

# Brasil12<sup>th</sup>Round

Oil & Gas Bidding Rounds

## Acre Basin

Raphael Victor Aleixo Vasconcellos

Cintia Itokazu Coutinho



## **Location**

Infrastructure and Operational Conditions

Exploration Overview

Tectonostratigraphic Evolution

Petroleum Systems

Plays

Analogous Exploration Successes

Area on Offer

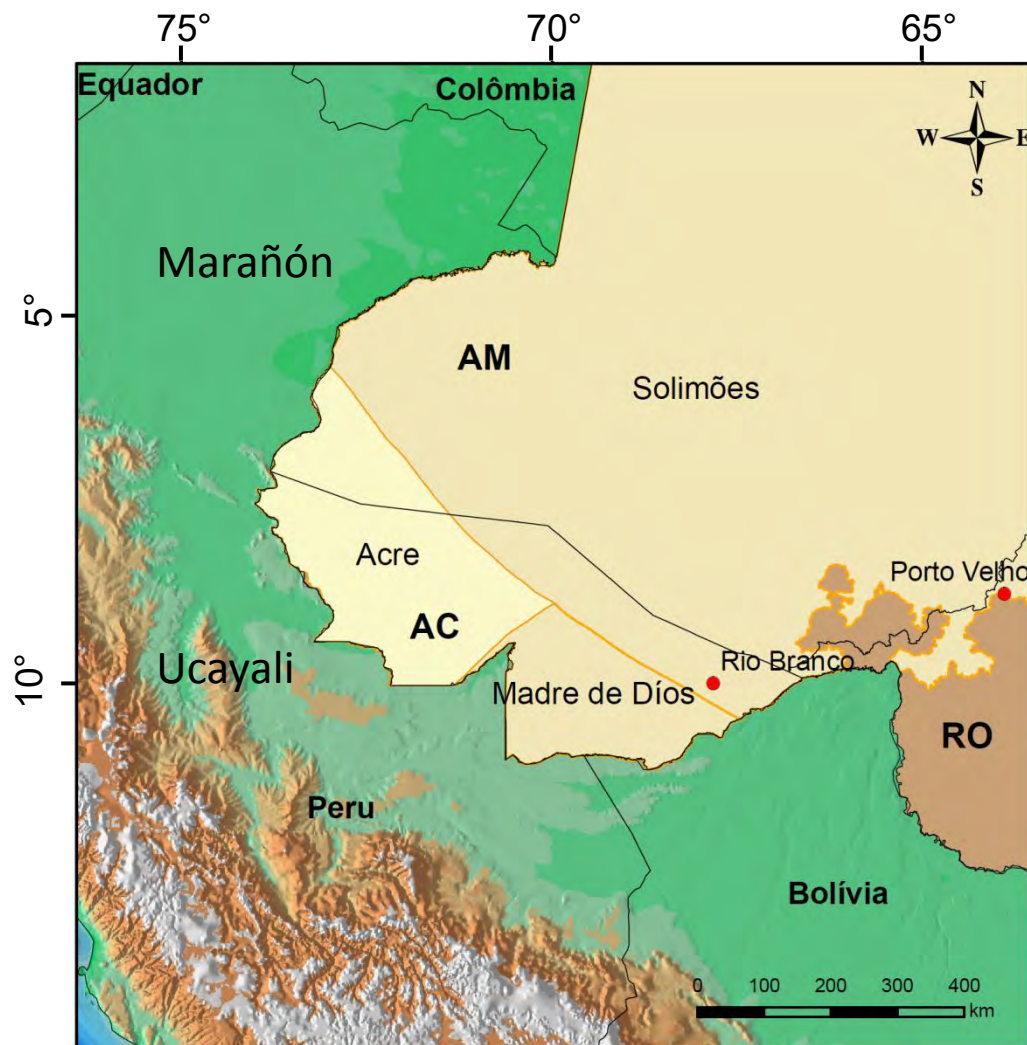
Final Remarks



**anp**  
National Agency  
of Petroleum,  
Natural Gas and Biofuels

**Brasil**  
**12<sup>th</sup> Round**  
Oil & Gas Bidding Rounds

# Location

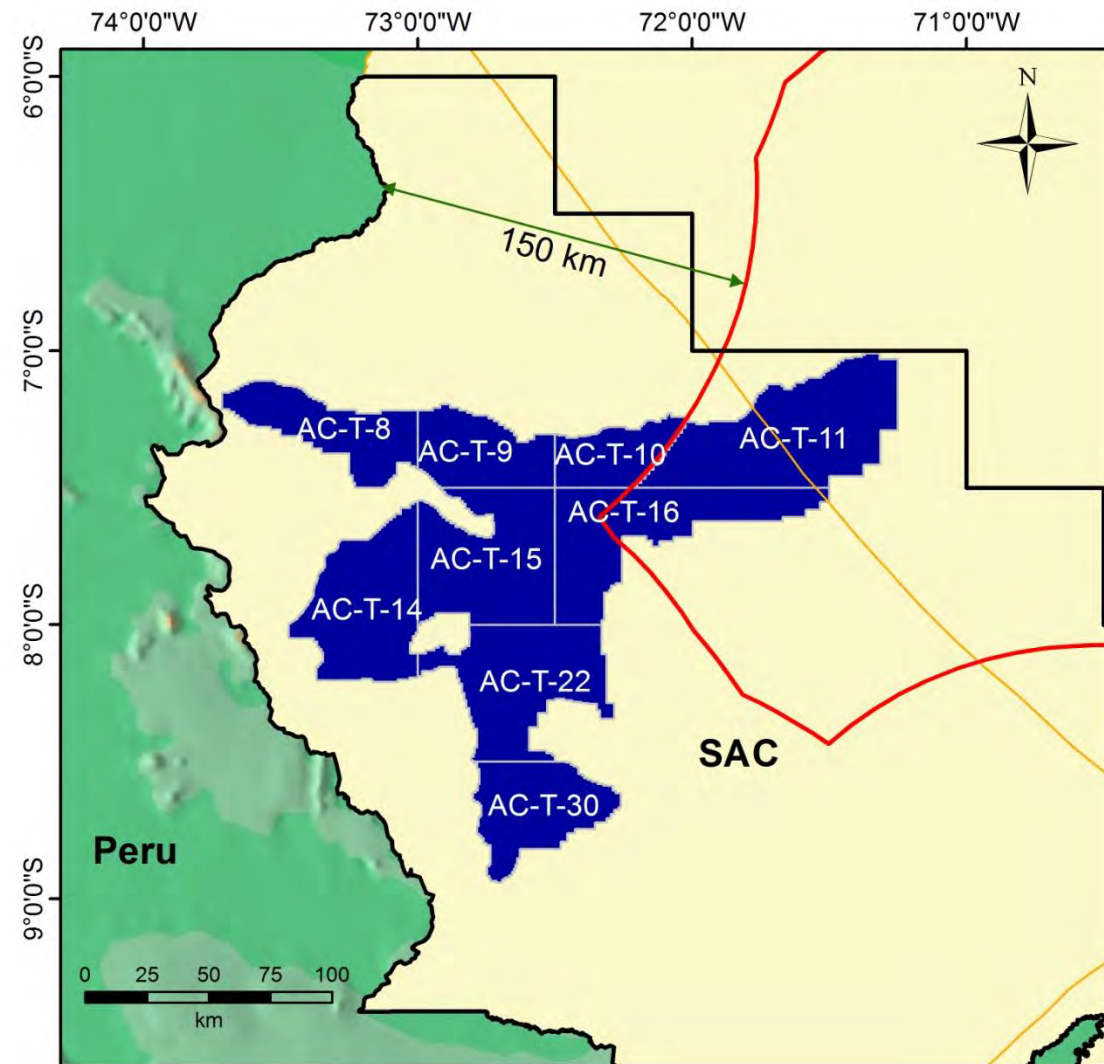


