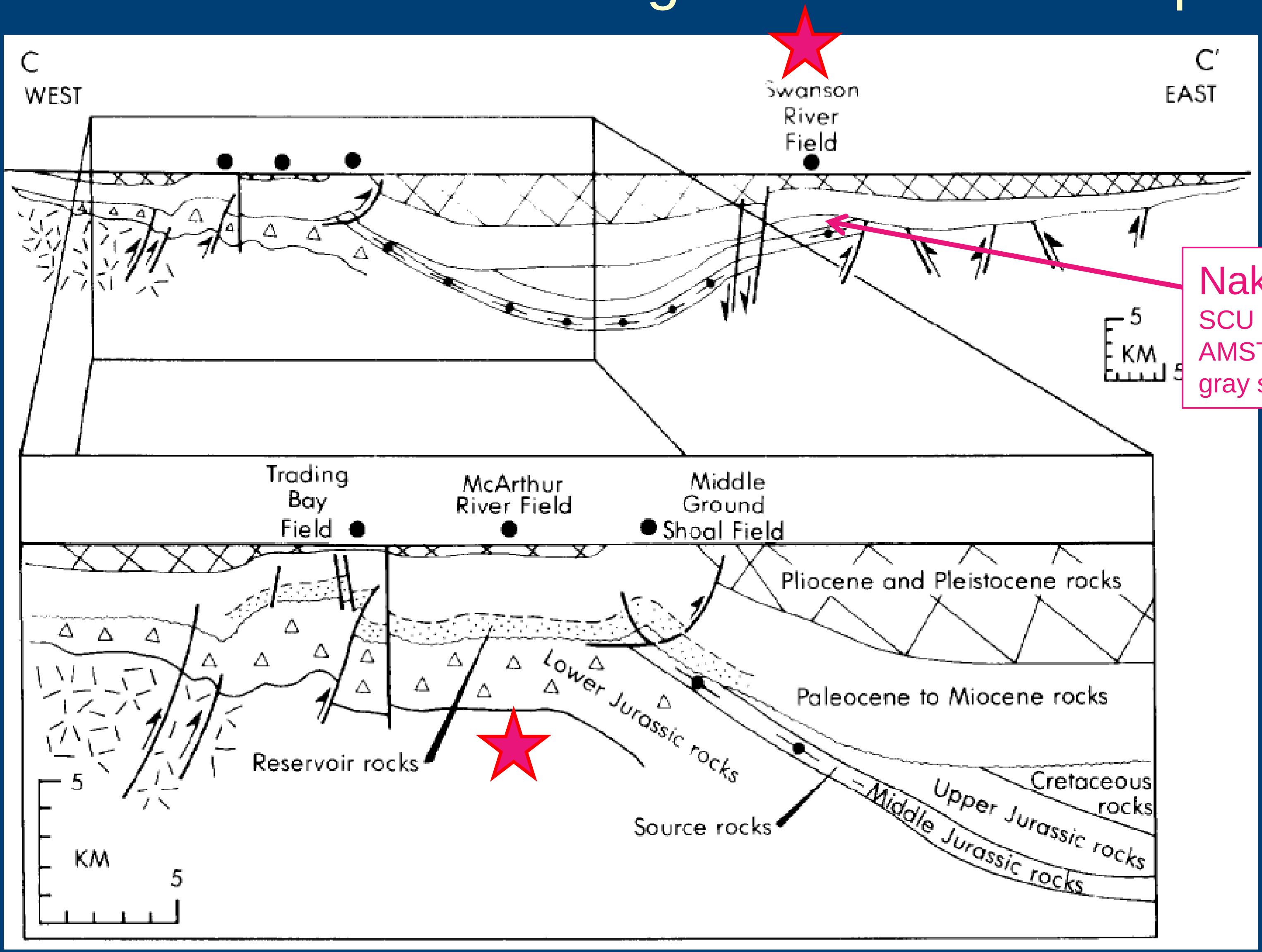
Jurassic
Triassic

Cross Sections showing Mesozoic Subcrop

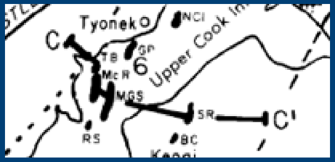
Petroleum Geology of CI Basin – An Exploration Model
Magoon and Claypool, 1981
USGS



Cross Sections showing Mesozoic Subcrop

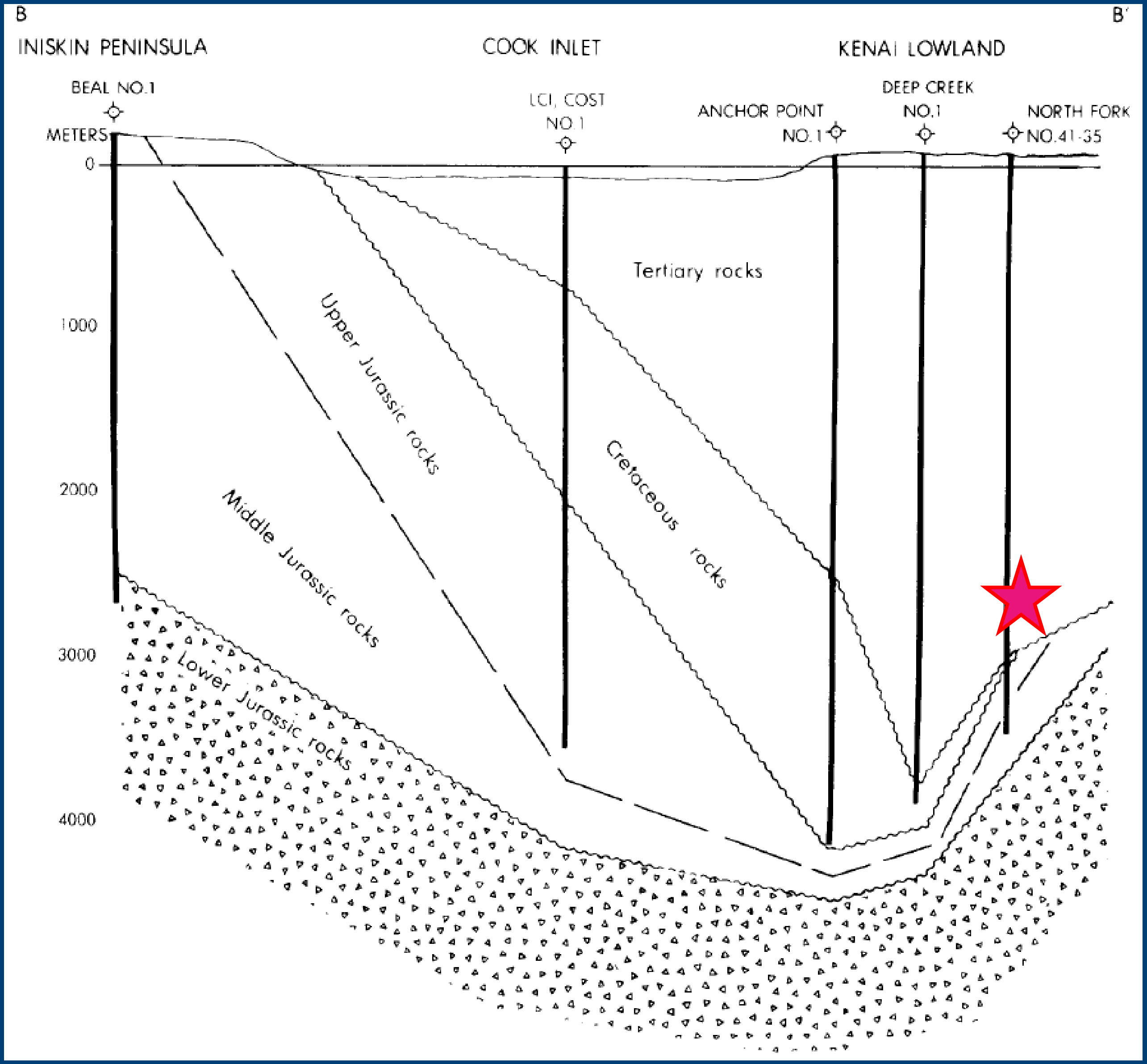


Naknek
SCU 33-33
AMSTRAT:
gray sh/gray tuff



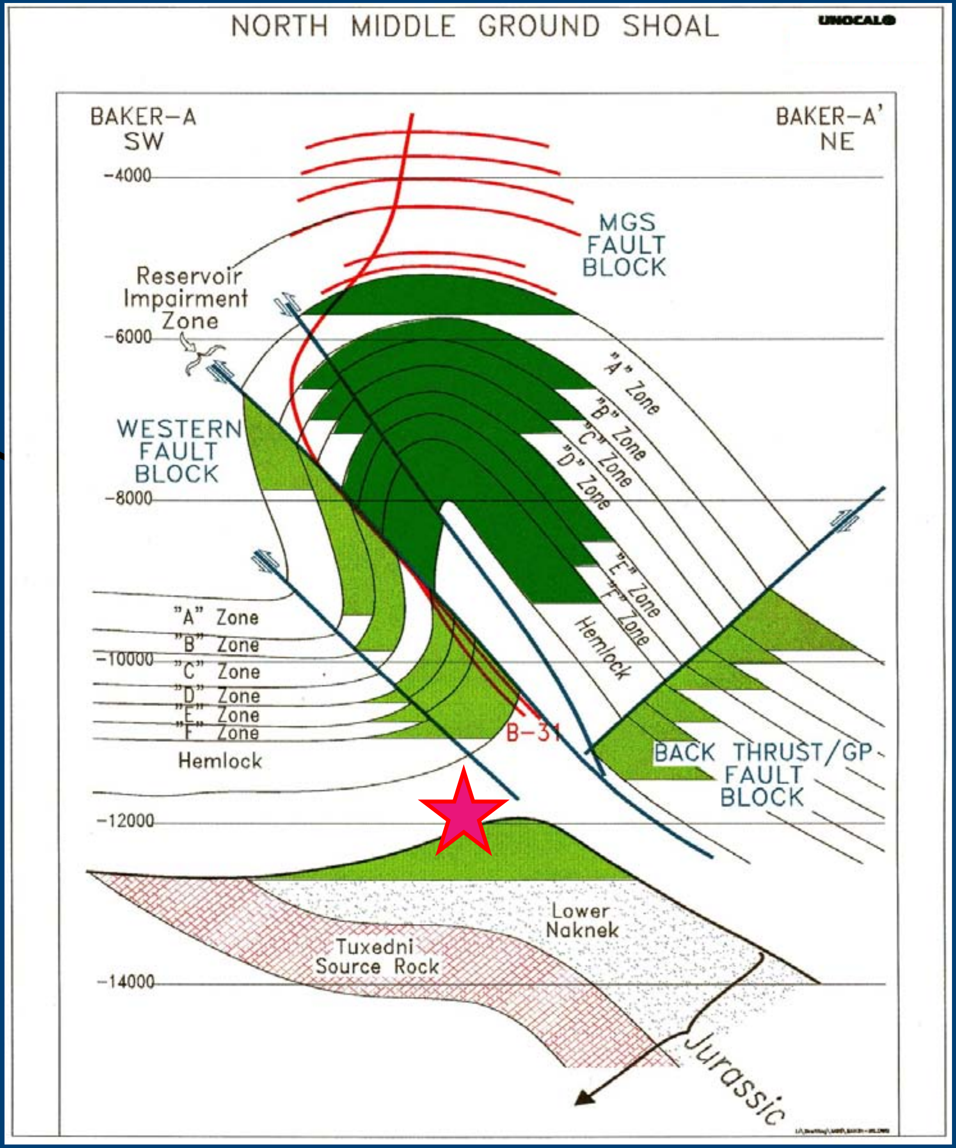
Petroleum Geology of CI Basin – An Exploration Model
Magoon and Claypool, 1981
USGS

