Idaho Oil and Gas Conservation Commission

May 14, 2025

Information Agenda

Subject

Presentation: An Overview of Idaho's Western Snake River Plain Petroleum System and Its Hydrocarbon Potential

Background

In March 2010, Bridge Energy drilled the ML Investments #1-10 well in Payette County resulting in the first commercial hydrocarbon discovery in the state of Idaho. This discovery led to additional development drilling by Alta Mesa to confirm the extent of what was to become the Willow Field. Gas gathering and processing facilities were constructed and full time production commenced in August 2015.

Three years later in 2018, Alta Mesa drilled the Barlow #1-14 well near Fruitland which was the discovery well for the Harmon Field. This was followed by the Fallon #1-10 confirmation well on the northwest side of the Harmon Field.

In February 2020, Mark Barton, petroleum geologist at the Idaho Geological Survey, presented a summary of the production that had occurred in the field to the Idaho Oil and Gas Conservation Commission.

Discussion

Since 2020, Willow Field development drilling has ceased and production has declined in the field. During that same time, additional development wells have been drilled in the Harmon Field resulting in a shift of activity to the west of the initial discovery. Dr. Barton will be presenting an update on his continued studies of the production in the Western Snake River Plain, with an assessment of the additional exploration and production potential which may remain in the basin.

Attachment

1. Presentation – Idaho's Western Snake River Plain Petroleum System and Its Hydrocarbon Potential by Mark Barton, Idaho Geological Survey

Idaho's Western Snake River Plain Petroleum System and Its Hydrocarbon Potential

Idaho Oil and Gas Commission Presentation
May 14, 2025

Mark Barton
Idaho Geological Survey

Miocene igneous intrusion-WSRP, Idaho

ATTACHMENT 1

AGENDA

IGS Oil & Gas Program

Petroleum System Basics

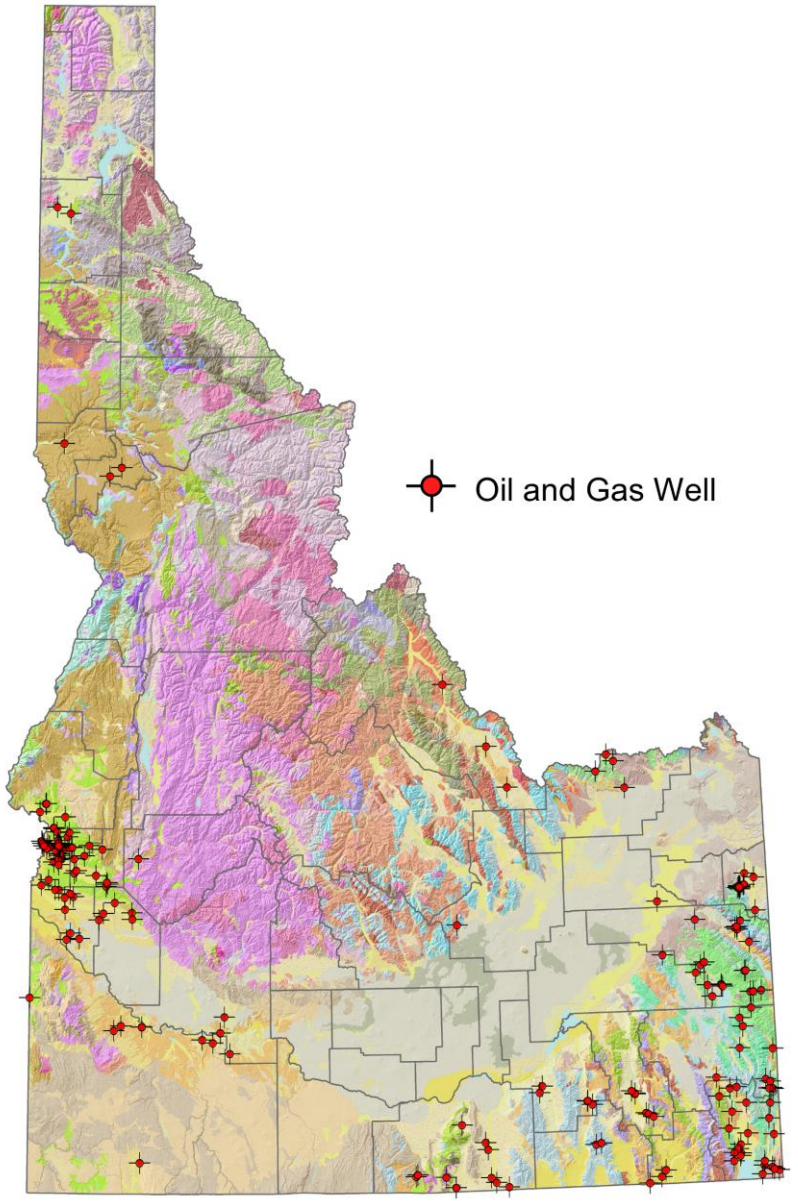
- Conventional
- Atypical Igneous

WSRP Petroleum System

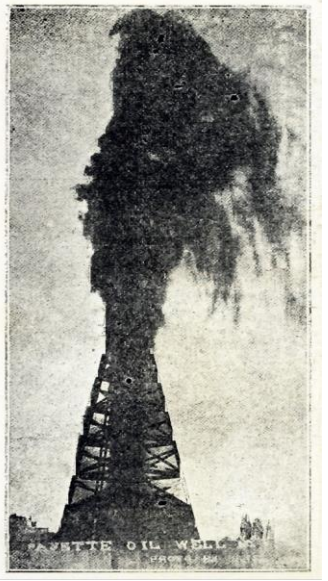
- Hydrocarbon plays
  - Willow, Harmon, Hamilton
- Producing fields
  - Willow
  - Harmon

Opportunities/Challenges

- Hamilton Play
- Harmon Play
- Willow Play
- Southern Basin



Gusher
Payette No.8
Crystal Dome
Payette County, ID
1928



First commercial production
ML Investment 1-10
Little Willow Creek
Payette County, ID
2010

IGS Oil and Gas Program

Activities

- Conducting research on proven and potential petroleum systems in the state of Idaho.
  - Basin analysis
  - Reservoir presence and effectiveness
  - Source rock potential
  - Geochemistry of gas and fluids
- Collecting and archiving subsurface geological data.
- Transferring knowledge to operators, policymakers, and the public.

Focus Areas

Western Snake River Plain (proven)

- Conventional petroleum system in the early stages of exploration and development.

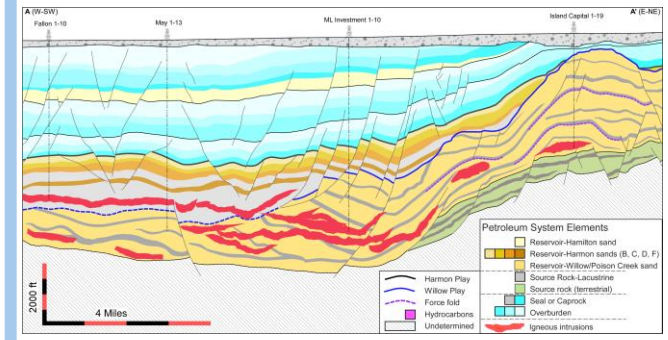
South-central Idaho (speculative)

- Possible petroleum system based on reports of oil seeps within Permian age strata exposed on the flanks of the Cassia Mountains.

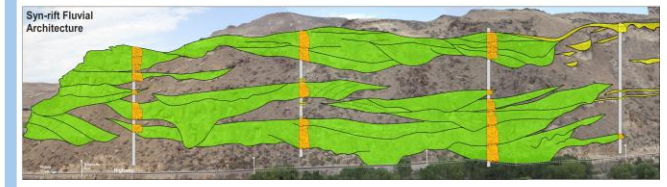
South-eastern Idaho (speculative)

- Possible petroleum system based on world class source rock (Permian Phosphoria Fm) and existence of producing fields in the fold-and-thrust belt of Wyoming and Utah.