Paleozoic Basin – Tertiary  
Area 97,380 km<sup>2</sup>  
Thickness > 4,700 m

- Capital
- States
- Sedimentary
- Basement



# Sector and Blocks



**Frontier Basin**  
**9 Blocks**  
**Total area: 19,719 km<sup>2</sup>**  
**8 Blocks in Border Strip**

## Legend

-  Sector
-  Blocks
-  Border Strip



Location

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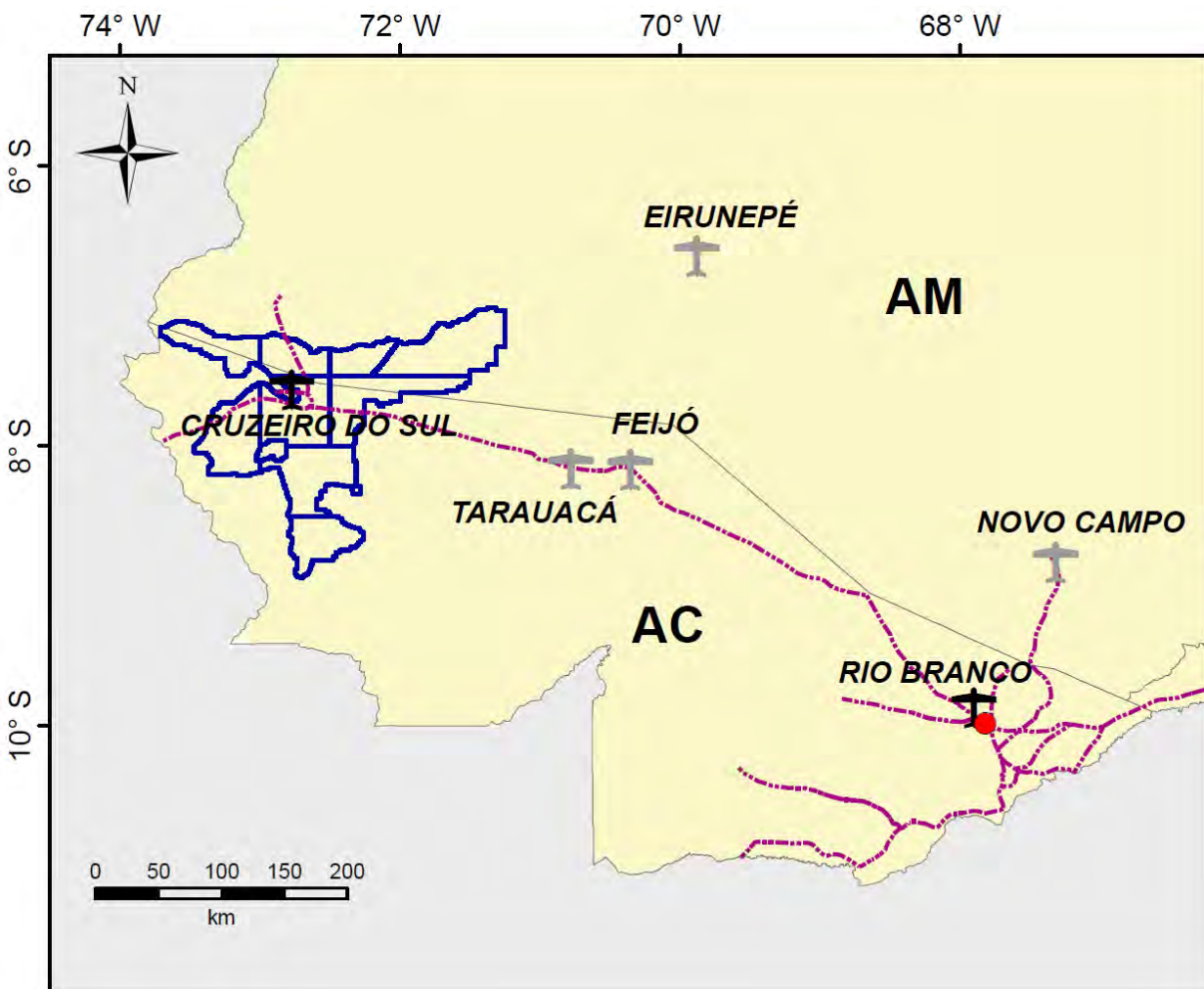
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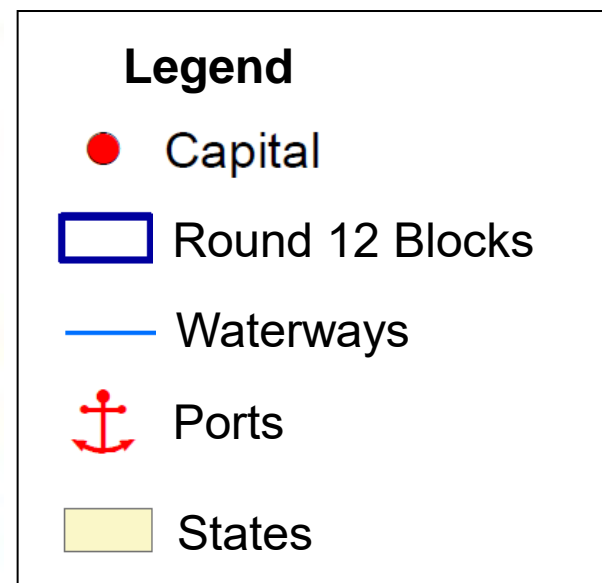
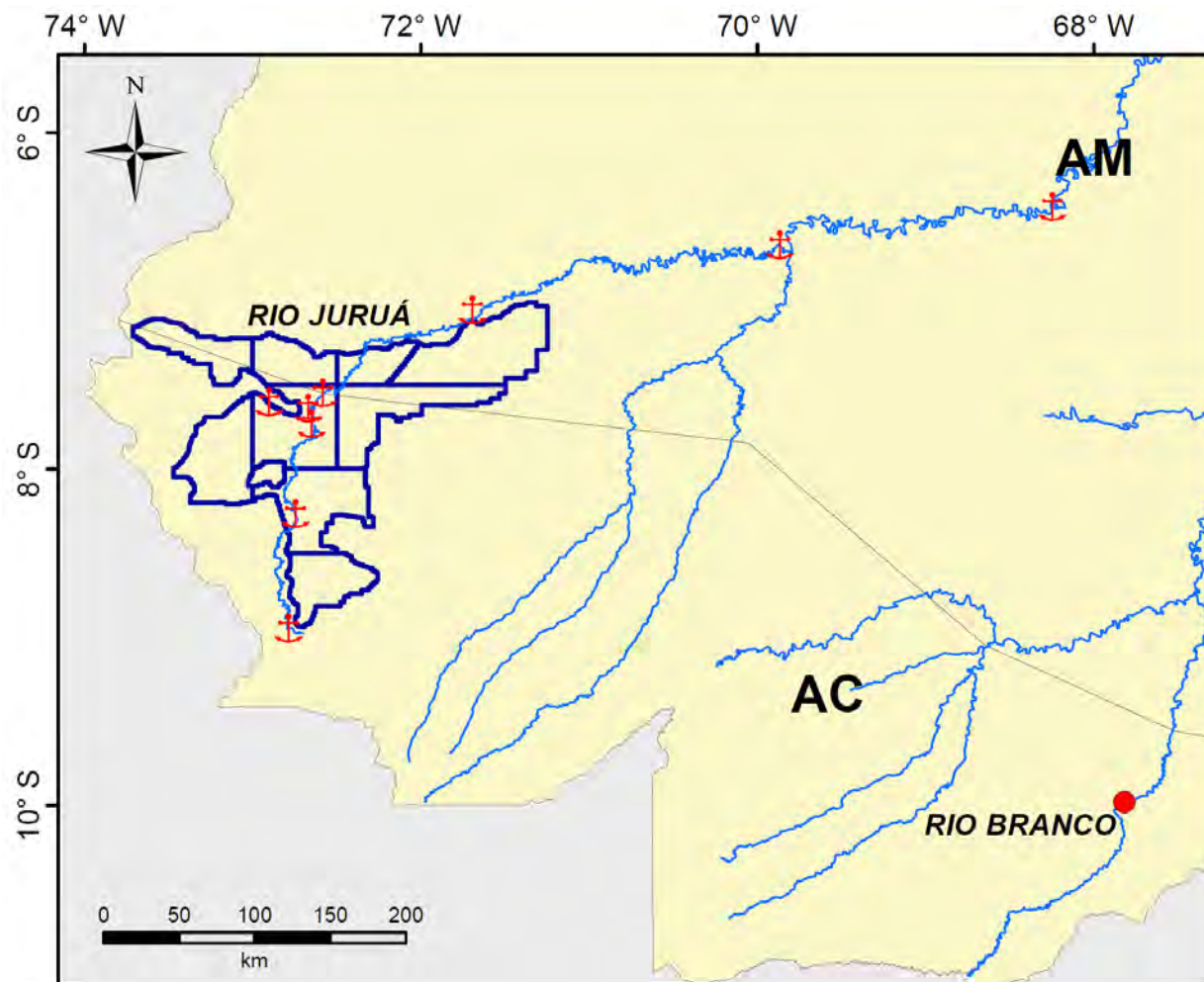
# Infrastructure