Cross Sections showing Mesozoic Subcrop

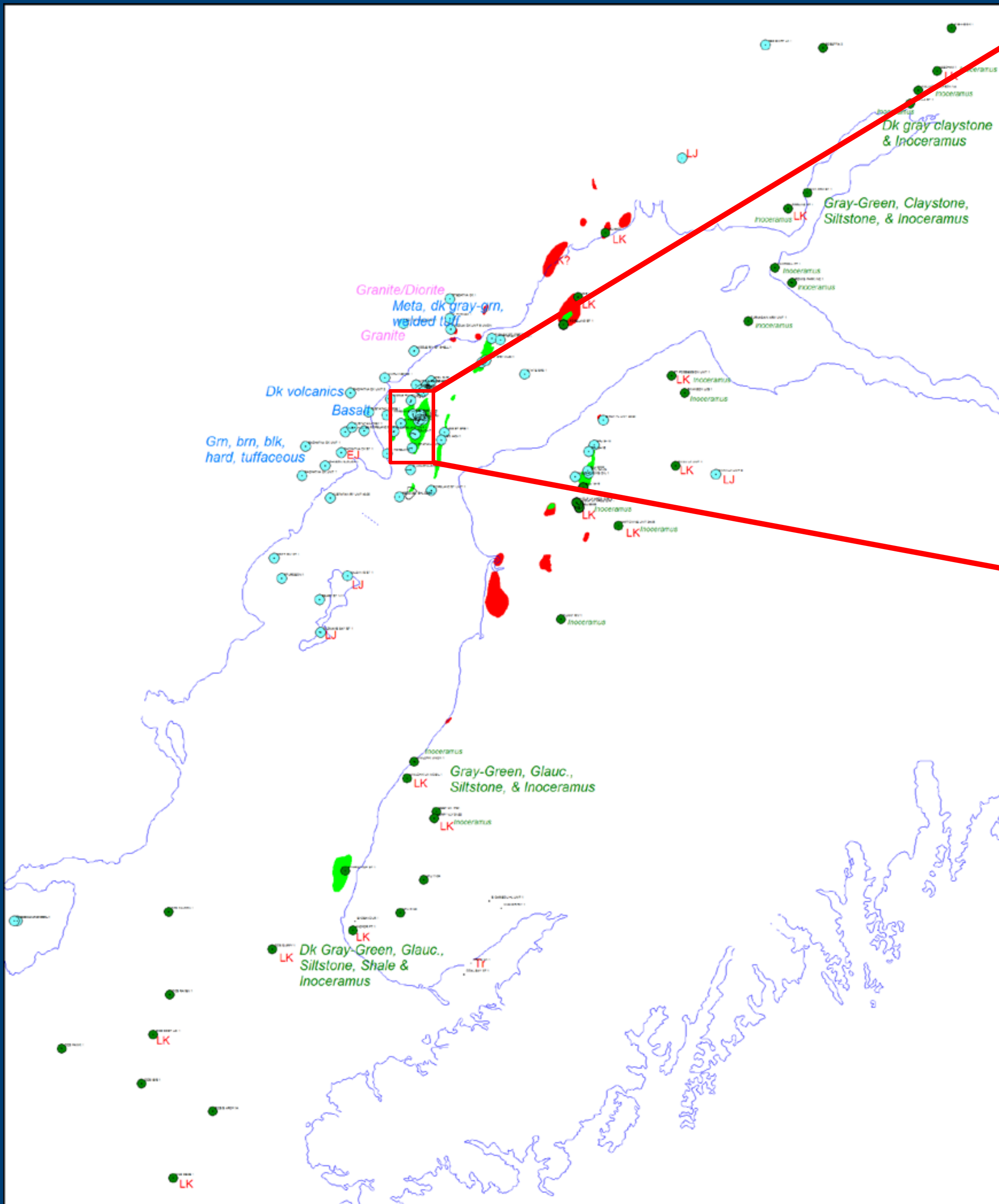


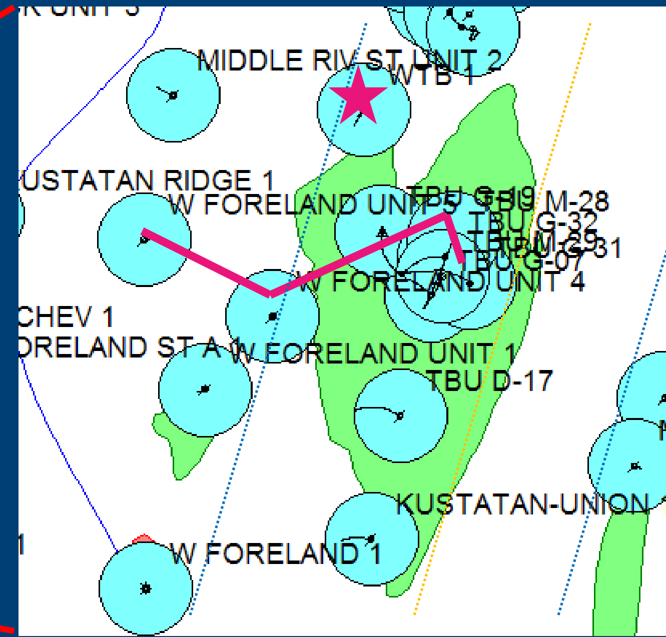
Petroleum Geology of CI Basin – An Exploration Model
Magoon and Claypool, 1981
USGS

Cross Sections showing Mesozoic Subcrop



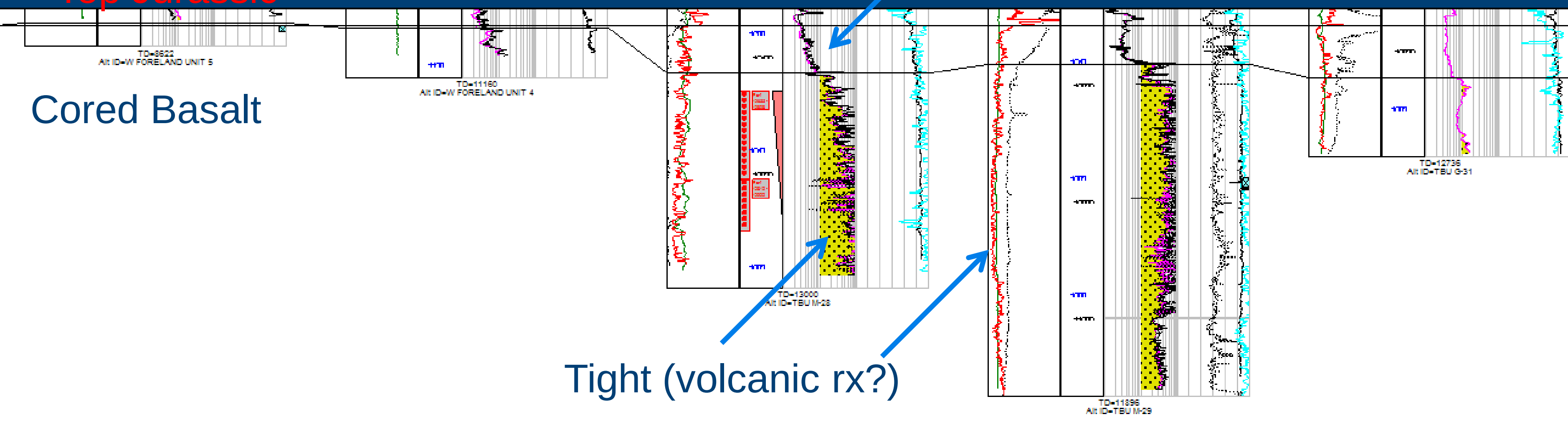
2005 Presentation to Joint Senate & House Resources Committee
By Dan Seamount, AOGCC Commissioner