Basins

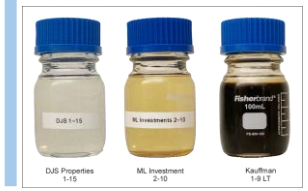


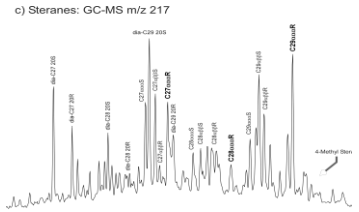
Reservoirs



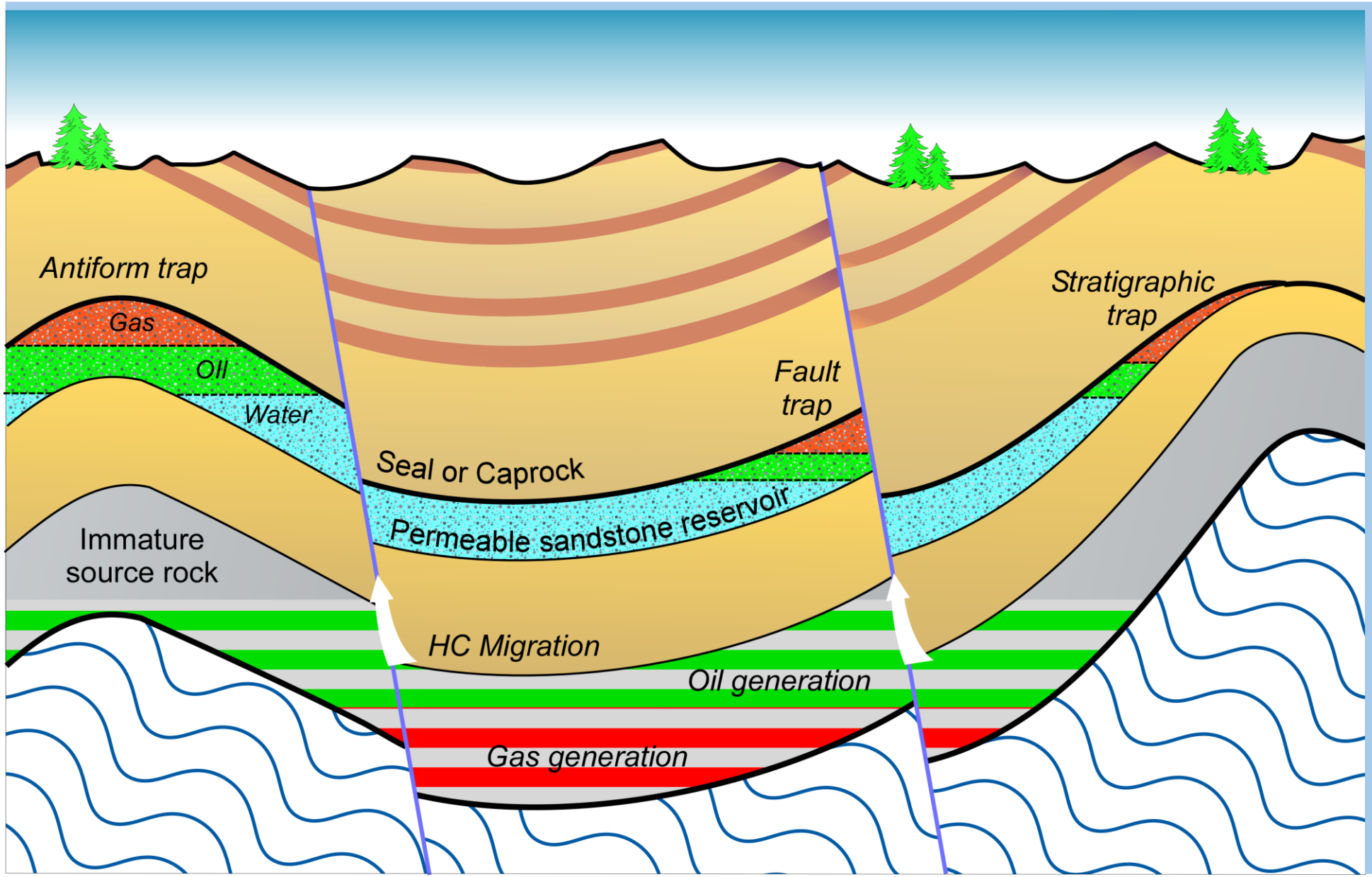
Source Rocks

Fluids





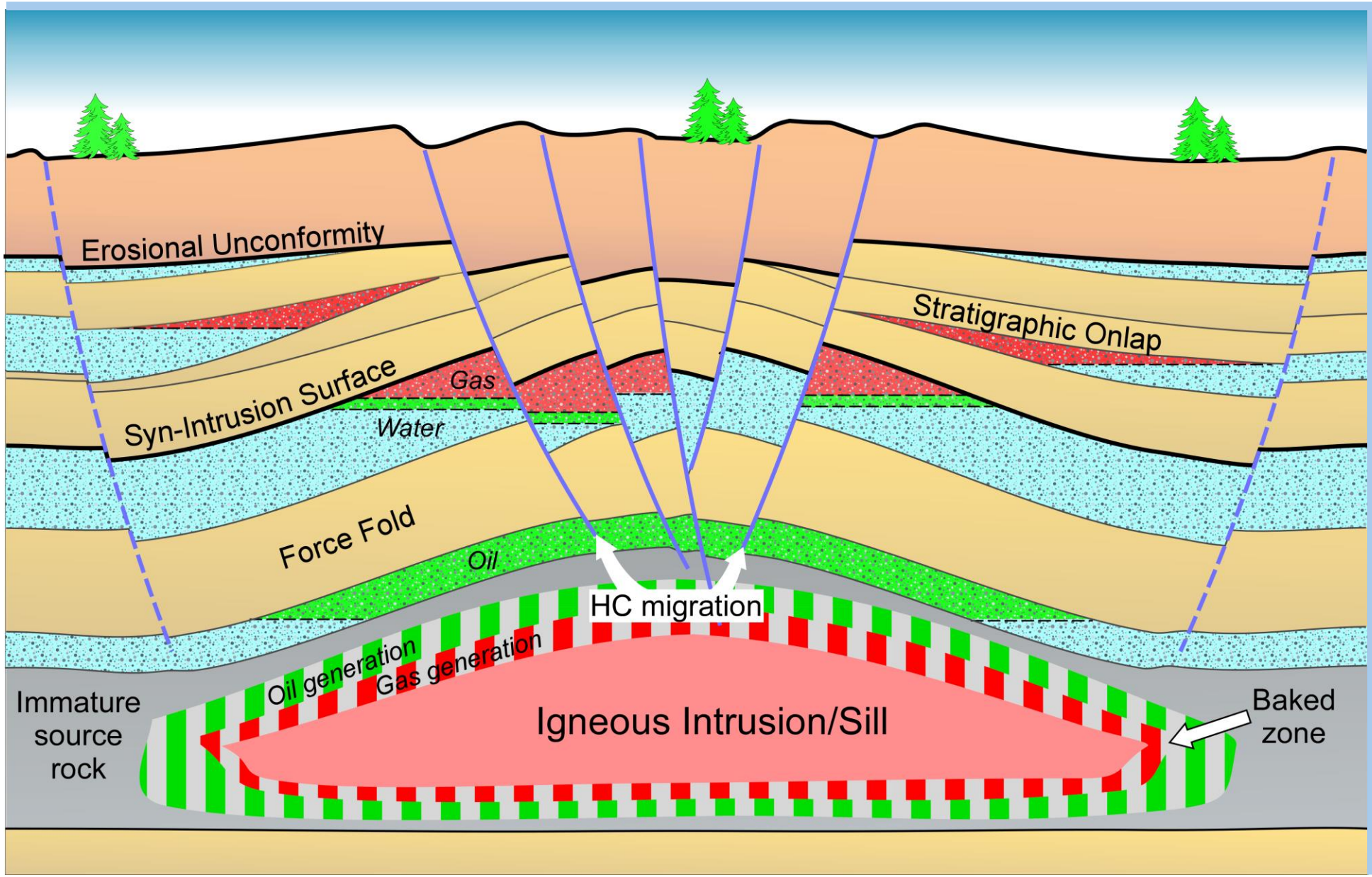
Conventional Petroleum System



A complete petroleum system consists of organic-rich source rocks, permeable reservoir units, and effective seals or caprocks to retain hydrocarbons.

Key geological processes include source rock maturation, hydrocarbon migration, and trap formation—often driven by regional tectonic activity.