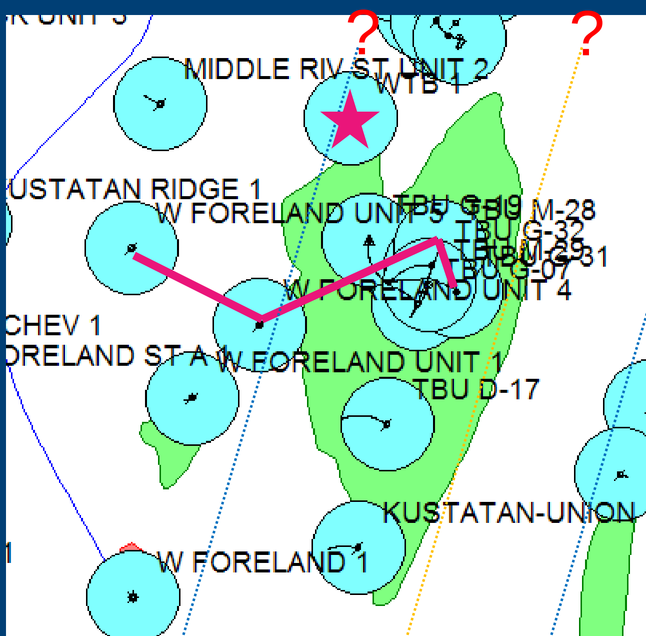




McArthur River Field

Cross Sections – McArthur River Field



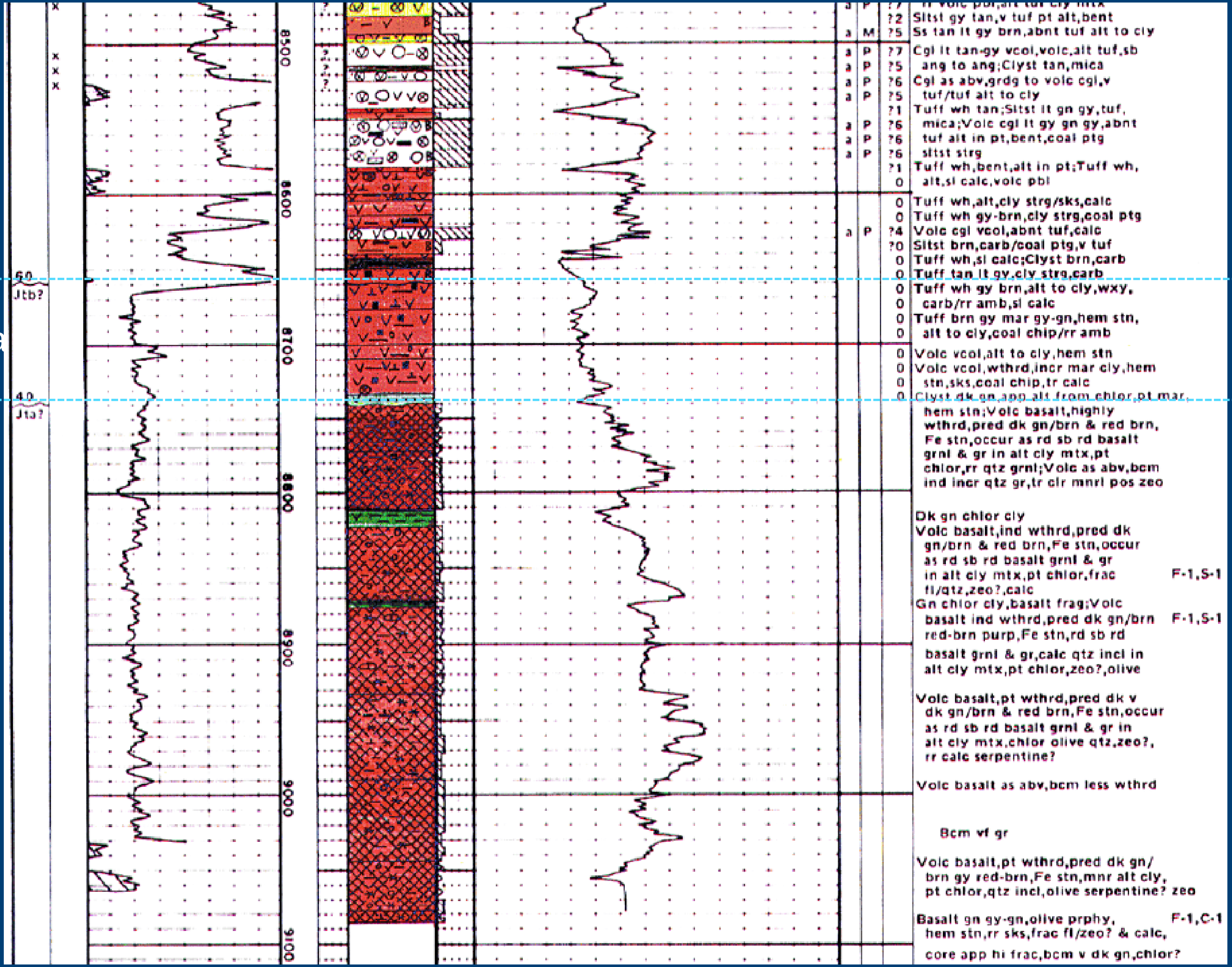


ARCO WTB 1
50-733-20325-0000
TD = 9087

West Foreland

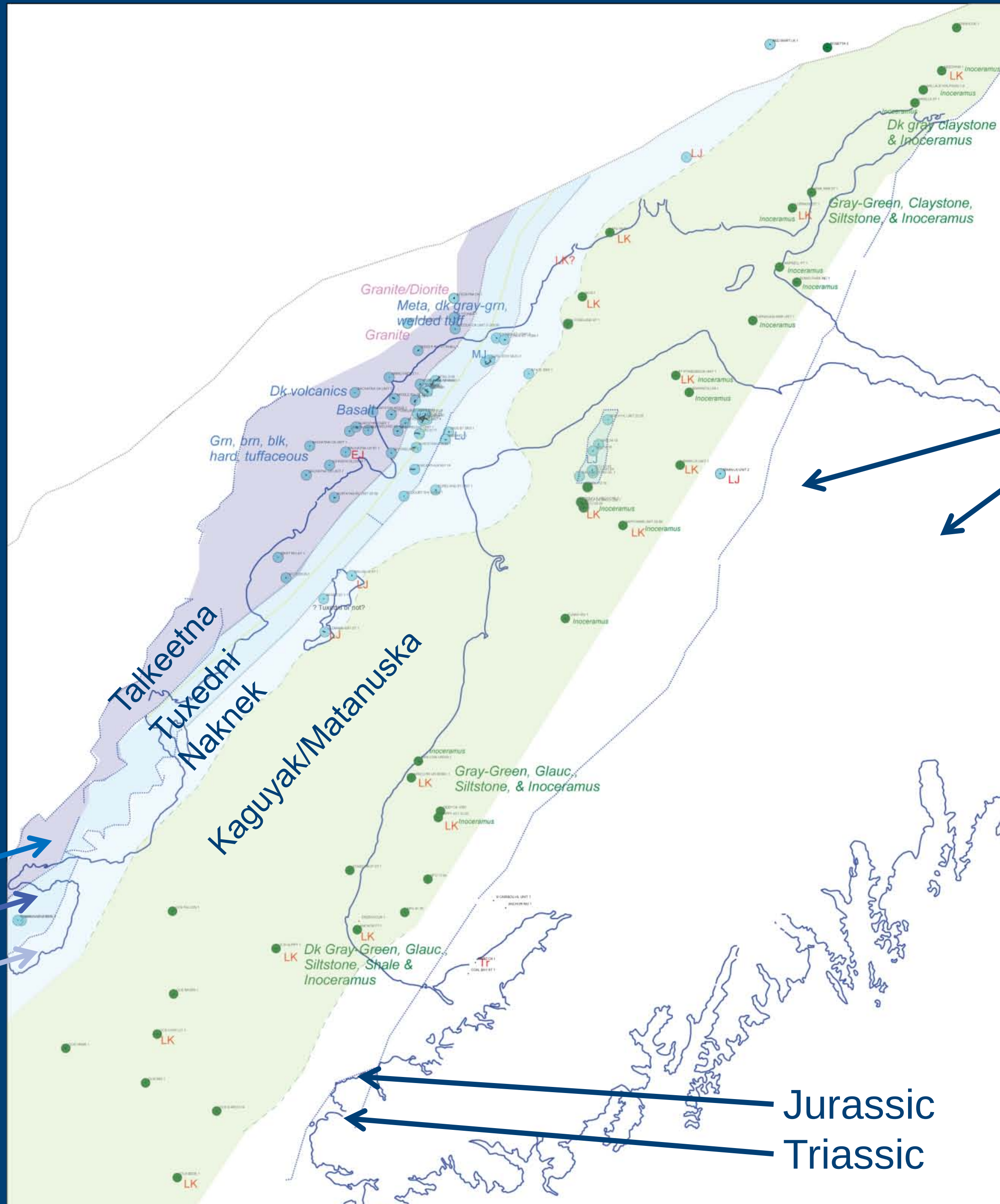
Tuxedni (or) Weathered Talkeetna

Talkeetna



Lithologic logs are made by AMSTRAT

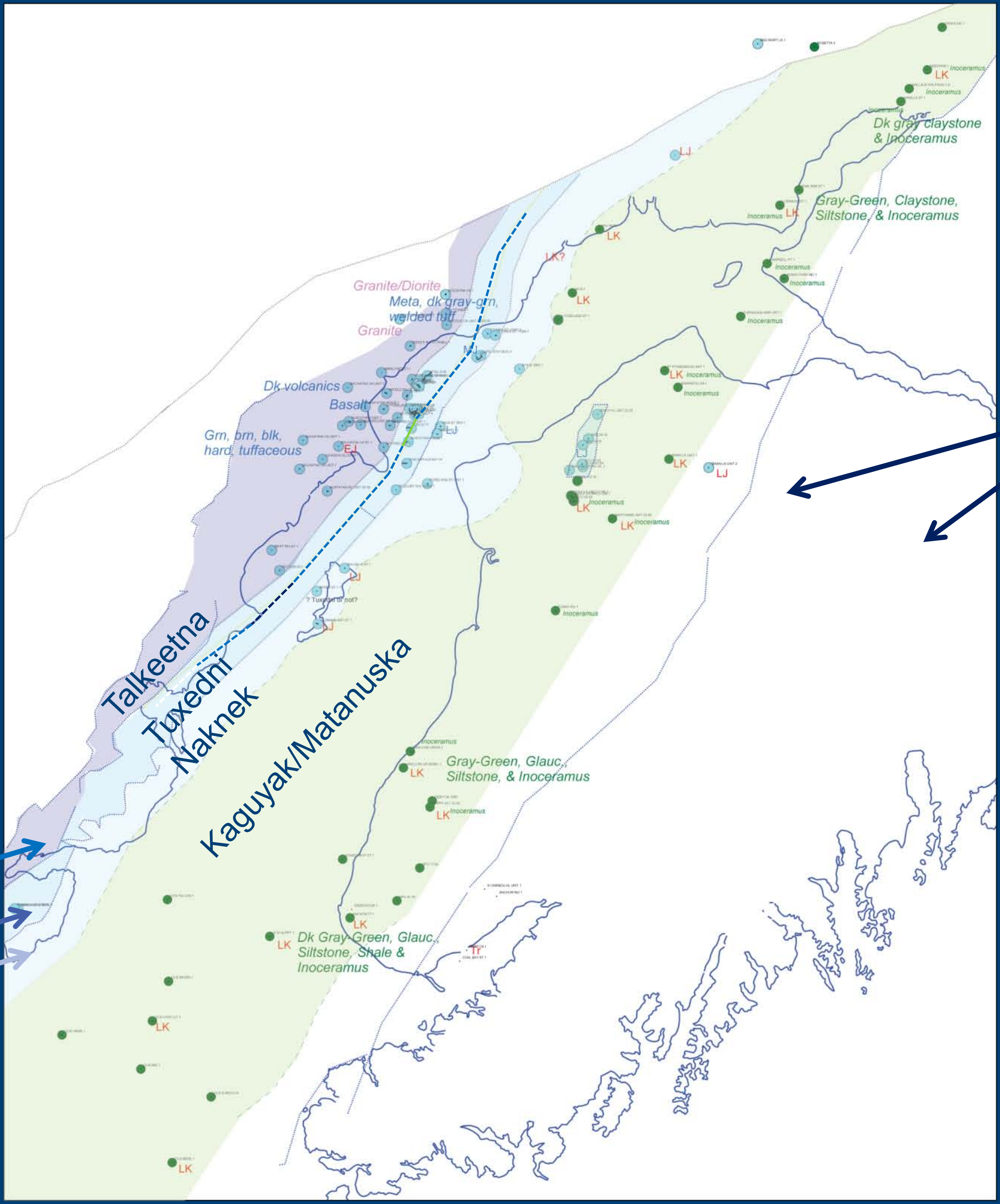
Matanuska - LK



McHugh
Valdez

Talkeetna-EJ
Tuxedni-MJ
Naknek-LJ

Matanuska - LK



McHugh
Valdez

Talkeetna-EJ
Tuxedni-MJ
Naknek-LJ

Goal: Present our initial thoughts and receive feedback!

1. Data incorporated into Base Tertiary and Mesozoic Subcrop Maps
2. Oil Production and Tests in the Jurassic Formation
3. Rock Descriptions of Mesozoic Section
4. Existing Subcrop Maps
5. DNR's Preliminary Subcrop Map(s) & Supporting Evidence
6. Seismic interpretation of CGGVeritas dataset (CI88 and CI89) and 1975 ALC prefix public data available from the USGS website
7. Preliminary seismic analysis

Mesozoic Seismic

- Background
  - Control – Seismic, well, outcrop
  - Basis for Interpretation – Data quality
- Lower Cook Inlet
  - Seismic walk through
- Upper Cook Inlet
  - Seismic walk through
  - Isopachs, analysis
- Upper and Lower Cook Inlet
  - Isopachs, analysis

Marine Seismic Control

- CGGVeritas Spec 2D Marine ‘88-’89
- USGS public ALC marine, ’75

- Synthetic ties – LCI OCS wells
- Formation Tops projected onto seismic
- Check Shots

- Extrapolate from surface geology
- Paly picks

CI-88, CI-89 2D Marine Spec

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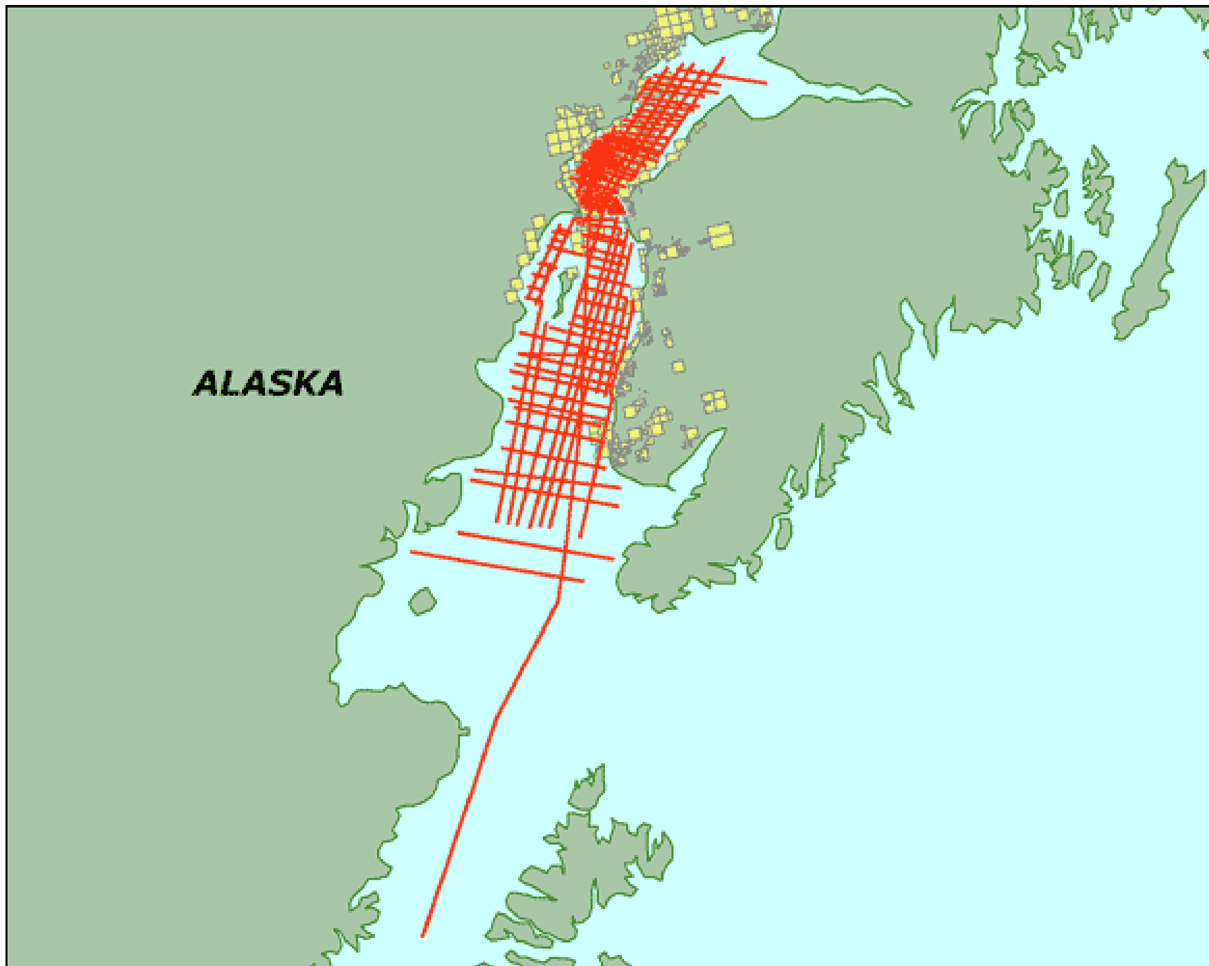
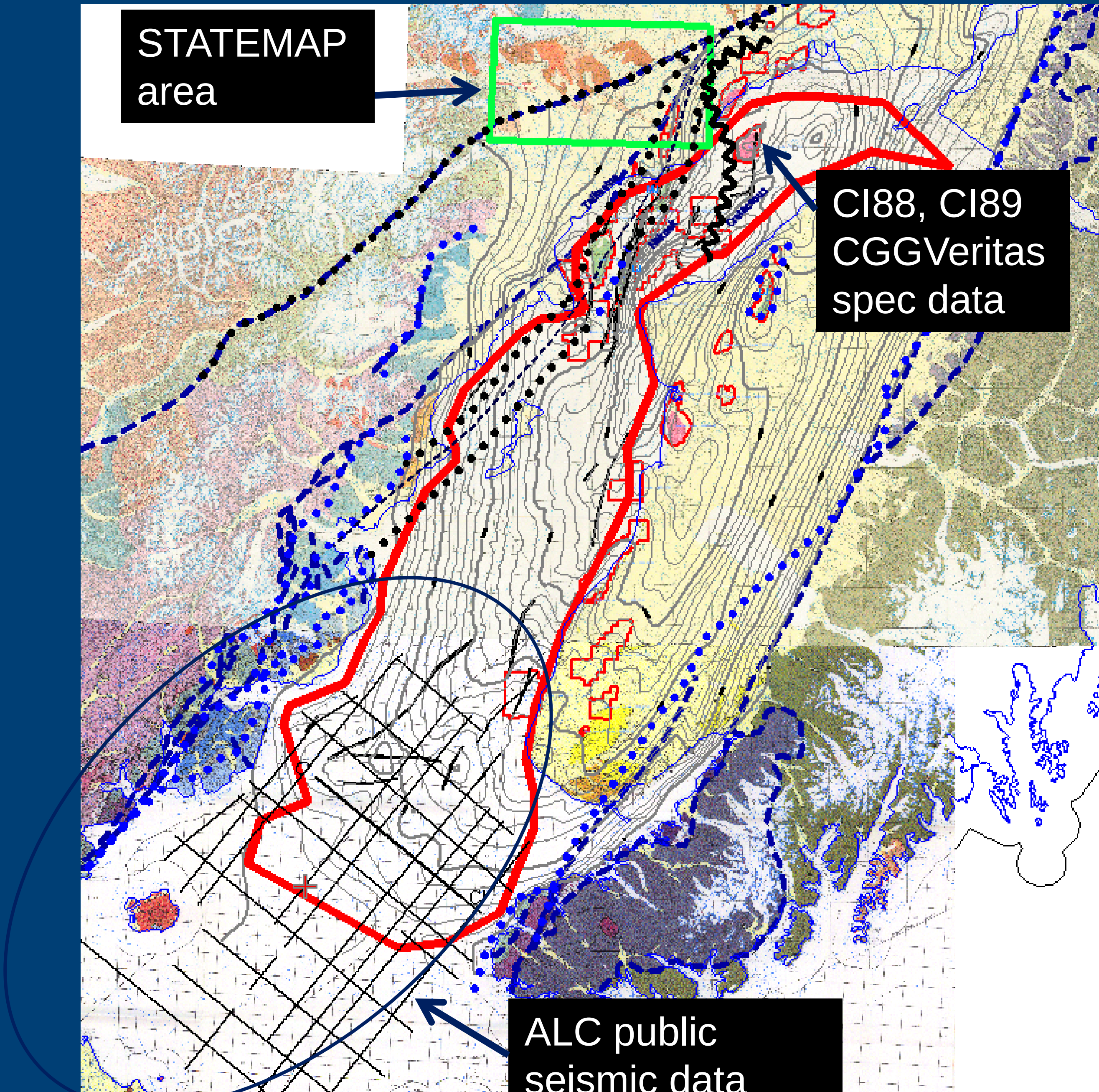
Home > Products & Services > Data Library > Marine Data > Alaska > Cook Inlet

Alaska
- > Chukchi Sea
- > Cook Inlet
- > Navarin Basin
- > Trading Bay

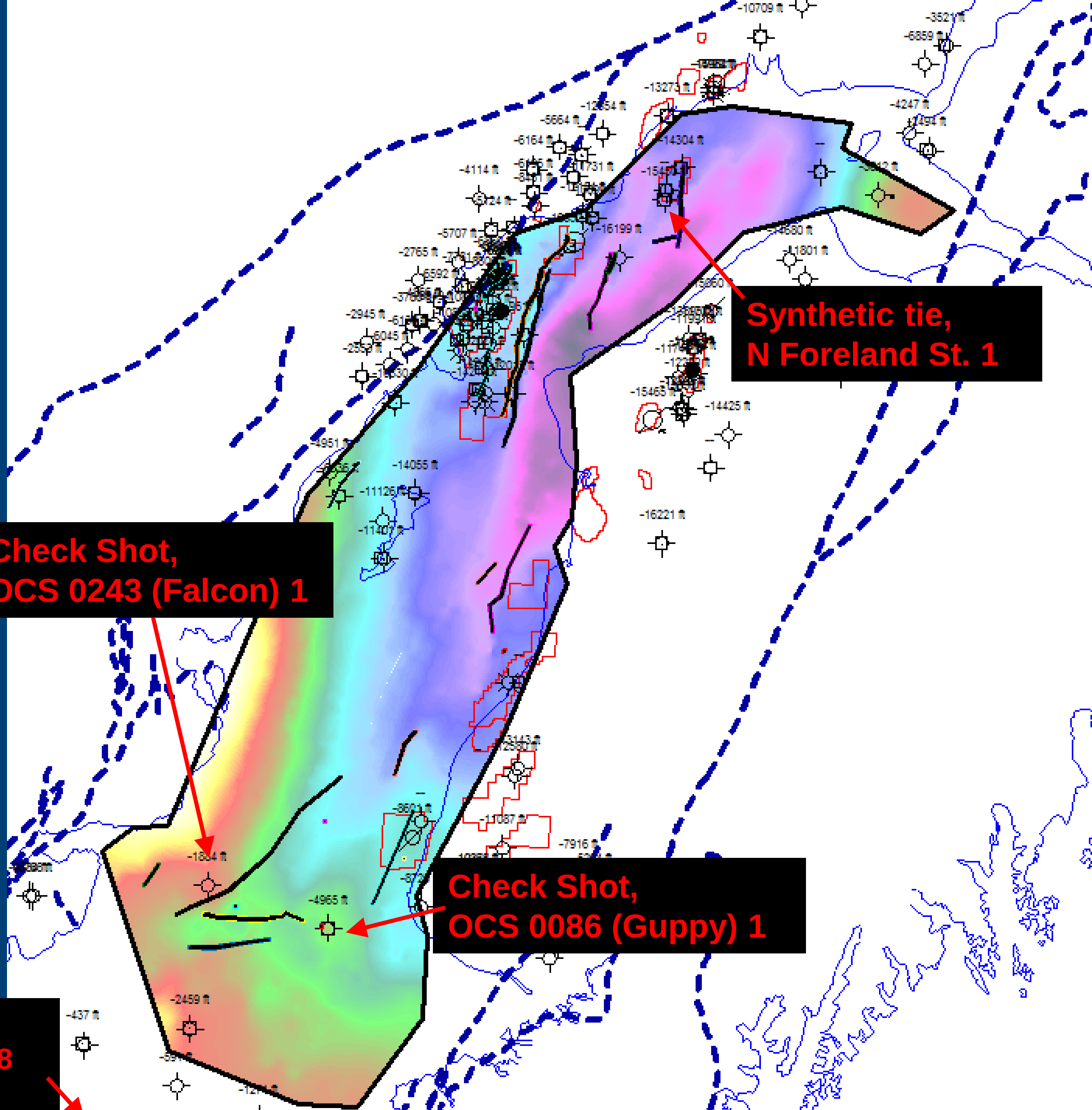
Cook Inlet: 2,204.9 miles



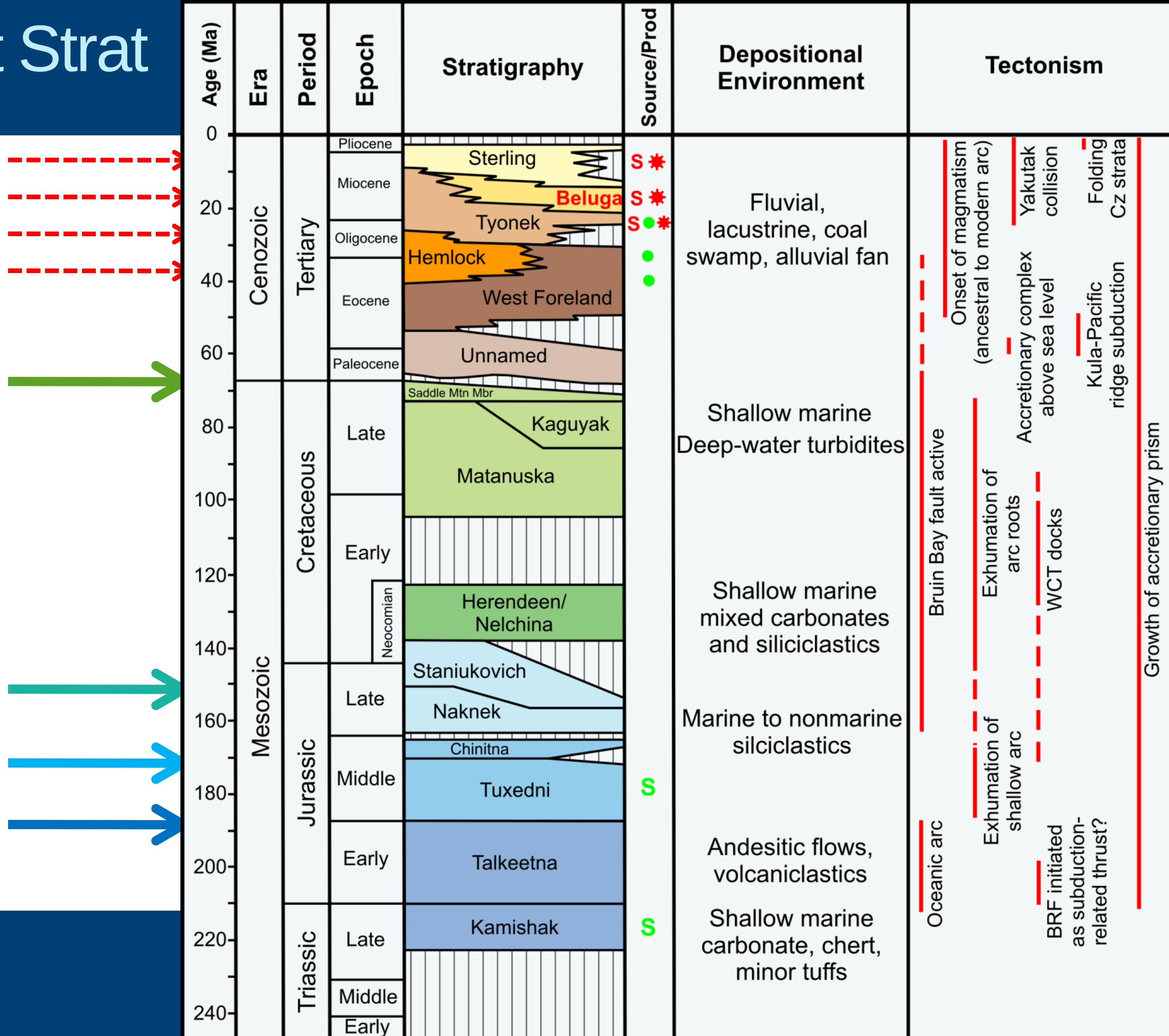
CI-88, CI-89 2D Marine Spec



Synthetic ties, check shots



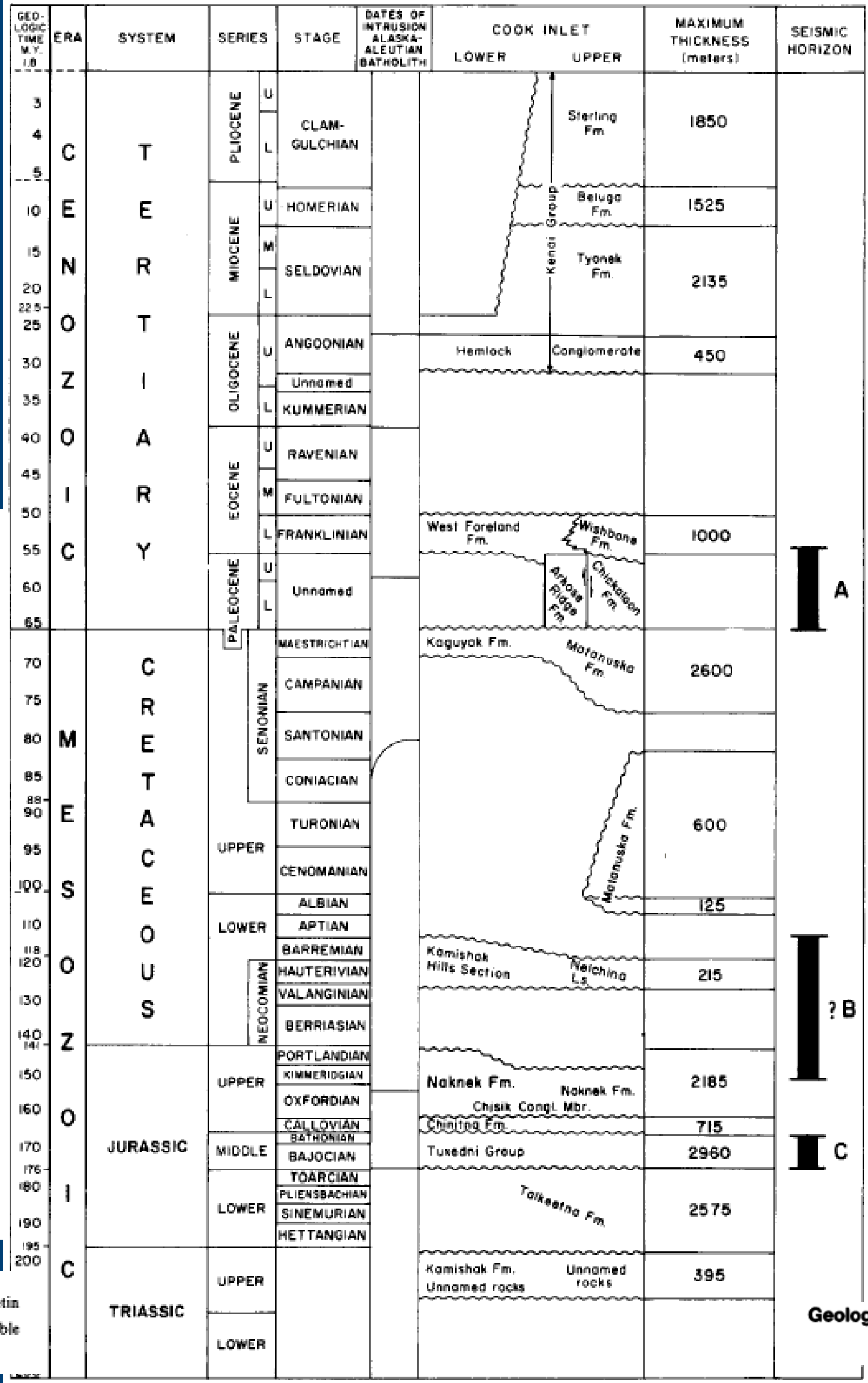
Cook Inlet Strat Column



Redrawn from Curry and others (1993) and Swenson (2003); additional information from Little and Naesser (1989), Plafker and others (1989), and Nokleberg and others (1994)

Fisher and Magoon, 1978

LCI Geologic Framework

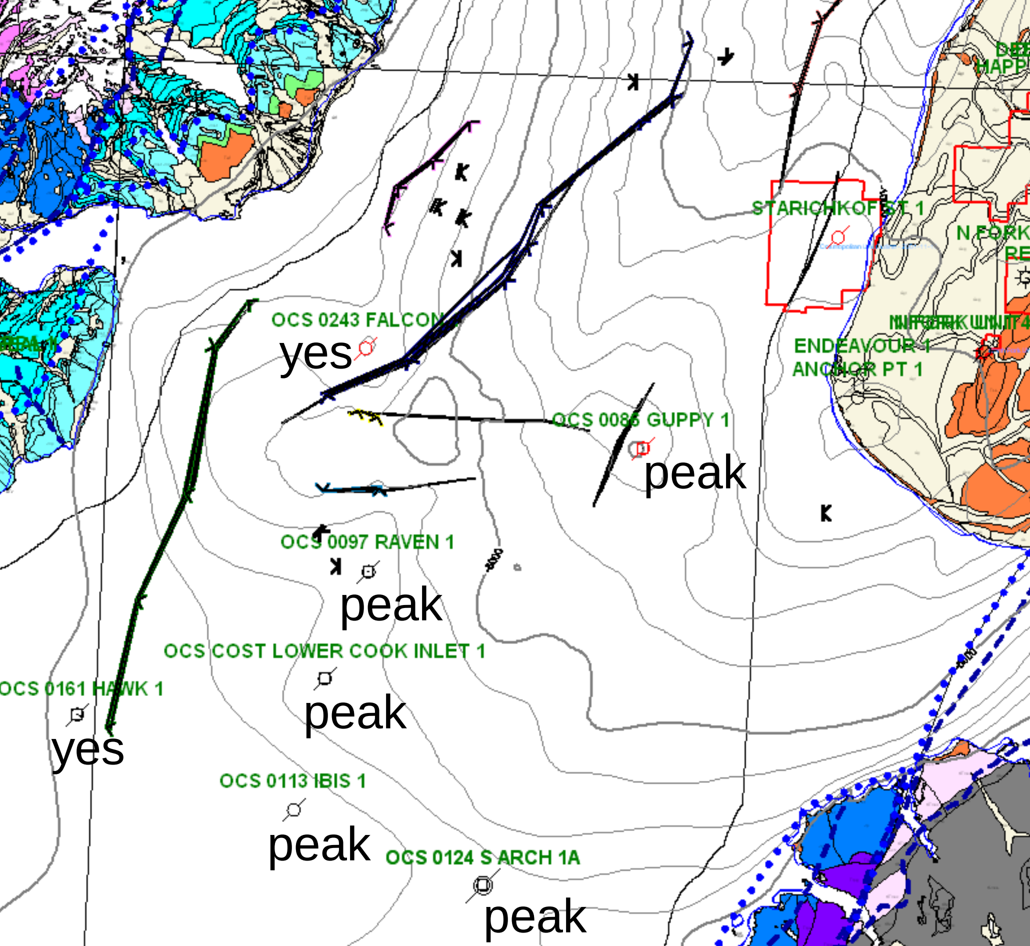


The American Association of Petroleum Geologists Bulletin
V. 62, No. 3 (March 1978), P. 373-402, 18 Figs., 1 Table