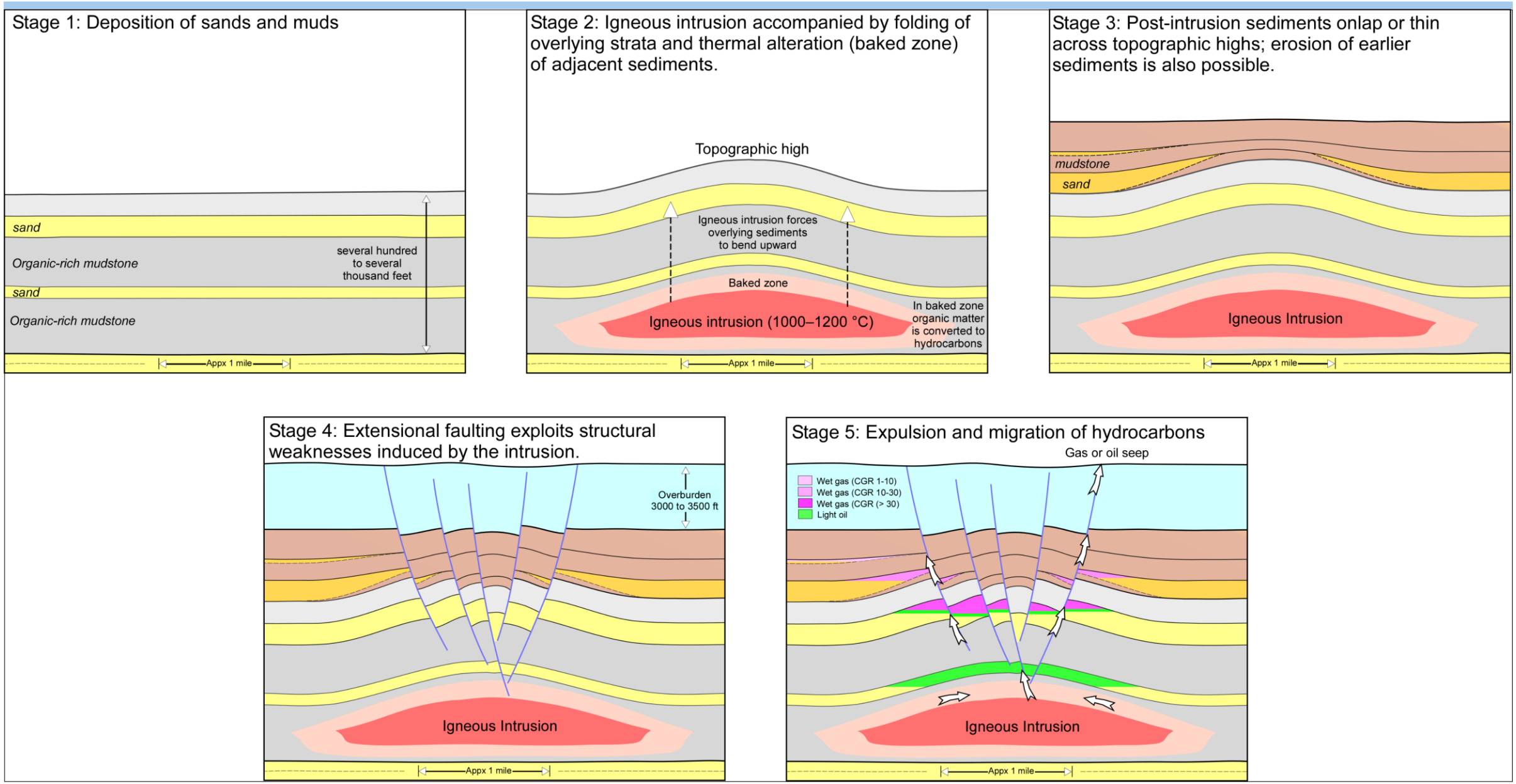
Atypical Igneous Petroleum System



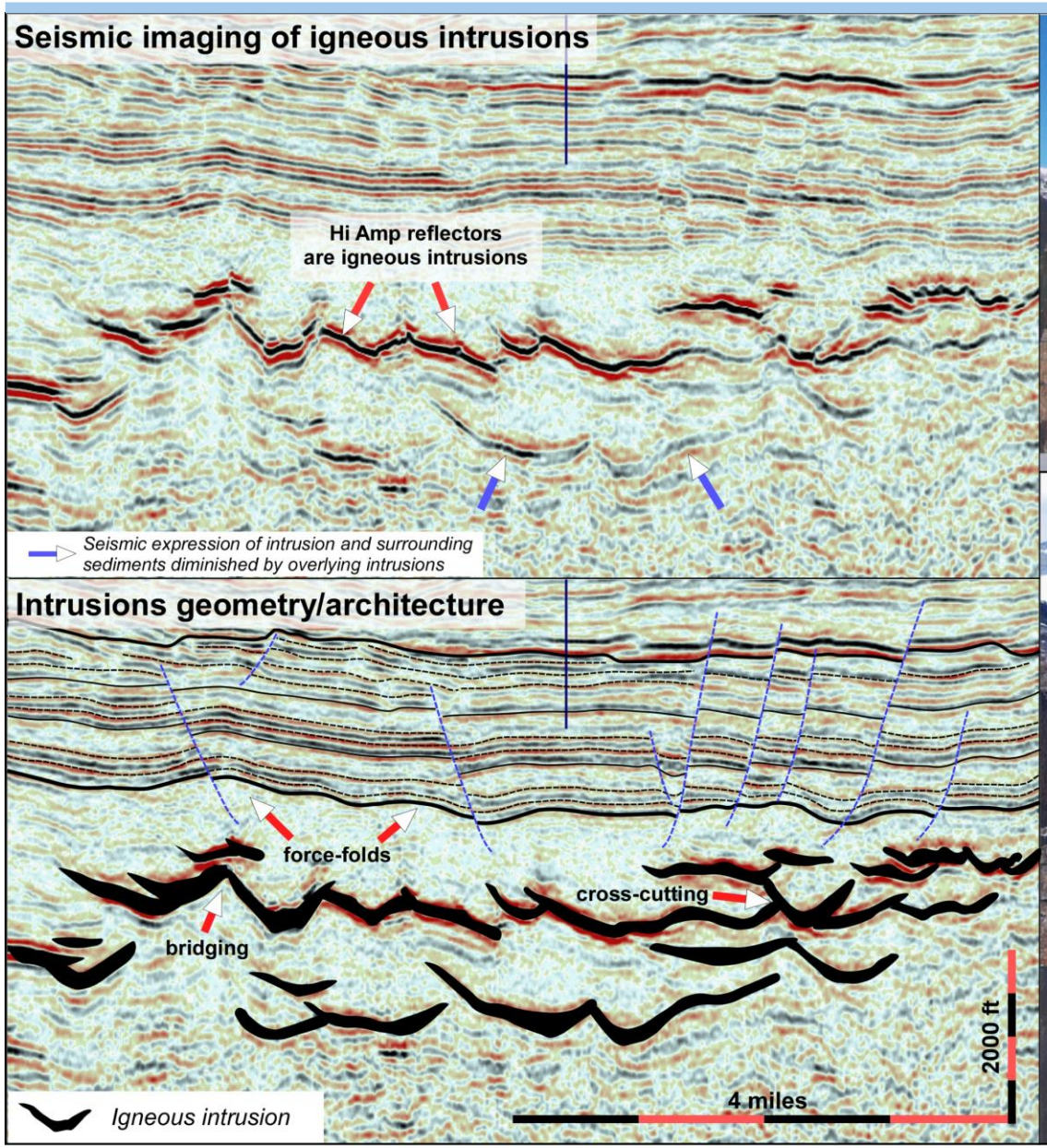
Comprise the same fundamental elements: organic-rich source rocks, permeable reservoirs, and effective seals or caprocks.

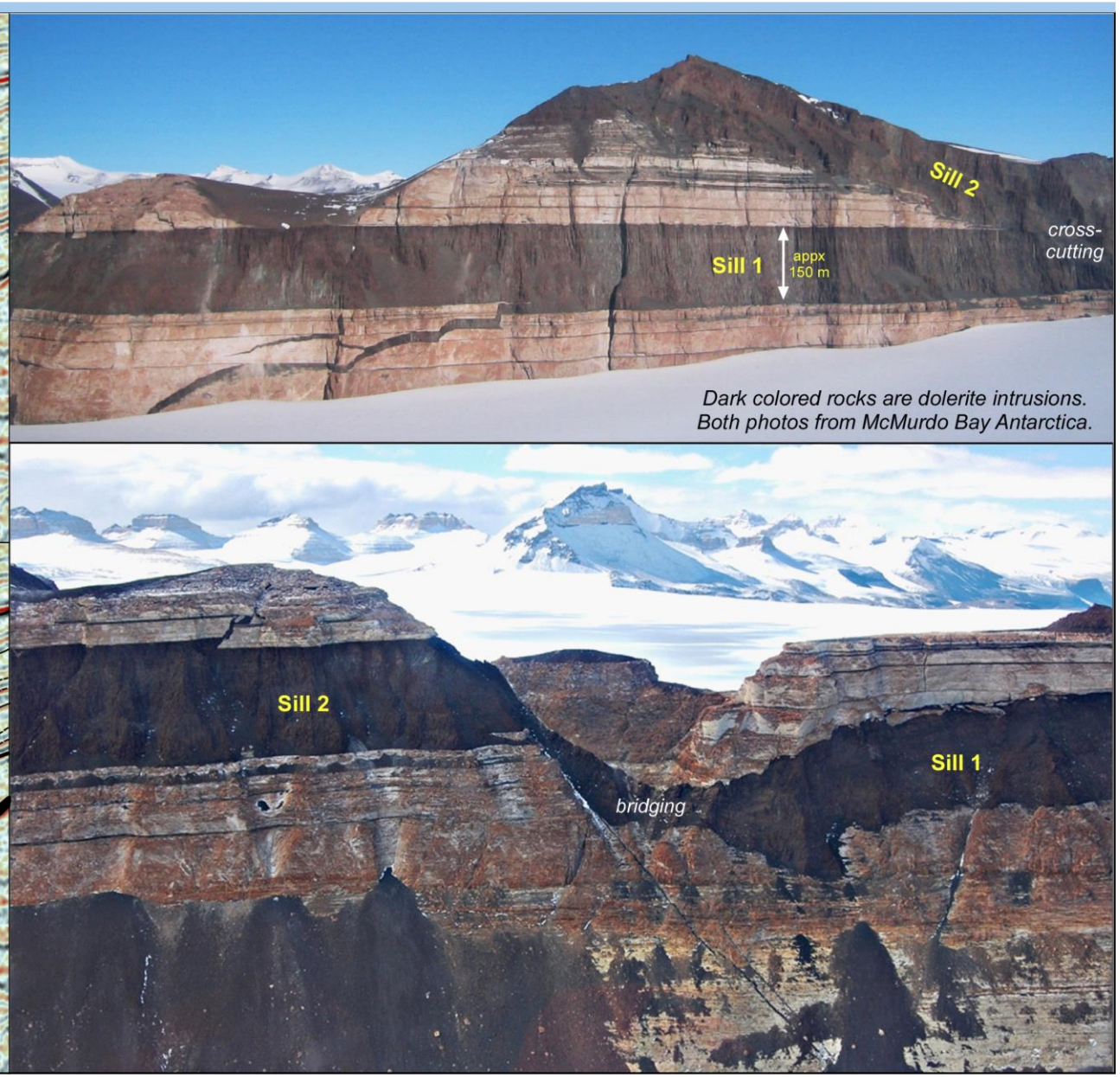
However, key processes—source rock maturation, hydrocarbon migration, and trap formation—are primarily driven by the thermal and structural impacts of igneous intrusions.