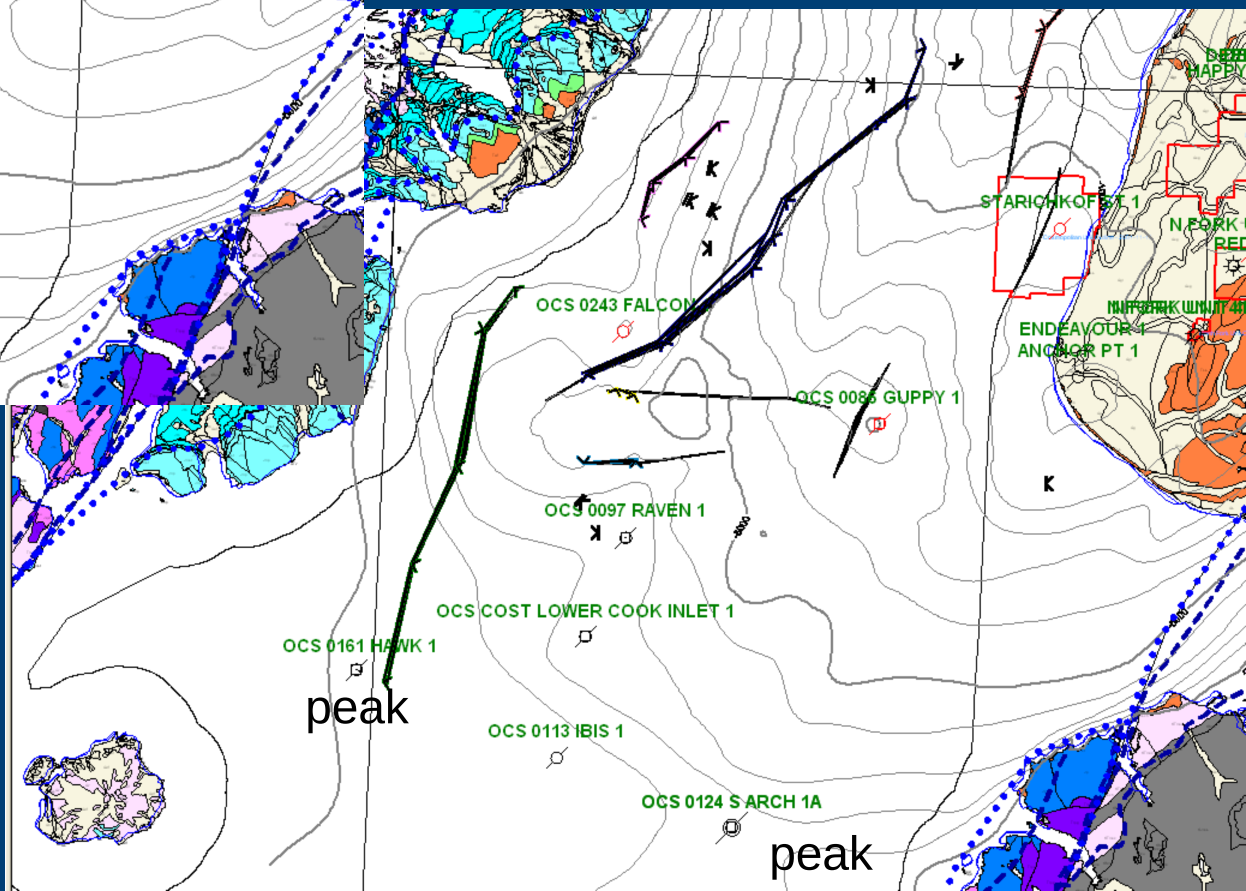
Geologic Framework of Lower Cook Inlet, Alaska[1]

MICHAEL A. FISHER and LESLIE B. MAGOON[2]

Naknek Synthetic expression, reverse polarity

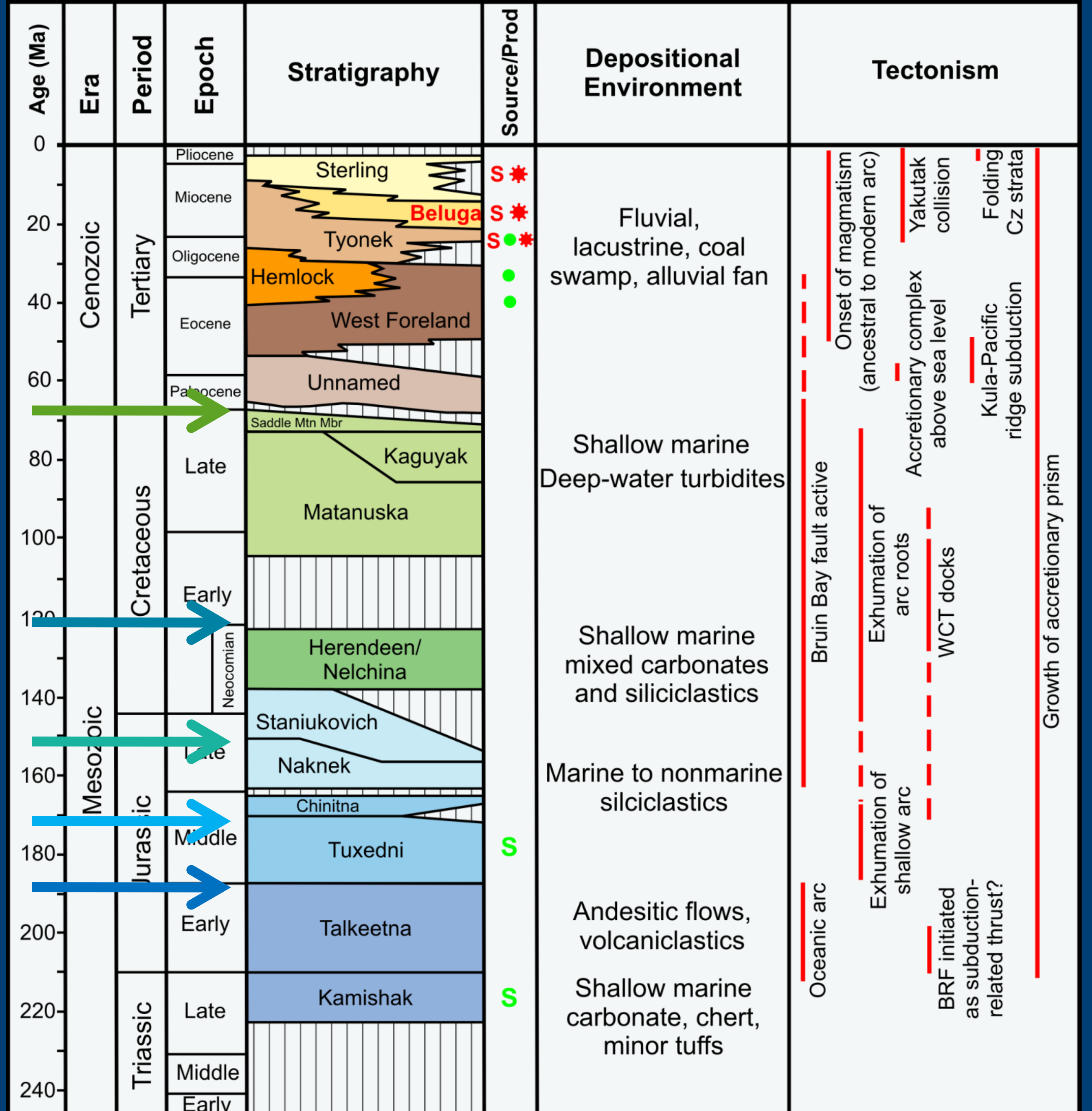


Talkeetna Synthetic expression, reverse polarity



Cook Inlet Strat Column

- OCS Synthetics (reverse polarity)
- Herendeen –sometimes a peak, often nothing much
- Naknek – usually a nice peak
- Tuxedni- Nothing anomalous
- Talkeetna- Often nice peak at bottom of high energy section



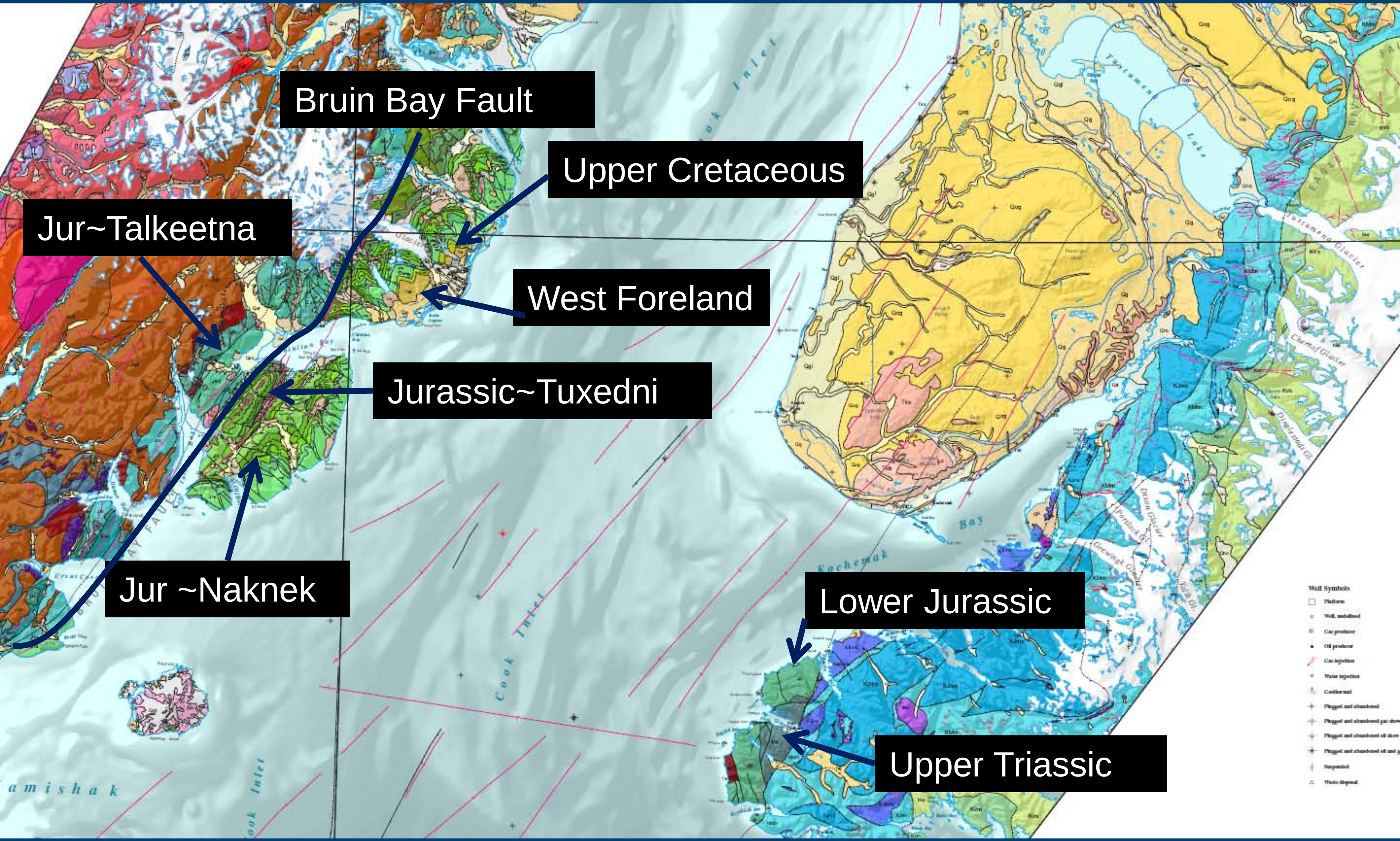
Redrawn from Curry and others (1993) and Swenson (2003); additional information from Little and Naesser (1989), Plafker and others (1989), and Nokleberg and others (1994)

Seismic Data quality in Mesozoic

- Variable in Upper and Lower Cook Inlet
- Most reliable at Naknek and Talkeetna (Upper and Lower Jurassic)
- Often picking "texture"
- Goal is internally consistent set of picks honoring all well control points
- Confidence higher in patterns than in exact picks

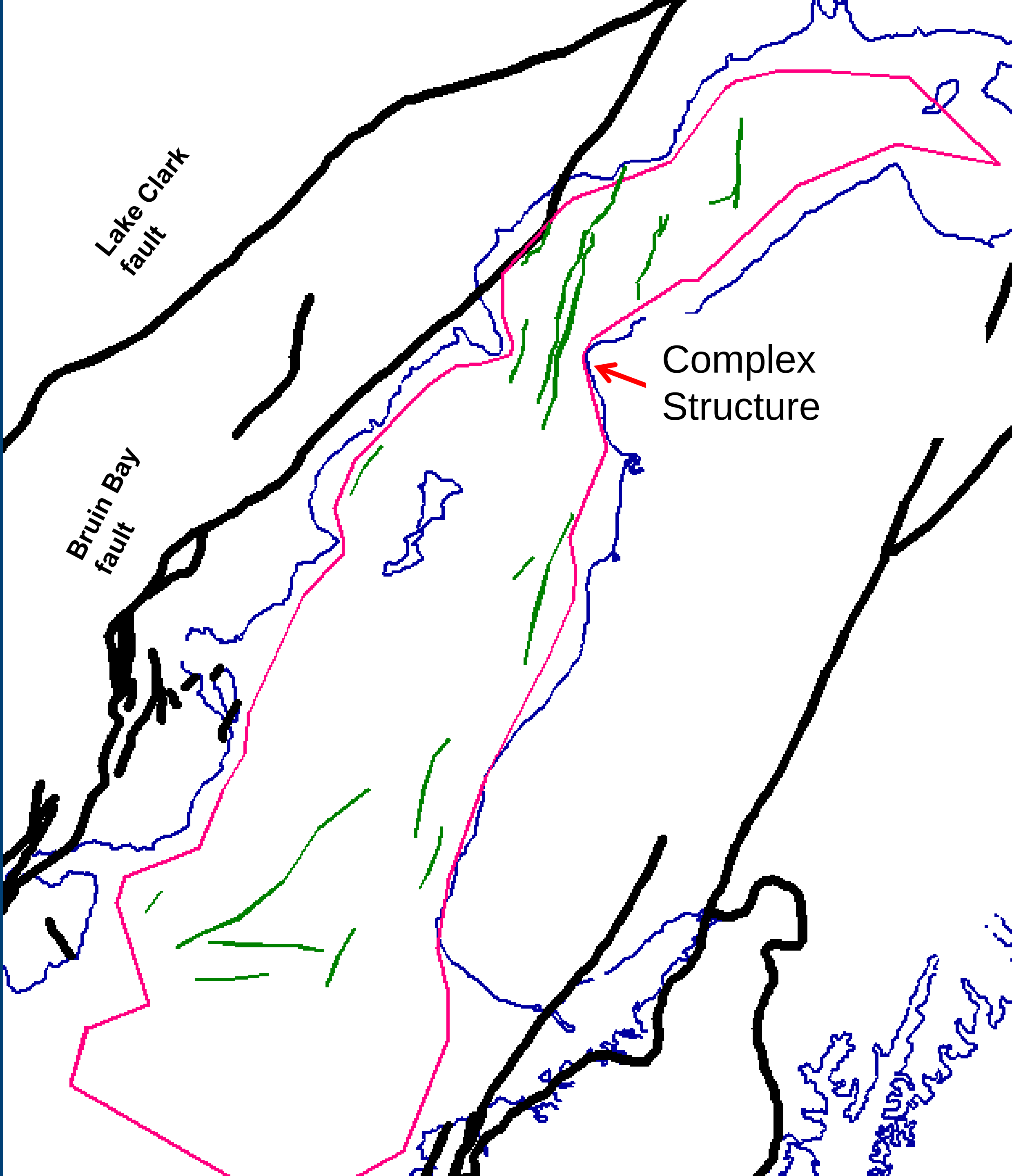
Horizon Control

- Lower Cook Inlet
  - OCS wells
  - Projection to outcrop
- Mid Cook
  - Wells defined subcrop limits – (inc.Paly)
  - Seismic character and fabric
- Upper Cook Inlet
  - Well picks where definitive
  - Wells defined subcrop limits from paly
  - Seismic character and fabric

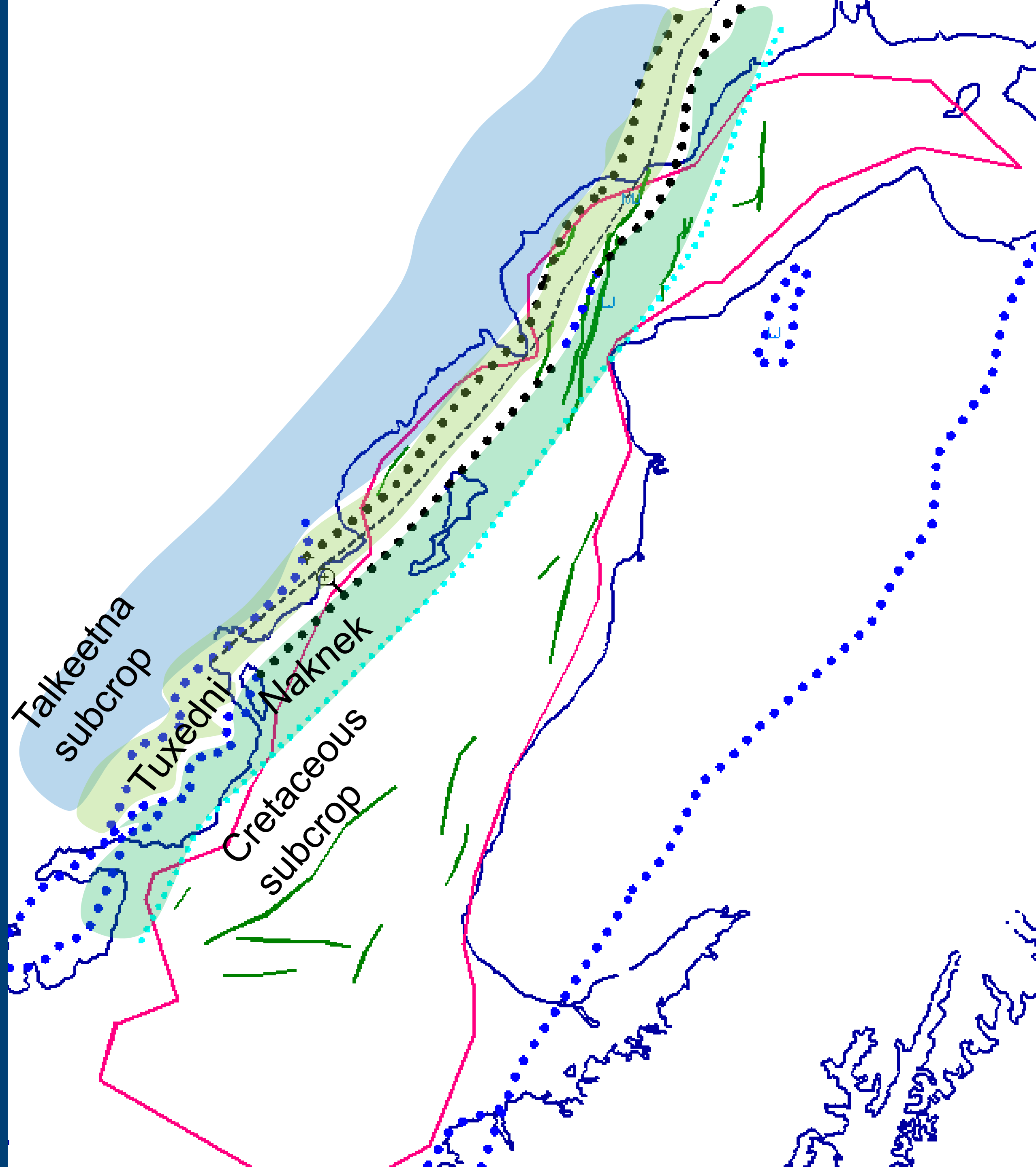


Wilson, et.al. 2009, Preliminary Geologic map of the Cook Inlet Region, Alaska

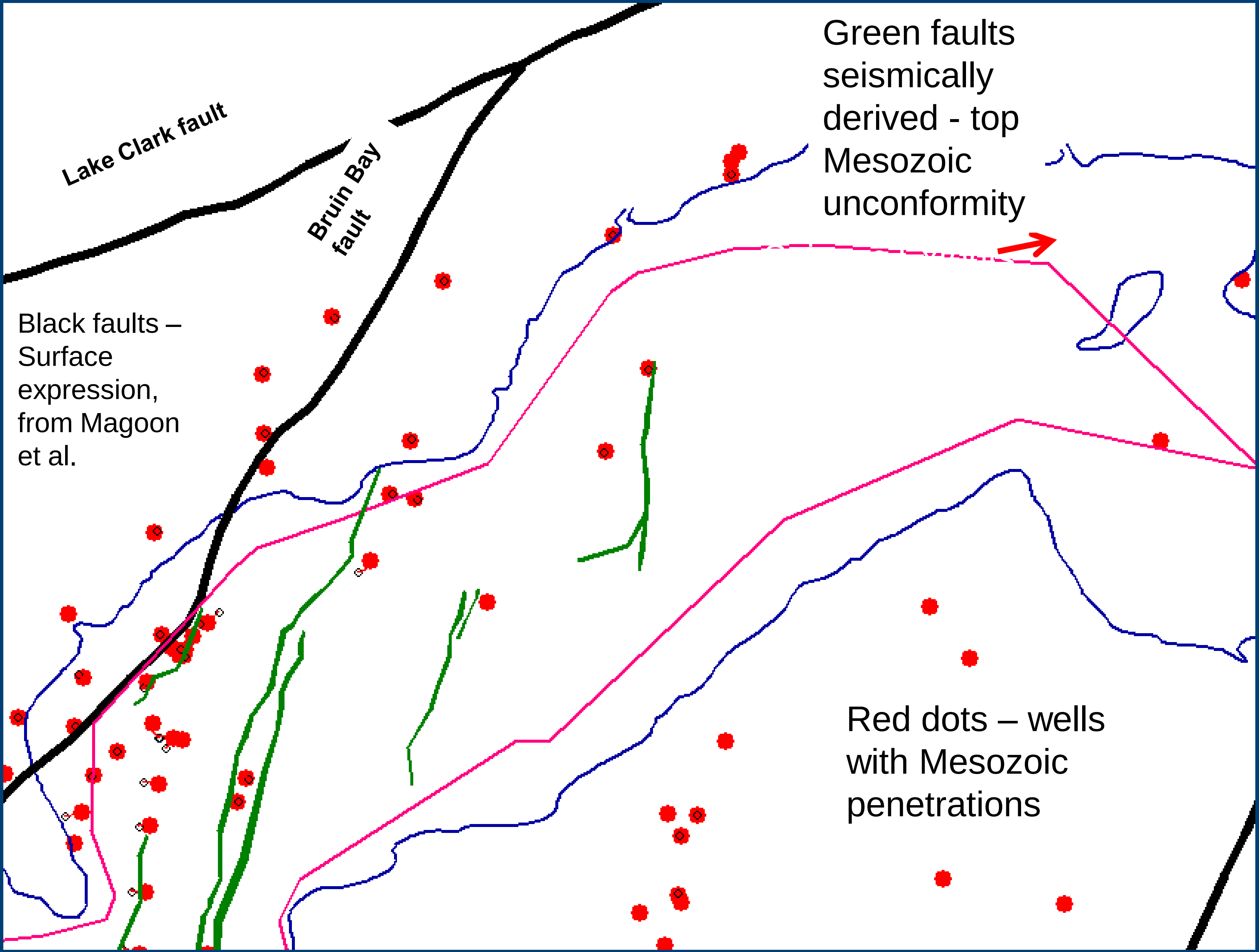
Cook Inlet Seismic Extents



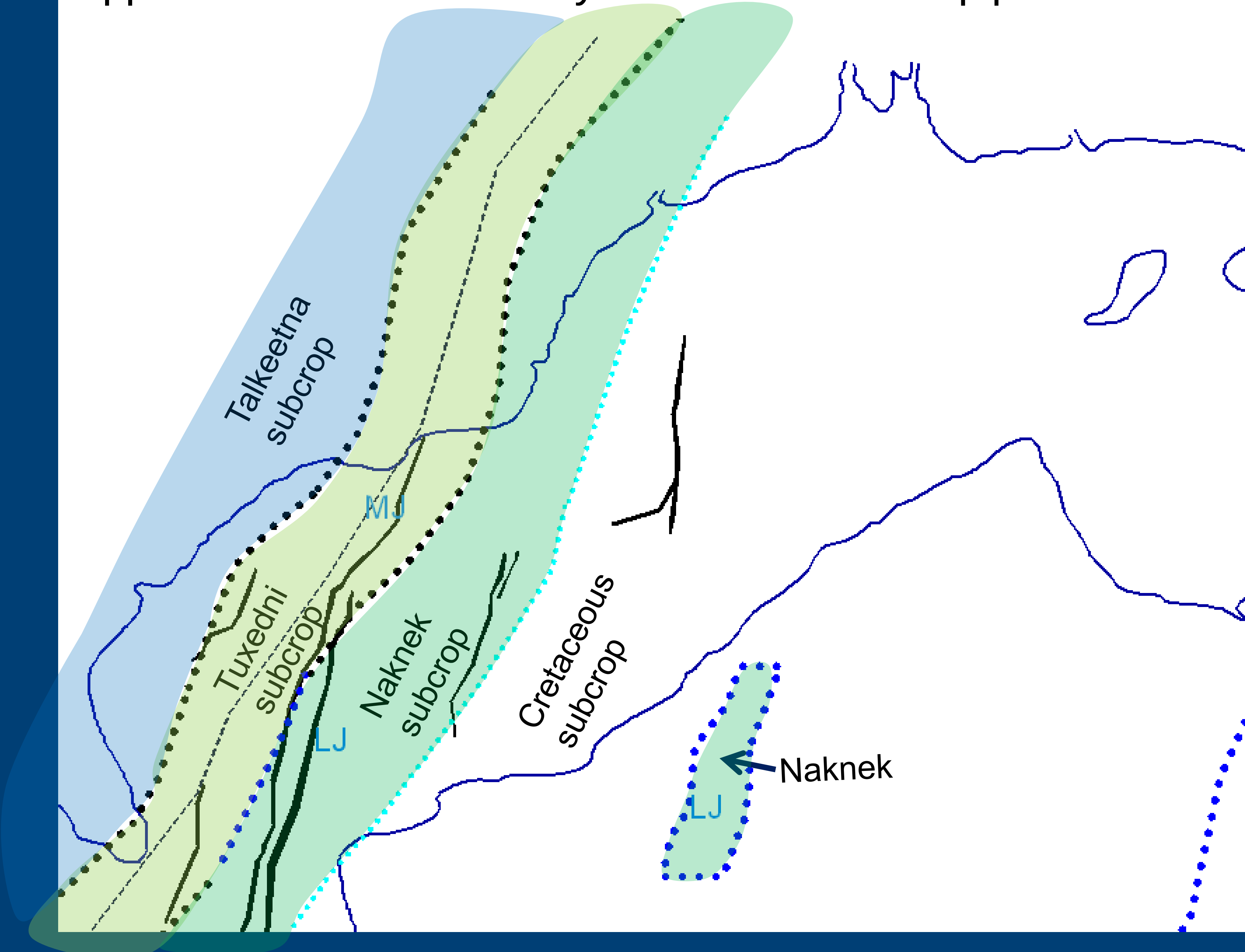
Cook Inlet Seismic location and ‘well only’ subcrop patterns