Intrusion formed structures-Process



Geometry and architecture of WSRP intrusions

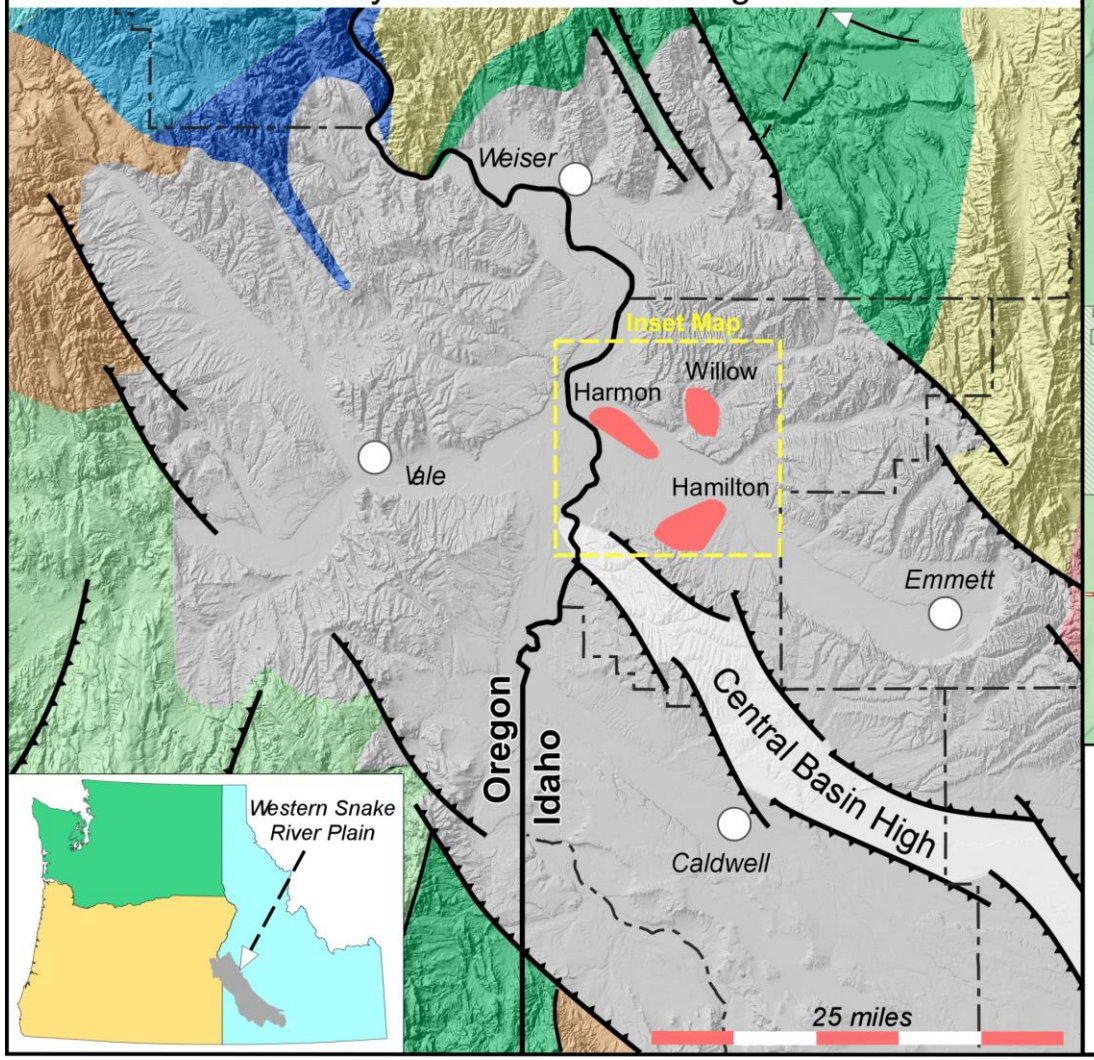


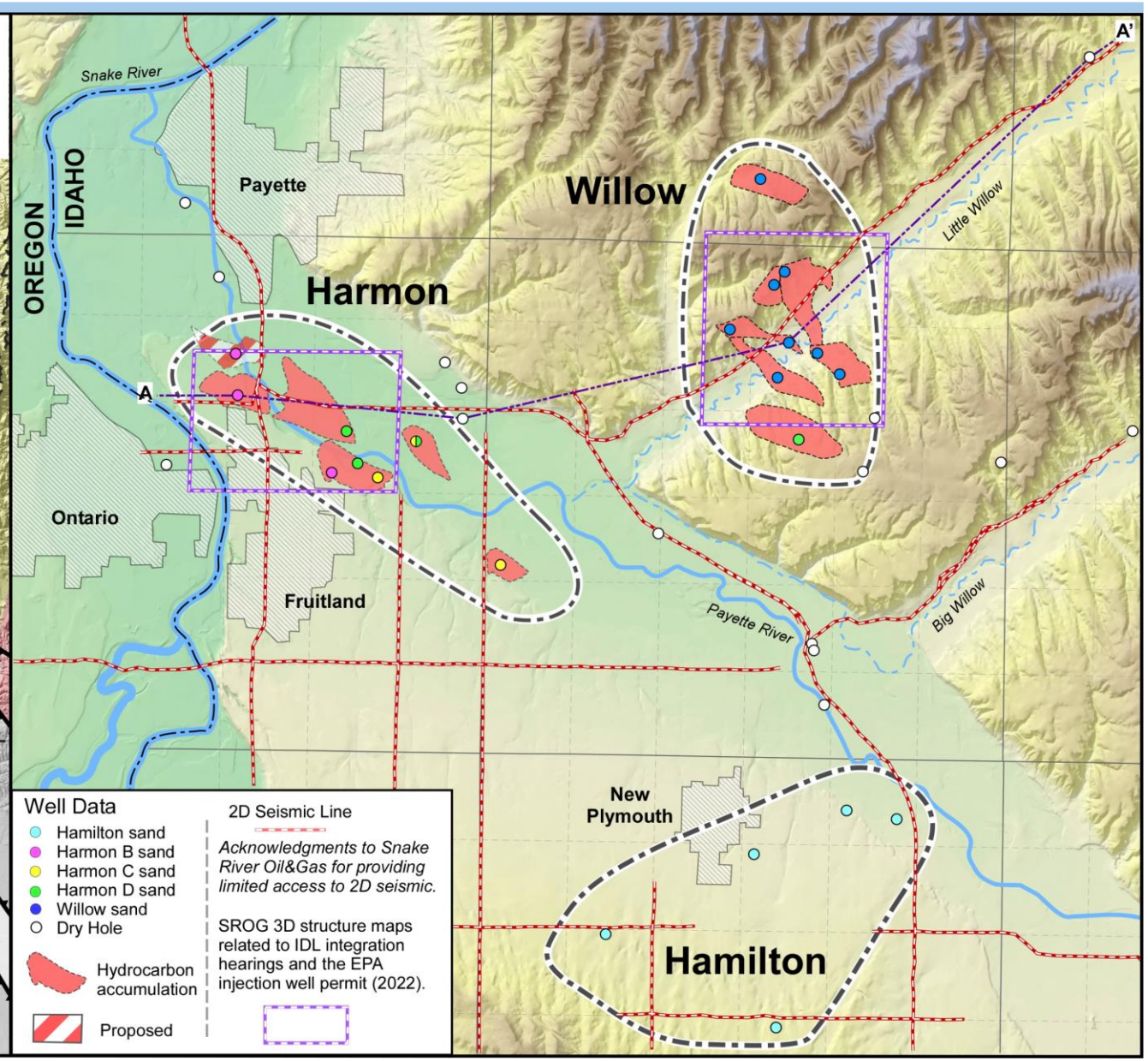


Western Snake River Plain (WSRP) Hydrocarbon Fields

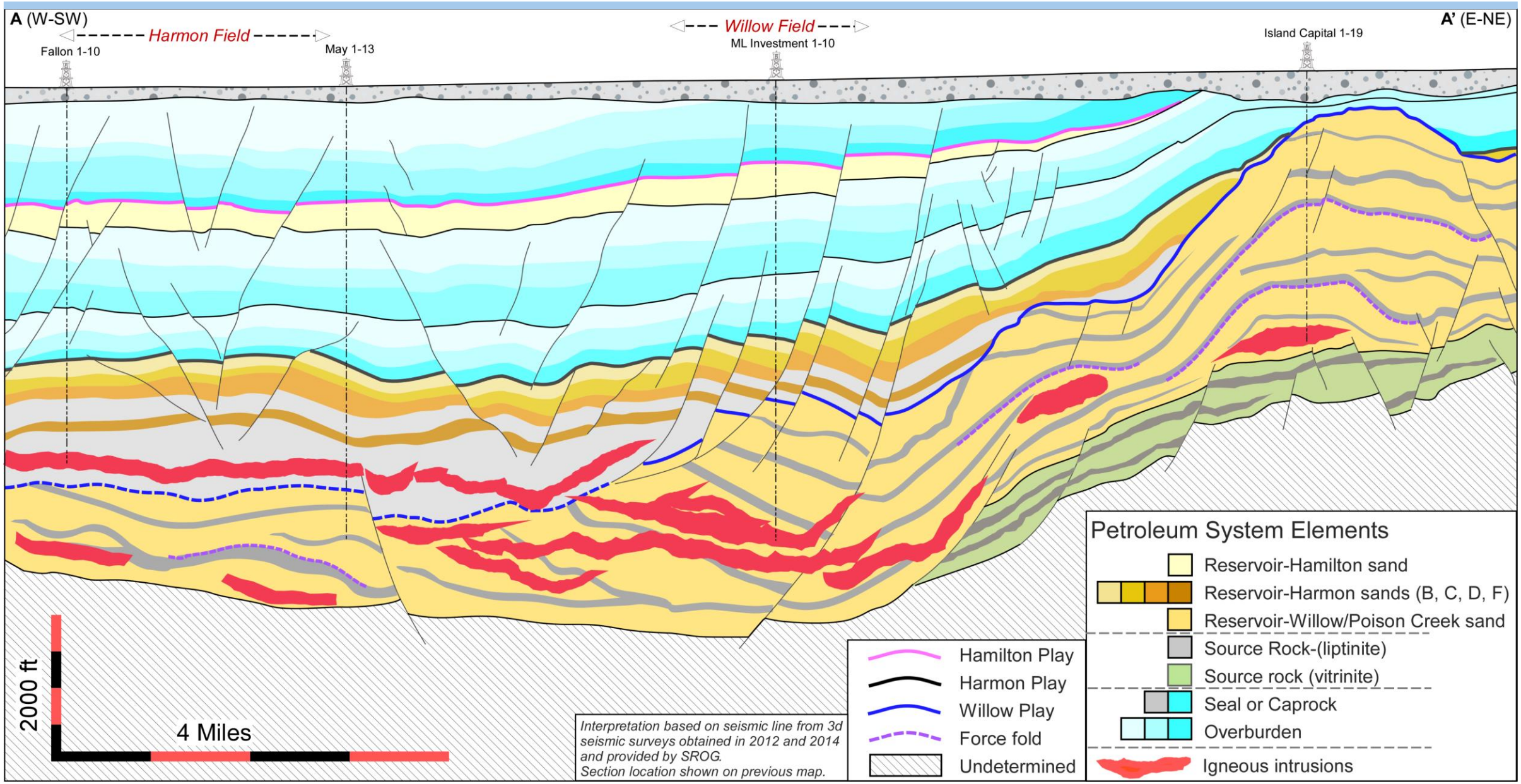
IDAHO GEOLOGICAL SURVEY

Neogene (2–12 Ma) extensional basin lies beneath the WSRP.
Basin fill consists of 2-4 kilometers of clastic sediments, volcanic rocks, and igneous intrusions.
Basin is subdivided by the Central Basin High