Upper Cook Inlet

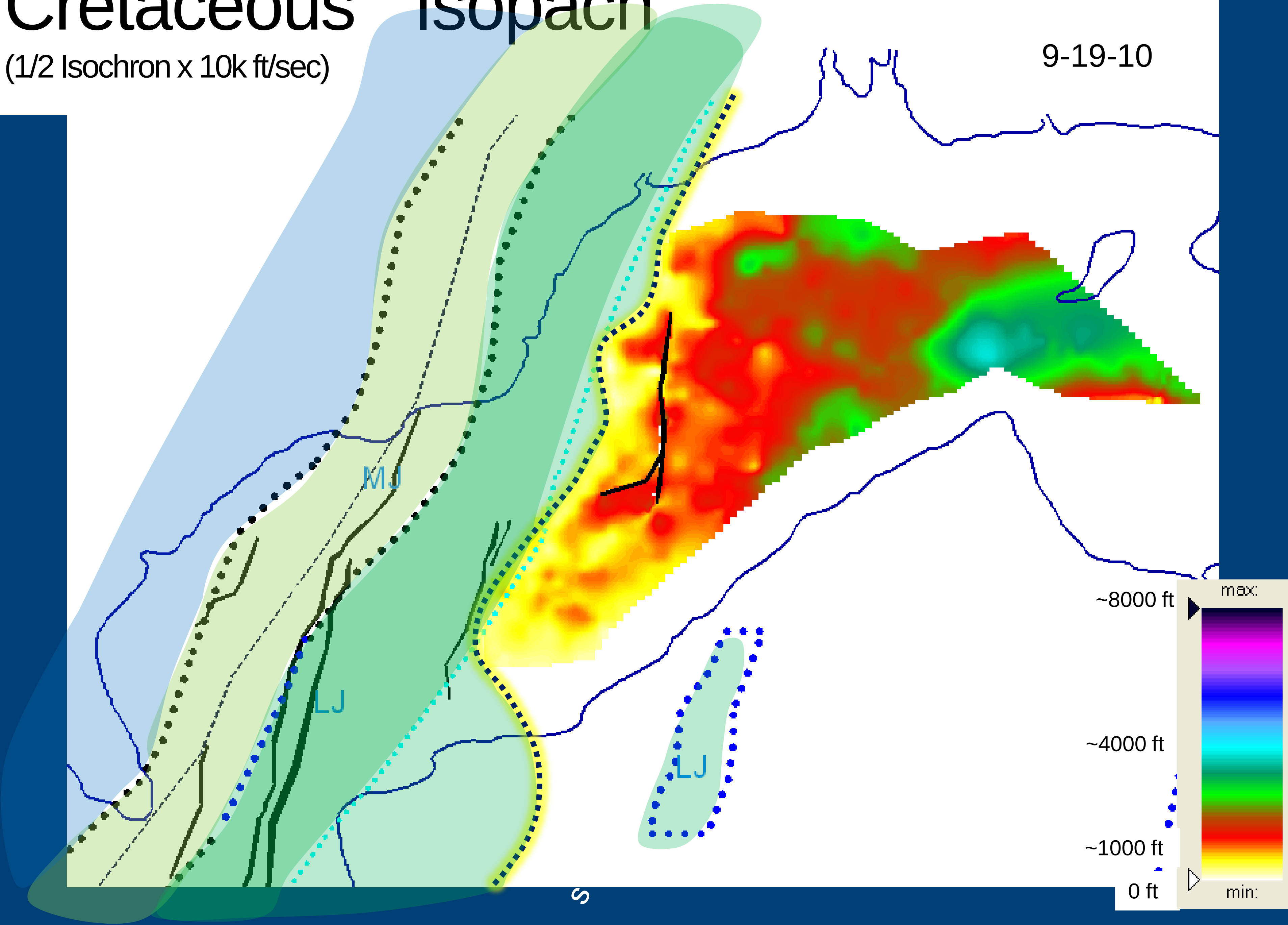


Upper Cook Inlet – ‘Well only’ constrained subcrop patterns



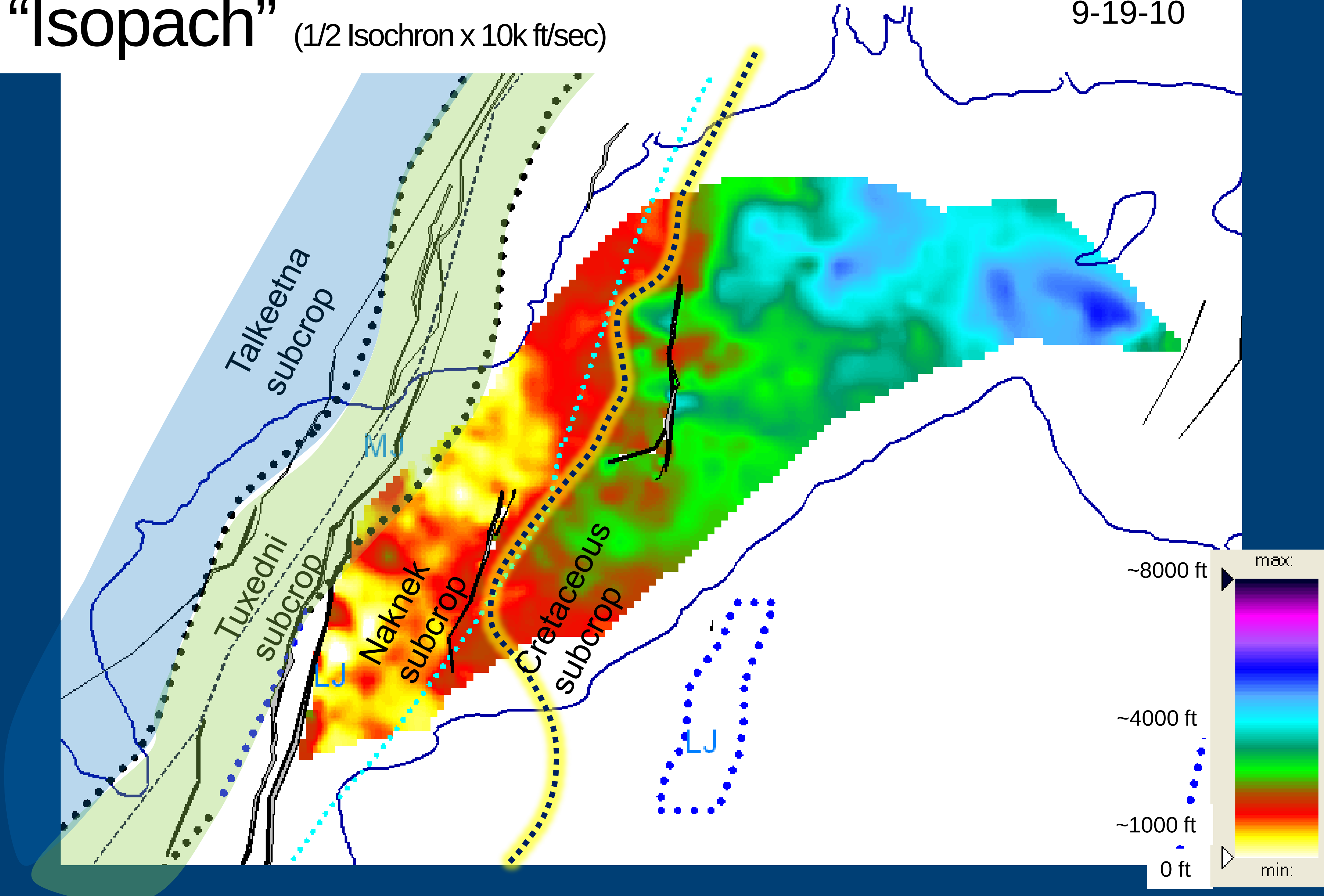
Cretaceous “Isopach”

(1/2 Isochron x 10k ft/sec)



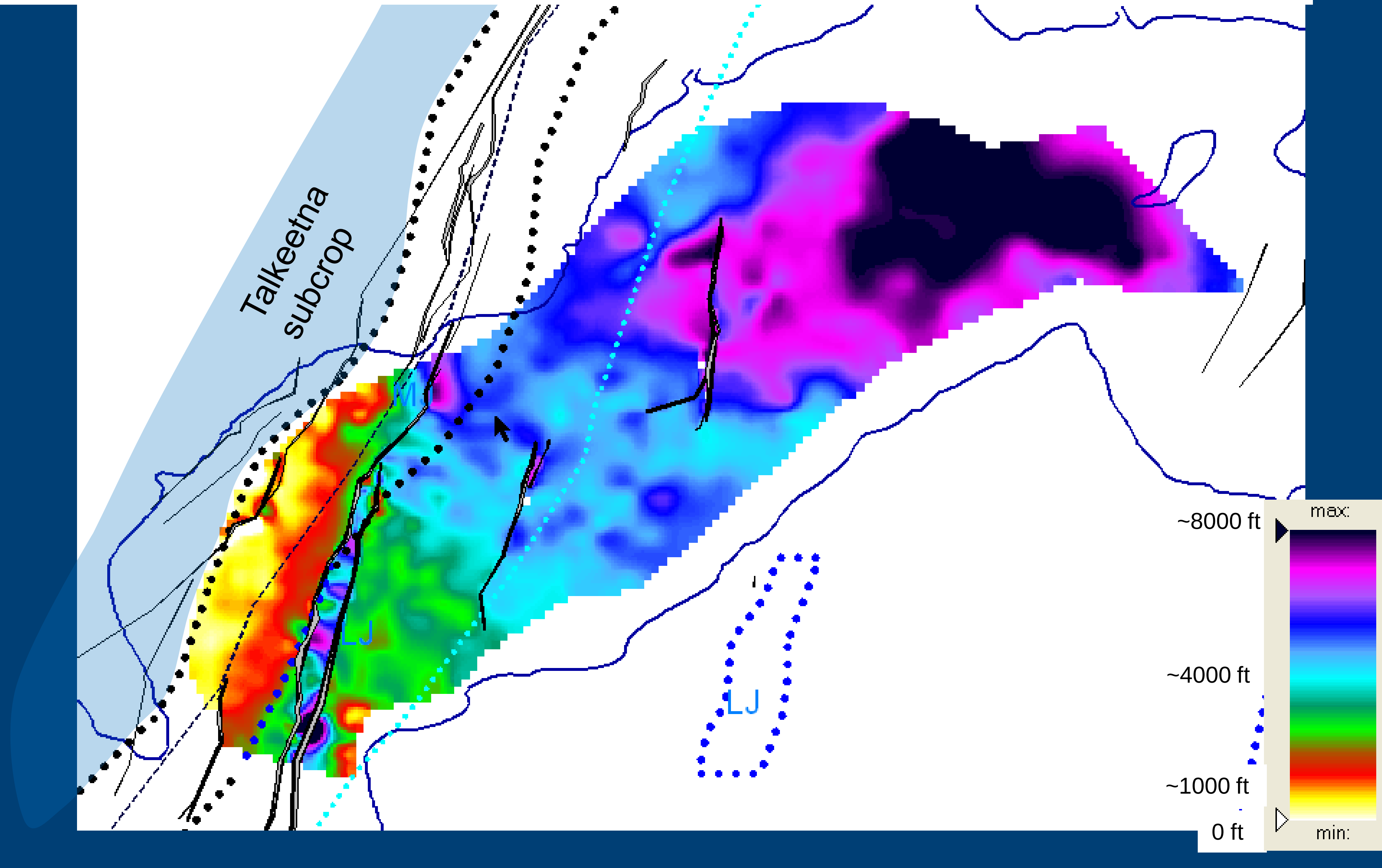
Naknek + Cretaceous "Isopach" (1/2 Isochron x 10k ft/sec)

9-19-10



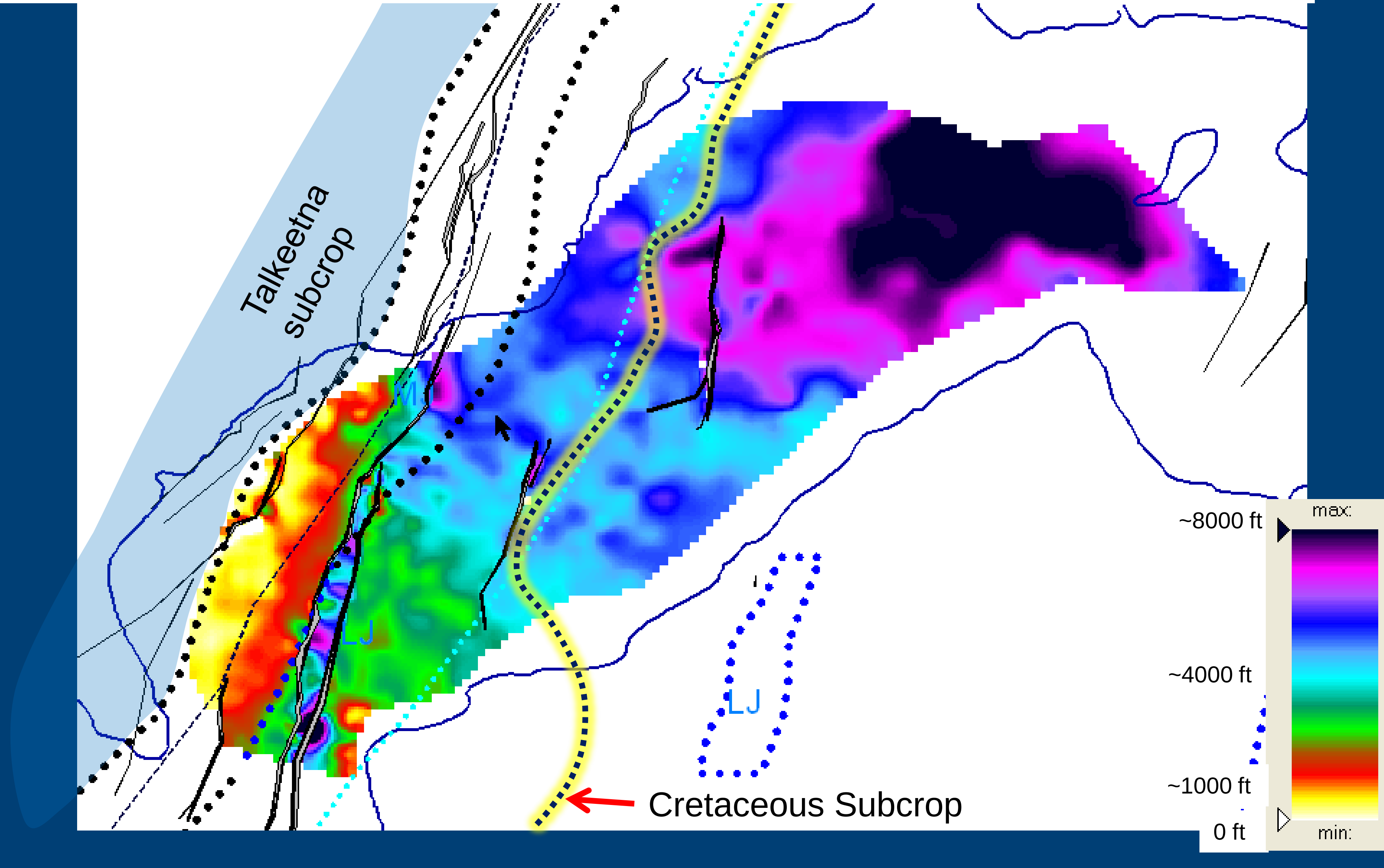
Tuxedni + Naknek + Cretaceous "Isopach"