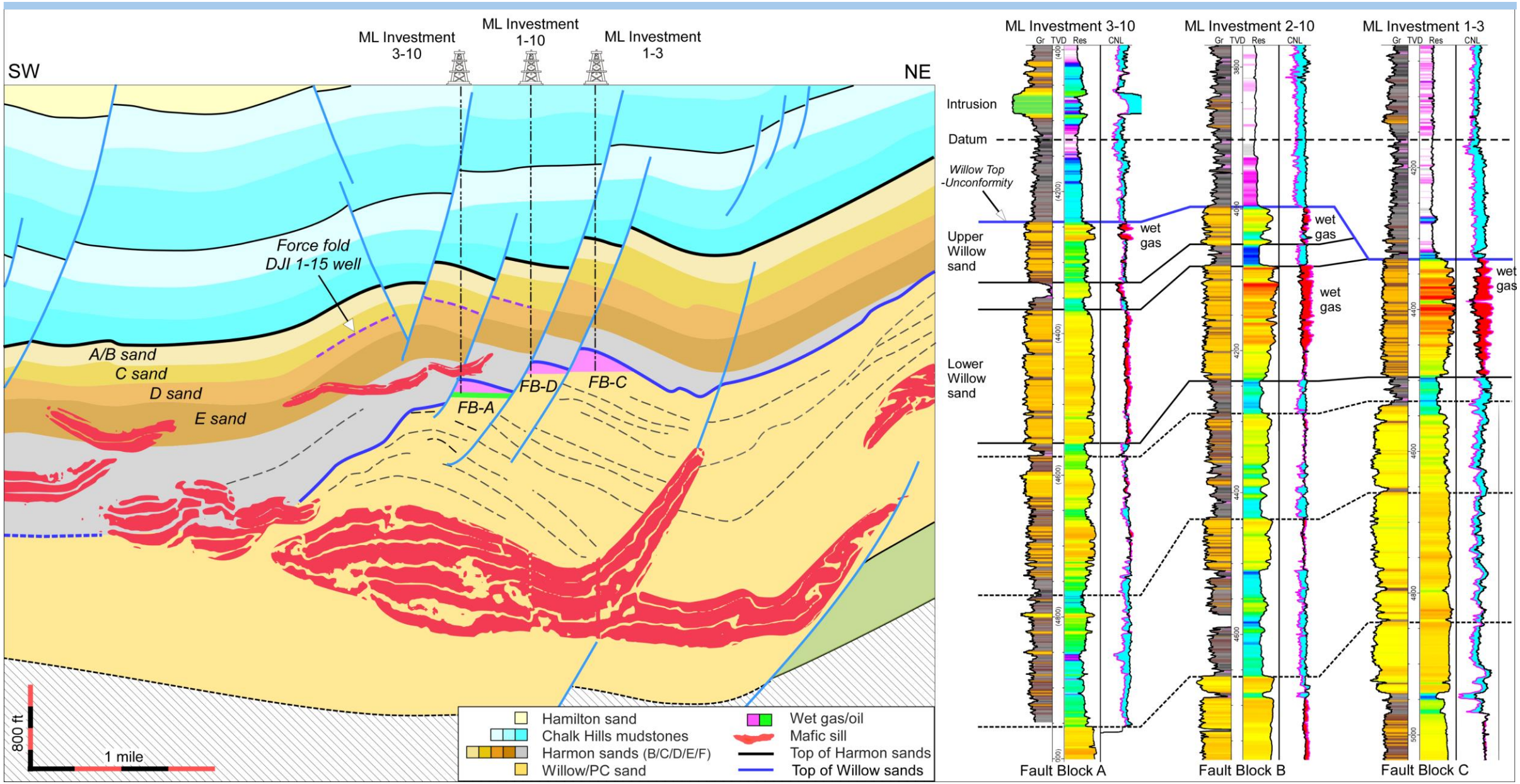




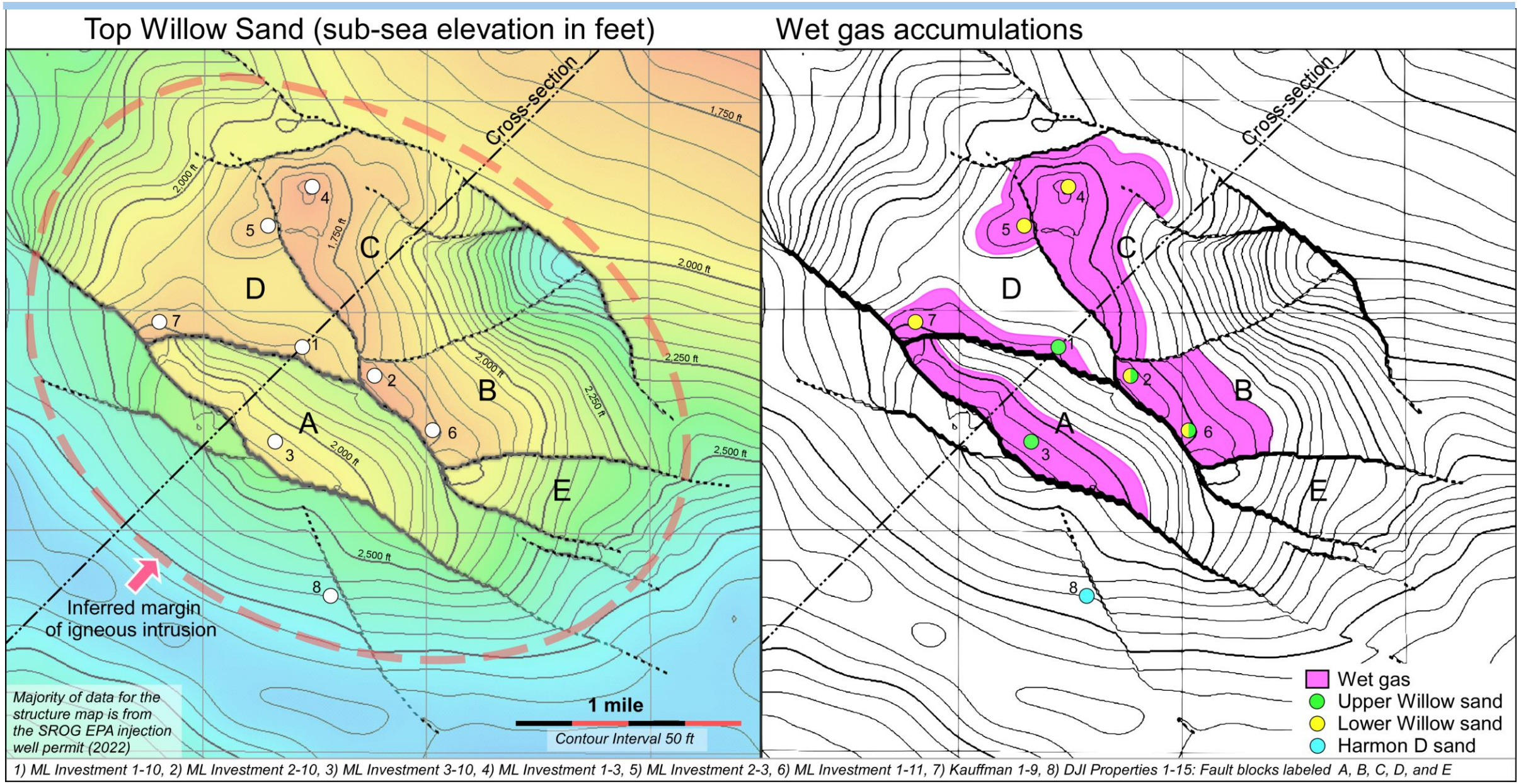
WSRP Petroleum System



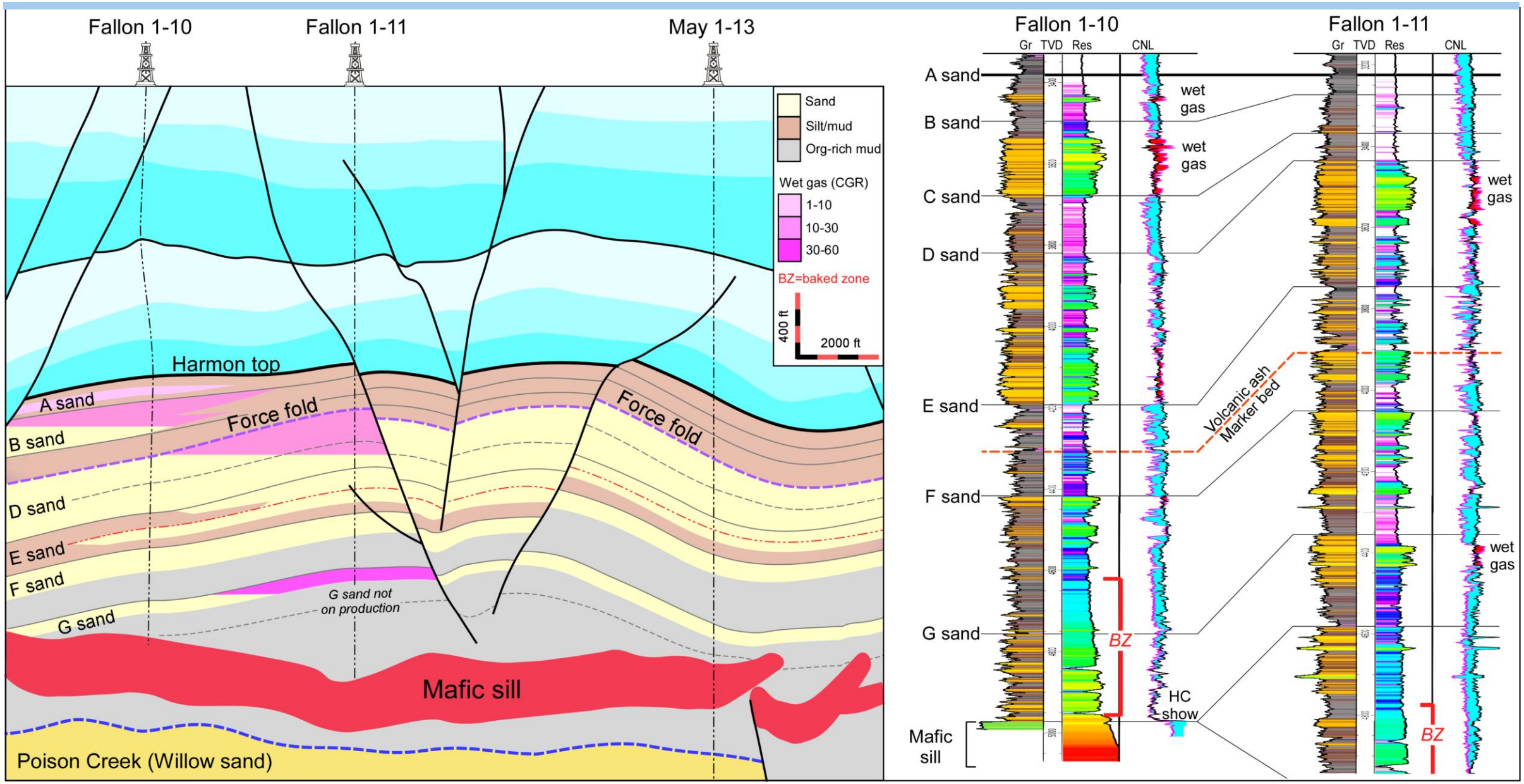
Willow Field Geology-Cross-section



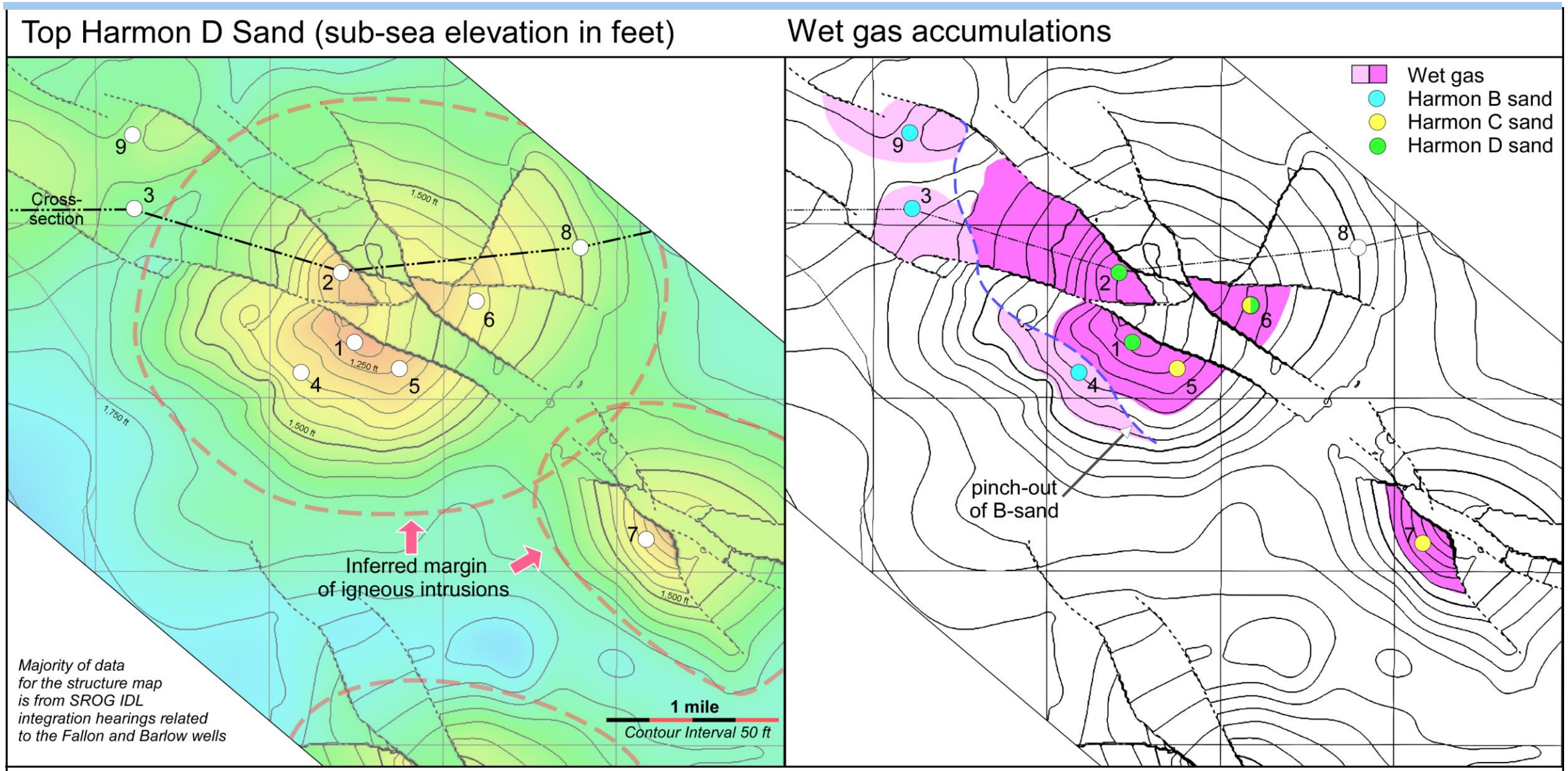
Willow Field Geology-Structure



Harmon Field Geology-Cross-section



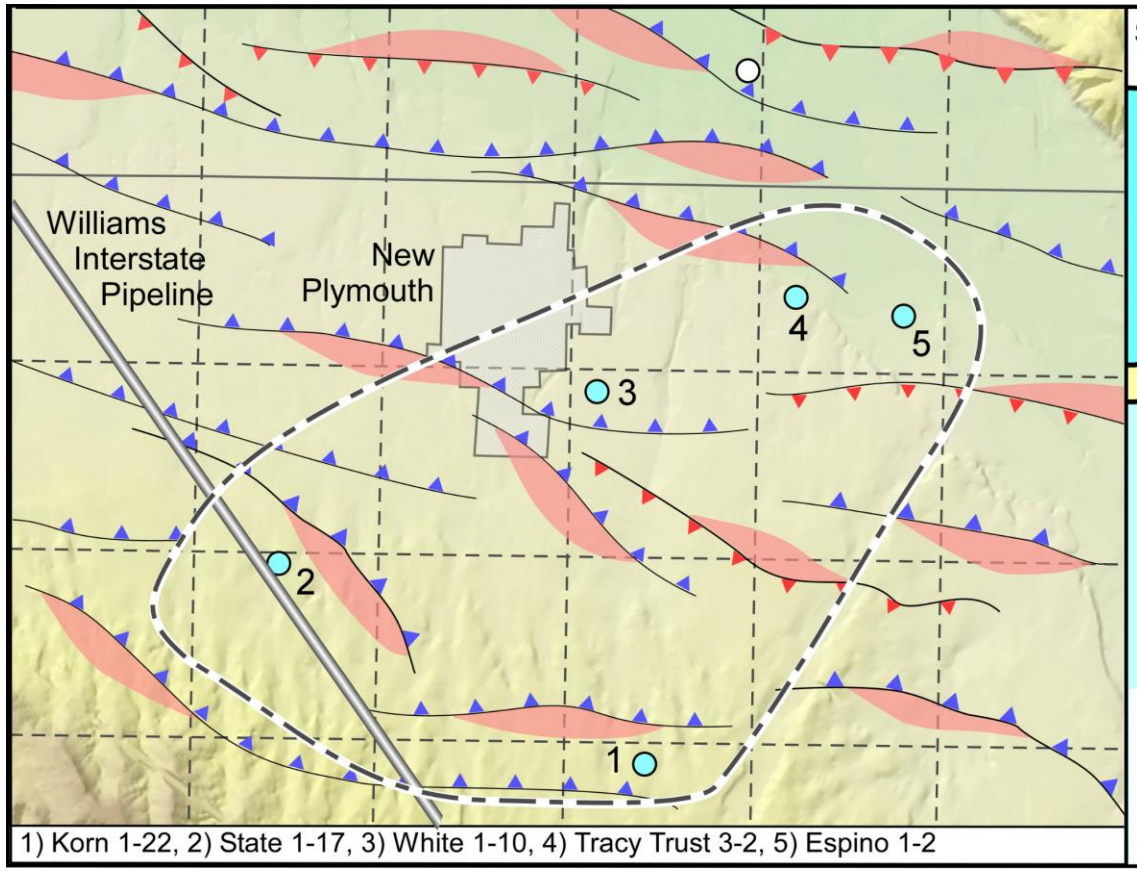
Harmon Field Geology-Structure



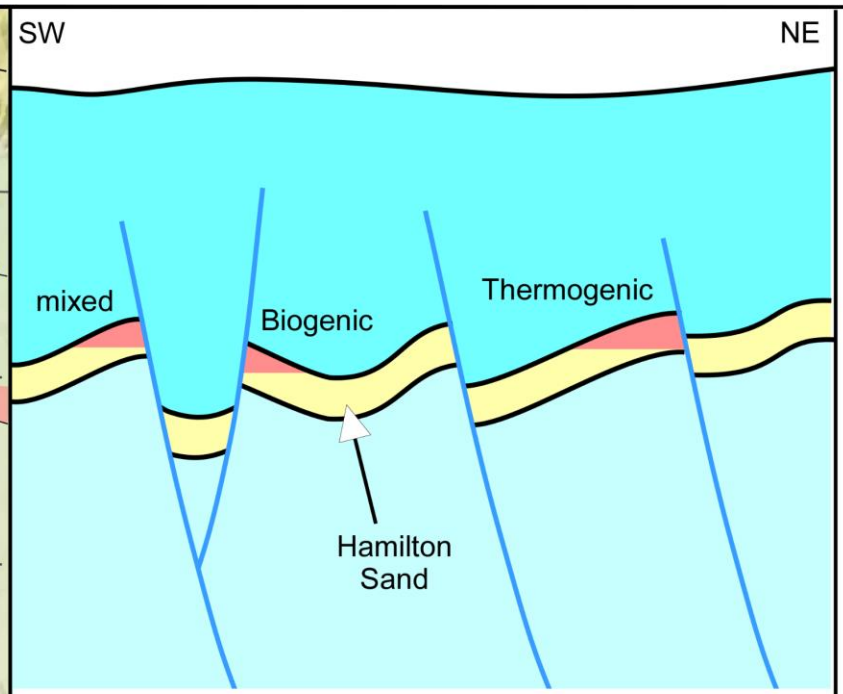
1) Barlow 1-14, 2) Fallon 1-11, 3) Fallon 1-10, 4) Barlow 2-14, 5) Barlow 3-14, 6) Dutch Lane 1-13, 7) Irvin 1-19, 8)May 1-13, 9) proposed

Hamilton Play

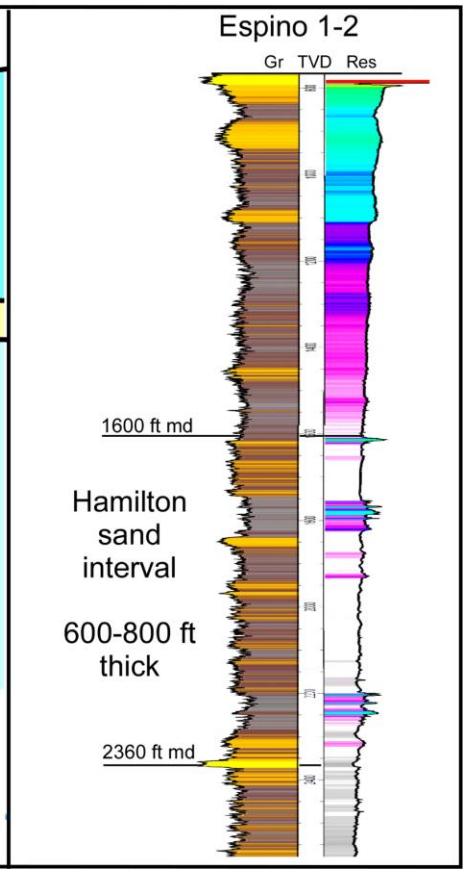
Shallow lean gas play, with Hamilton Field originally believed to be a large, continuous accumulation capable of supplying the Williams gas pipeline. Contrary to early expectations, the play comprises small, isolated accumulations located in the footwalls of normal faults, with overall poor well productivity. Field has been shut-in and subsequently abandoned. Accompanying map and cross-section is highly schematic and is not intended to represent precise geographic locations. Note-structures are the result of extension and not intrusions.



1) Korn 1-22, 2) State 1-17, 3) White 1-10, 4) Tracy Trust 3-2, 5) Espino 1-2



Schematic x-section: Lean gas accumulations occur in footwall. Based on carbon isotopes the origin of individual accumulations range from biogenic (Espino 1-2) to thermogenic (White 1-10).



Willow Play-Summary

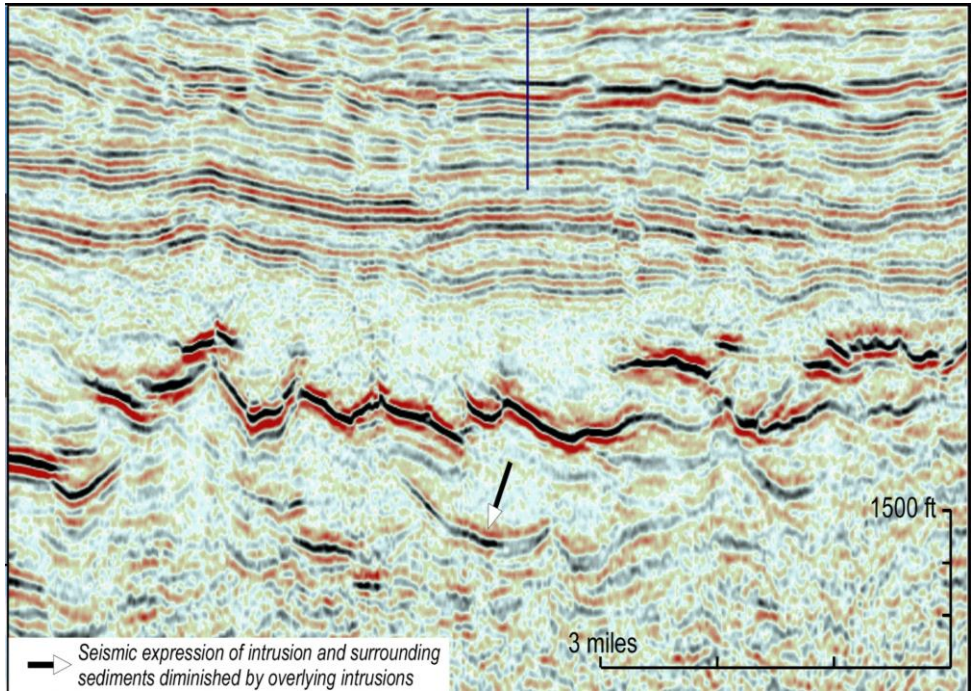
Well and seismic data suggest that the Willow play contains the key geological elements and processes indicative of a functioning petroleum system, similar to that of the Harmon play. This raises the potential for prospective gas and condensate accumulations within the region.

Challenges

- Thick basalt layers overlying the Poison Creek Formation significantly hinder seismic imaging, making it difficult to identify or accurately evaluate subsurface prospects.
- Current subsurface uncertainty limits exploration planning and risk assessment.

Upside Potential

- Acquisition of low-frequency, wide-array seismic data is an option to test the feasibility of imaging below the basalt (per James Allen, SROG). If successful, the technique could enable meaningful prospect delineation within the Willow Play.



The high reflectivity of basalts hinders seismic imaging of the underlying strata, complicating the evaluation of the Willow play.