(1/2 Isochron x 10k ft/sec)



Tuxedni + Naknek + Cretaceous "Isopach"

(1/2 Isochron x 10k ft/sec)



Cretaceous "Isopach"

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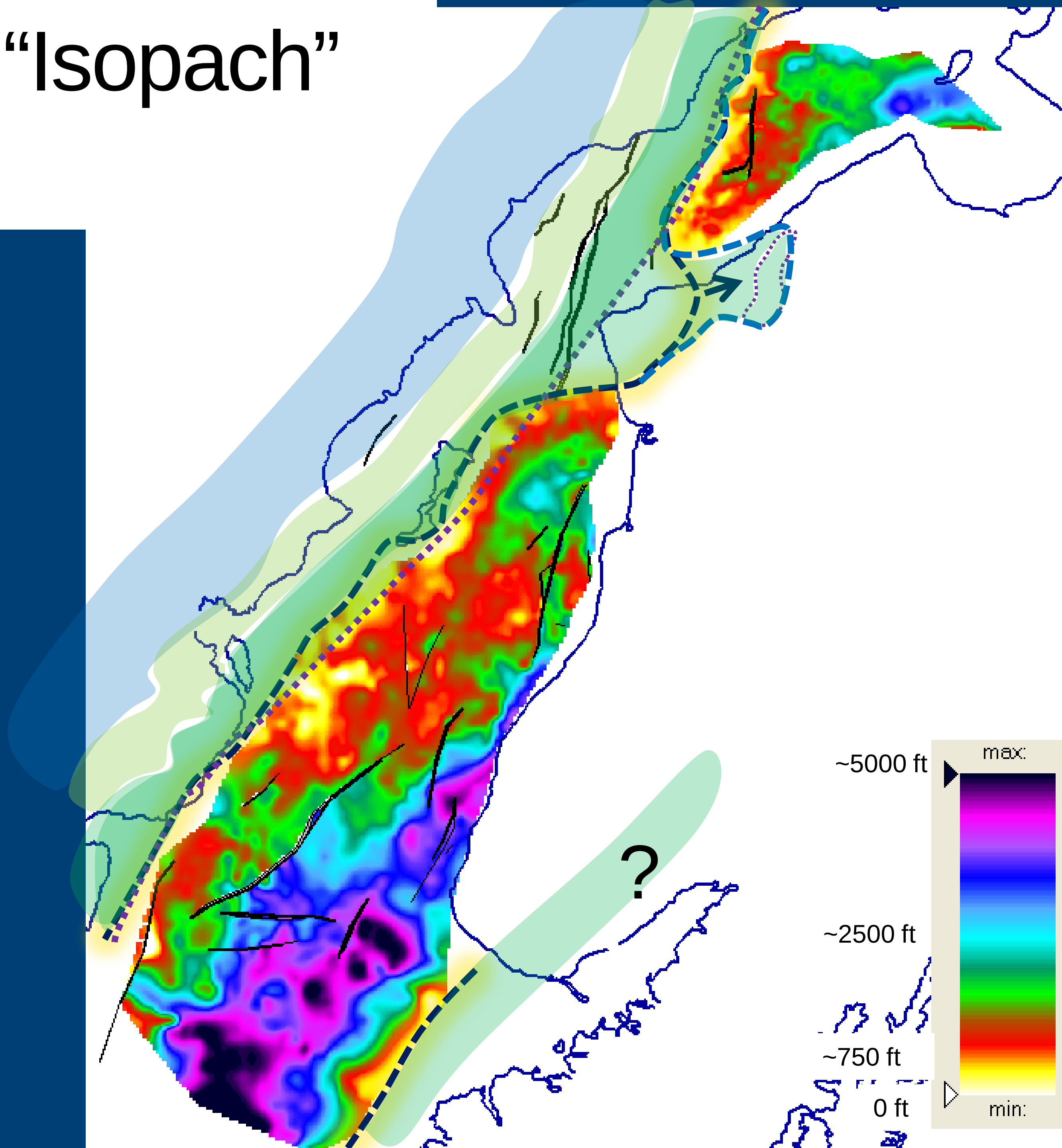
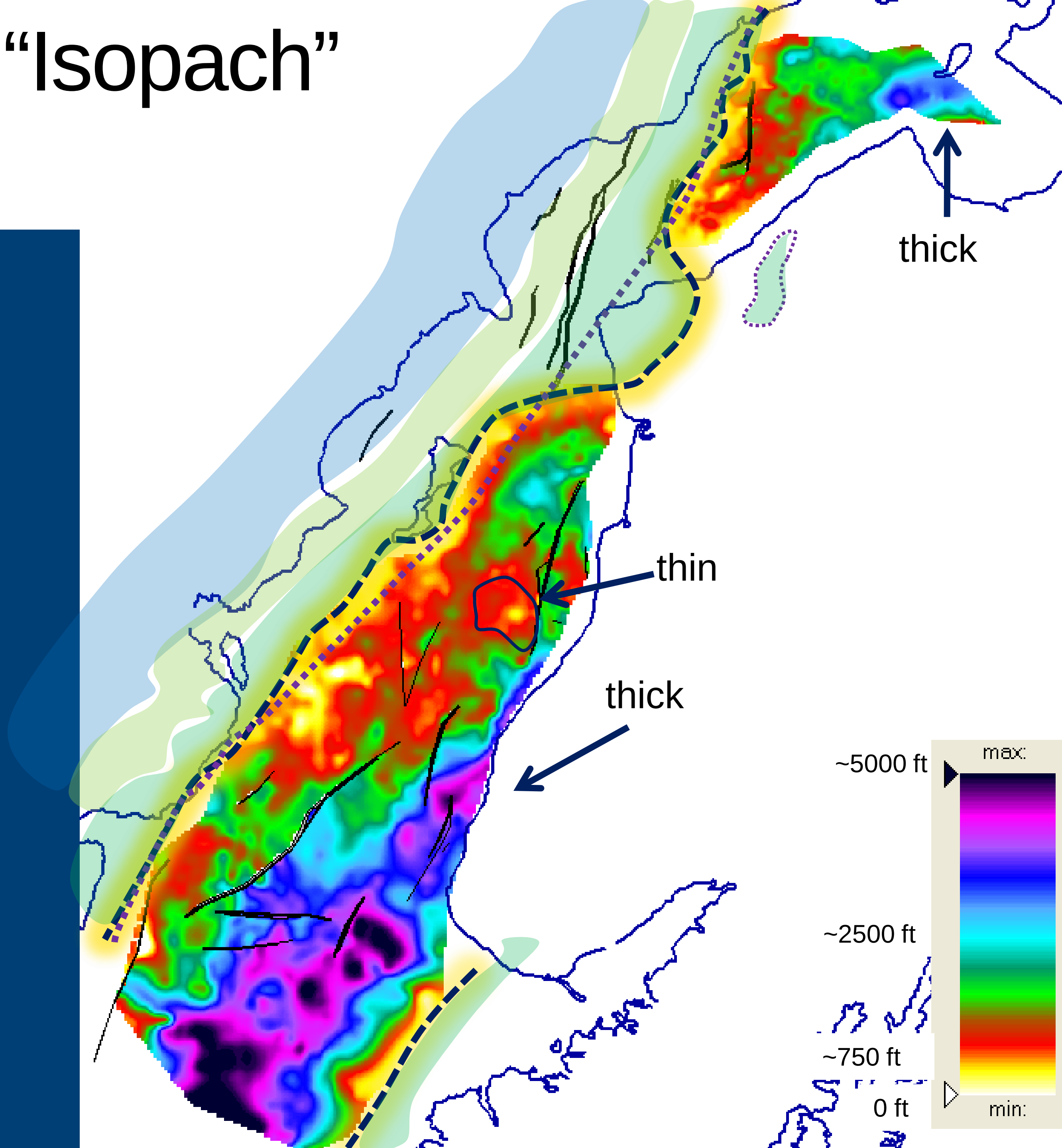
9-19-10



Cretaceous “Isopach”

(1/2 Isochron x 10k ft/sec)

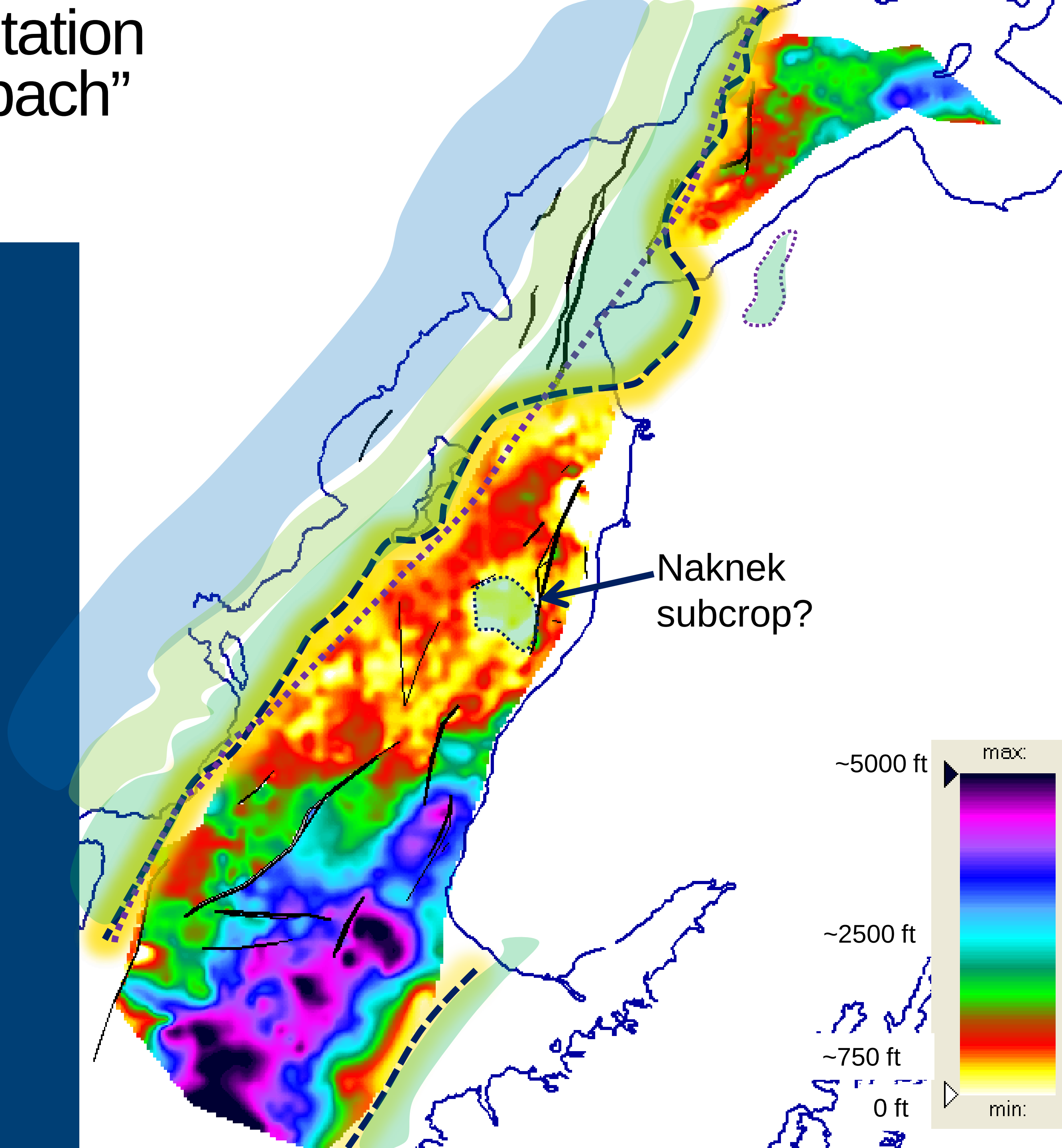
9-19-10



Alternate Interpretation Cretaceous “Isopach”

(1/2 Isochron x 10k ft/sec)

9-19-10



Cook Inlet Mesozoic Subcrop Summary

- First pass interpretation of well and seismic data completed.
  - Significant additional work planned.
- In spite of challenging data quality, seismic interpretation is providing insights into subcrop pattern shapes and position.
- Subcrop patterns have evolved through integration of well and seismic data.
- Jurassic subcrops interpreted on seismic could simplify oil migration pathways

Mesozoic Subcrop Map – Next steps

- Seismic
  - Polish interpretations for Tuxedni and Talkeetna
  - Study implications of patterns seen in Mesozoic isopachs
  - Create Naknek and Tuxedni isopachs for whole Inlet to improve understanding of paleostructures
- Wells
  - Look at cuttings for all wells
  - Look at all available core data
- Continue collaboration with DGGS and USGS
- Solicit Feedback

L. Gregersen, 2008

References Cited – page 1 of 2

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