Harmon Play-Summary

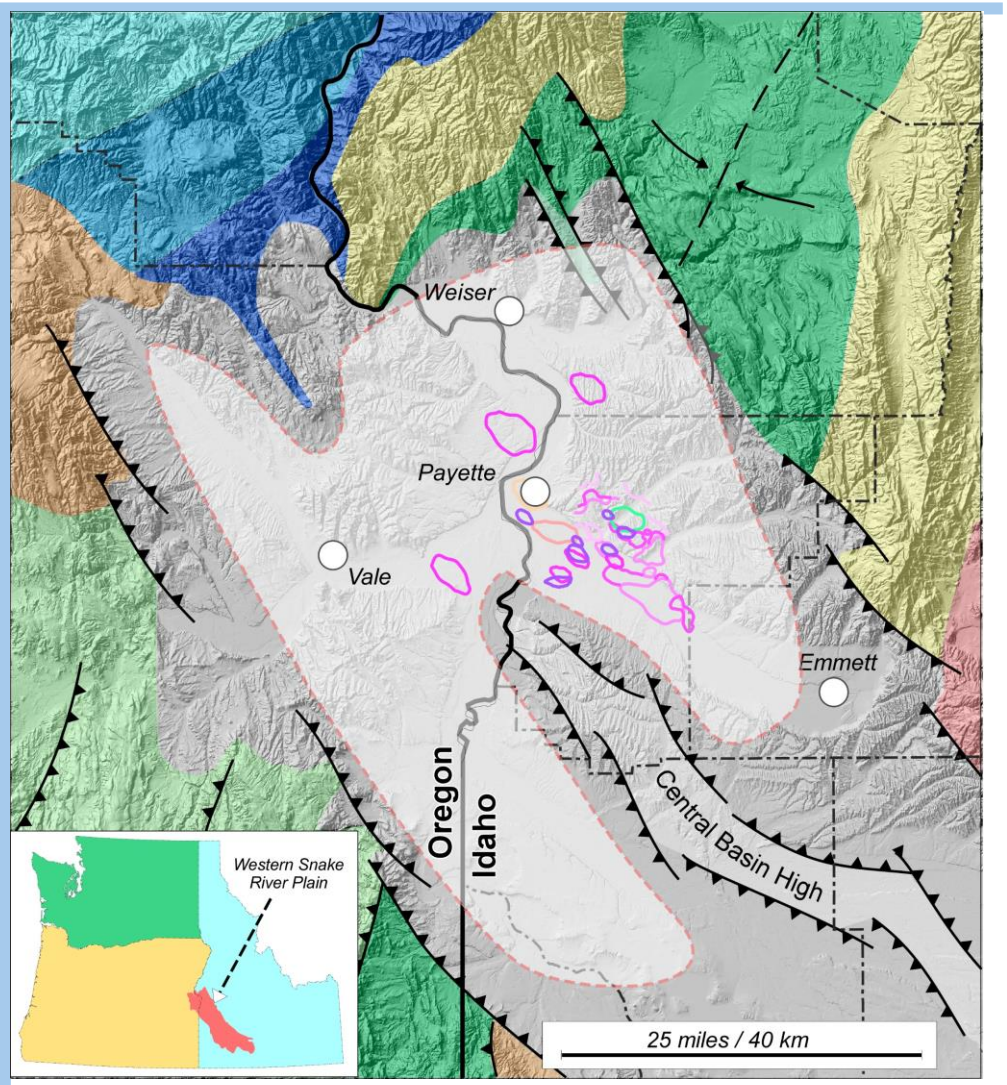
The Harmon play exhibits abundant igneous intrusions and related structures, that could represent numerous additional exploration prospects.

Challenges

- Data from existing producing fields suggest limited potential for large-scale reservoirs (i.e., >25 Bcf gas in place), reducing the likelihood of high-volume discoveries.
- Reservoir presence and quality are highly variable across the play, making reliable volume estimation and production forecasting challenging.

Upside Potential

- Recovery of heavier condensates and light oil from deeper intervals might be technically feasible with enhanced well designs or artificial lift systems.



White area represents portion of basin with common intrusions. Pink outlines represent individual sills within a small portion of the WSRP. Mapping is very incomplete.

Hamilton Play-Summary

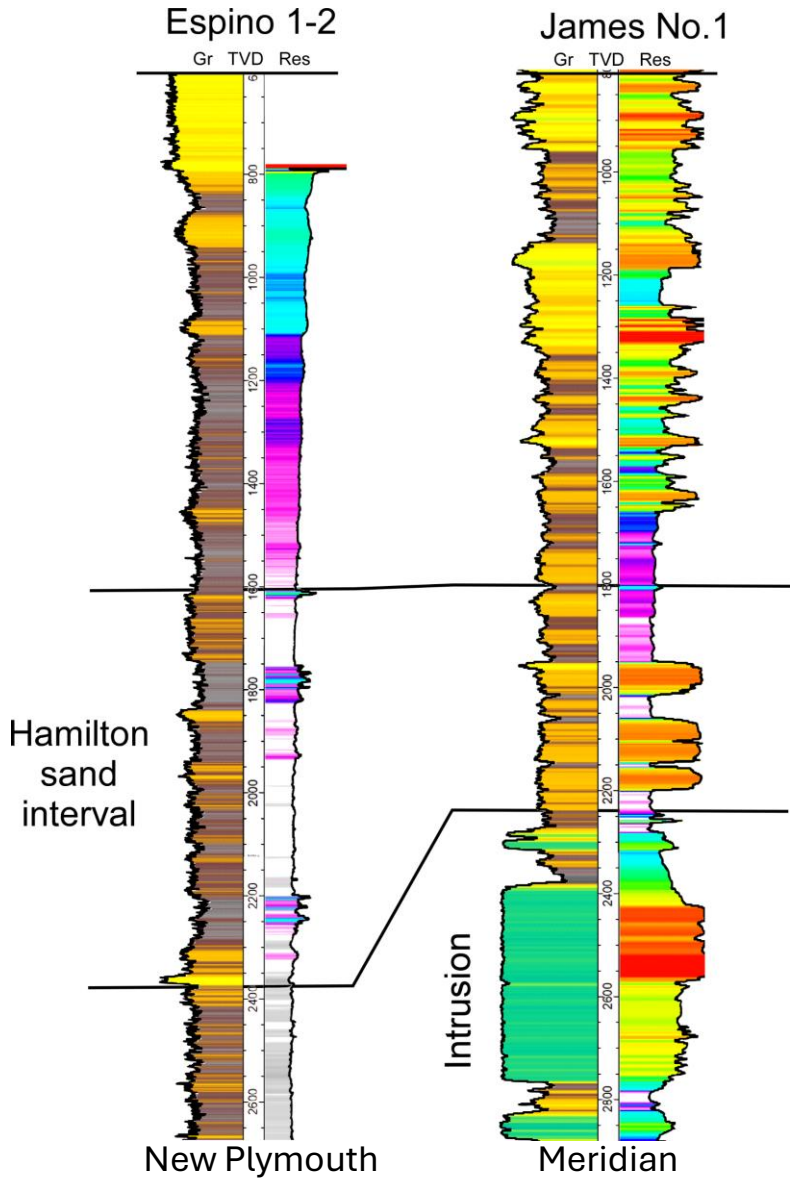
The Hamilton system represents a potential dry gas (mixed biogenic and thermogenic) play in a shallow geological setting, which may allow for cost-effective development with minimal infrastructure requirements.

Challenges

- Reservoir gas volumes in Payette County are relatively small and sub-economic under current market conditions.
- Reservoir quality is poor, which limits productivity.
- Potential for near-term development is unlikely without further supporting data or improved market conditions.

Upside Potential

- Existing well data suggests that the Hamilton sands thicken toward the south (Canyon and Ada Counties), which could lead to larger commercial-scale gas volumes.



Southern Basin-Summary

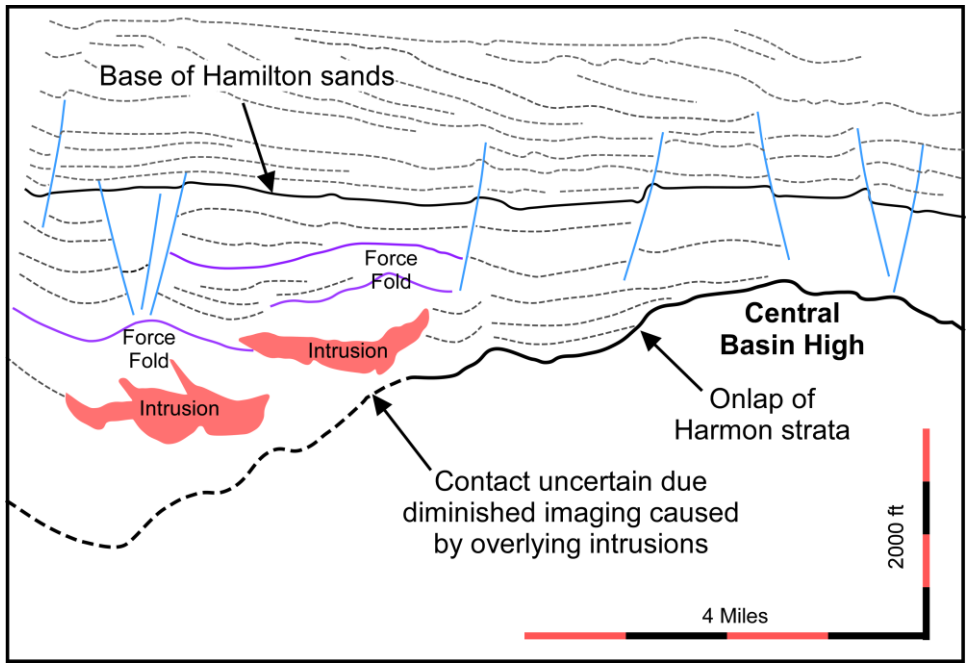
Vintage 2D seismic data reveals the presence of intrusions and force-fold structures in the Southern Basin, suggesting the potential for an atypical igneous petroleum system.

Challenges:

- The basin remains undrilled, and no well data currently exists to confirm the presence of viable reservoir or source rocks.
- Without subsurface calibration, key petroleum system elements remain speculative, increasing exploration risk.
- A stratigraphic test well would be required to assess the basin's potential. Until such data is acquired, the play is considered low-potential with high geological uncertainty.

Upside Potential

- Future exploration could be facilitated by hydrogen exploration in the region.



Interpretation of vintage 2d seismic line (IB-17) from the WSRP south of the Central Basin High. Intrusions and related force-fold structures are present within Harmon equivalent strata.

Questions----Thank You!

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Miocene igneous intrusions-WSRP, Idaho