## Legend

- Capital
- Round 12 Blocks
-  International Airports
-  Regional Airports
- Roads
- States

# Infrastructure



Location

Infrastructure and Operational Conditions

**Exploration Overview**

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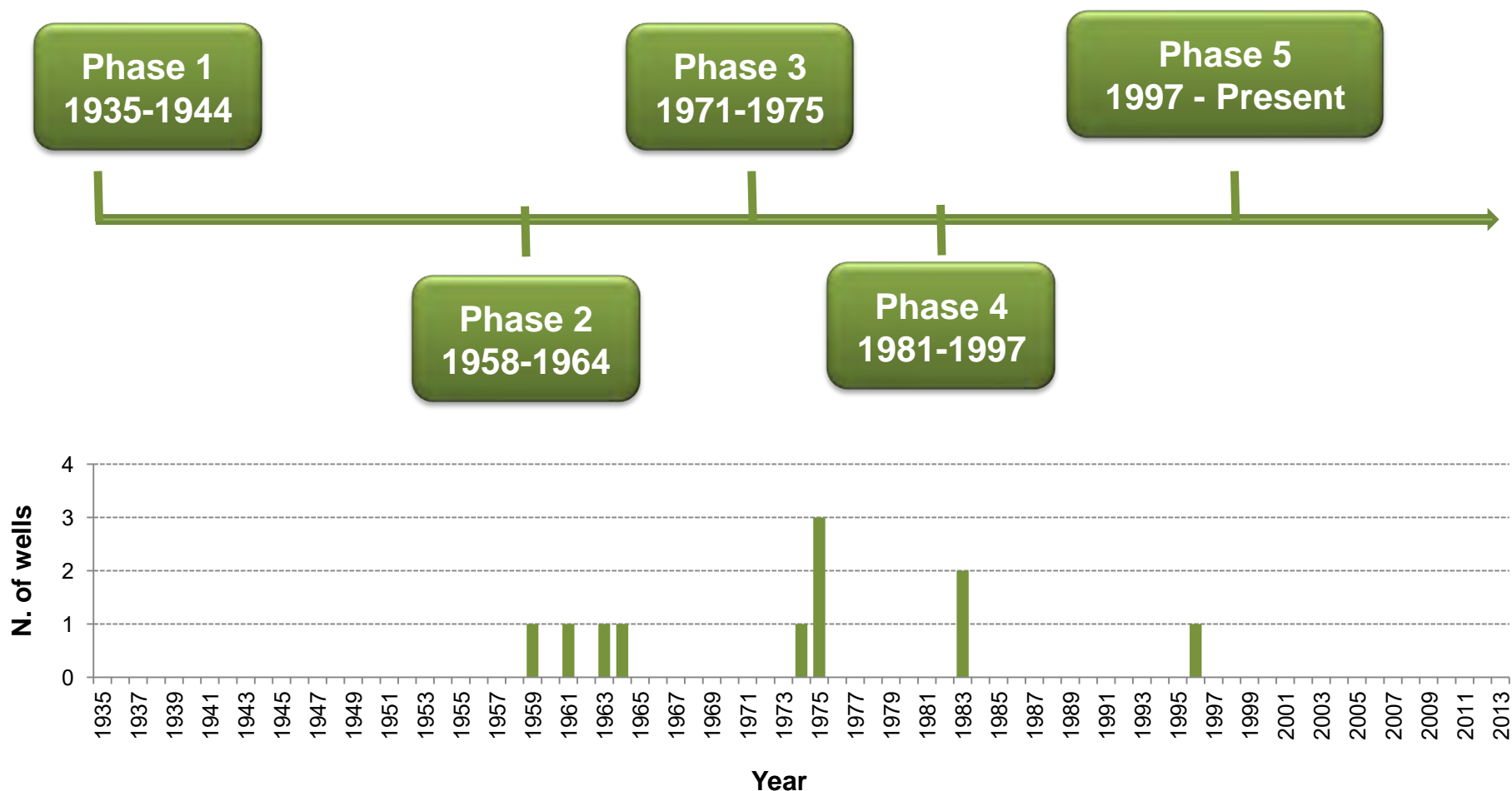
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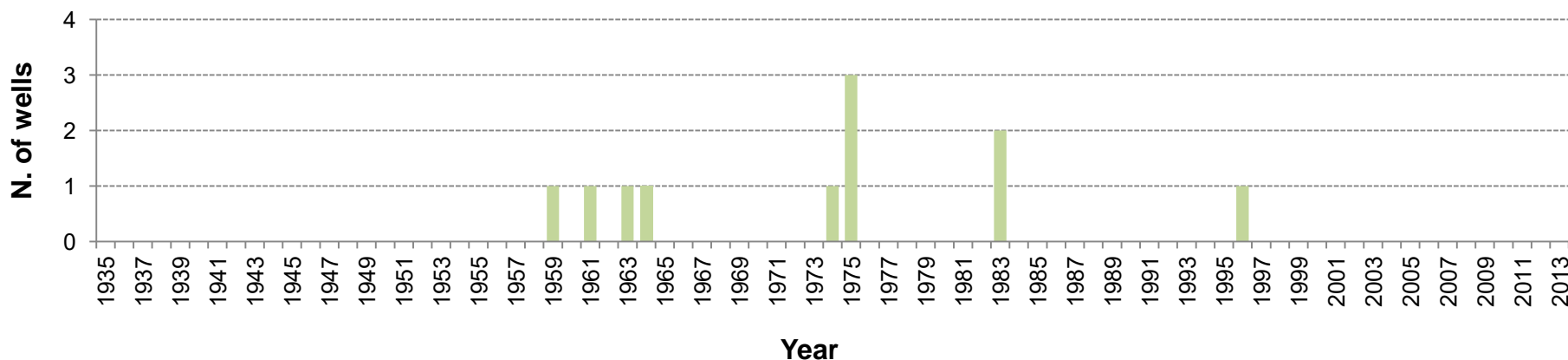
## Hydrocarbon exploration efforts in the Acre Basin: 5 main phases



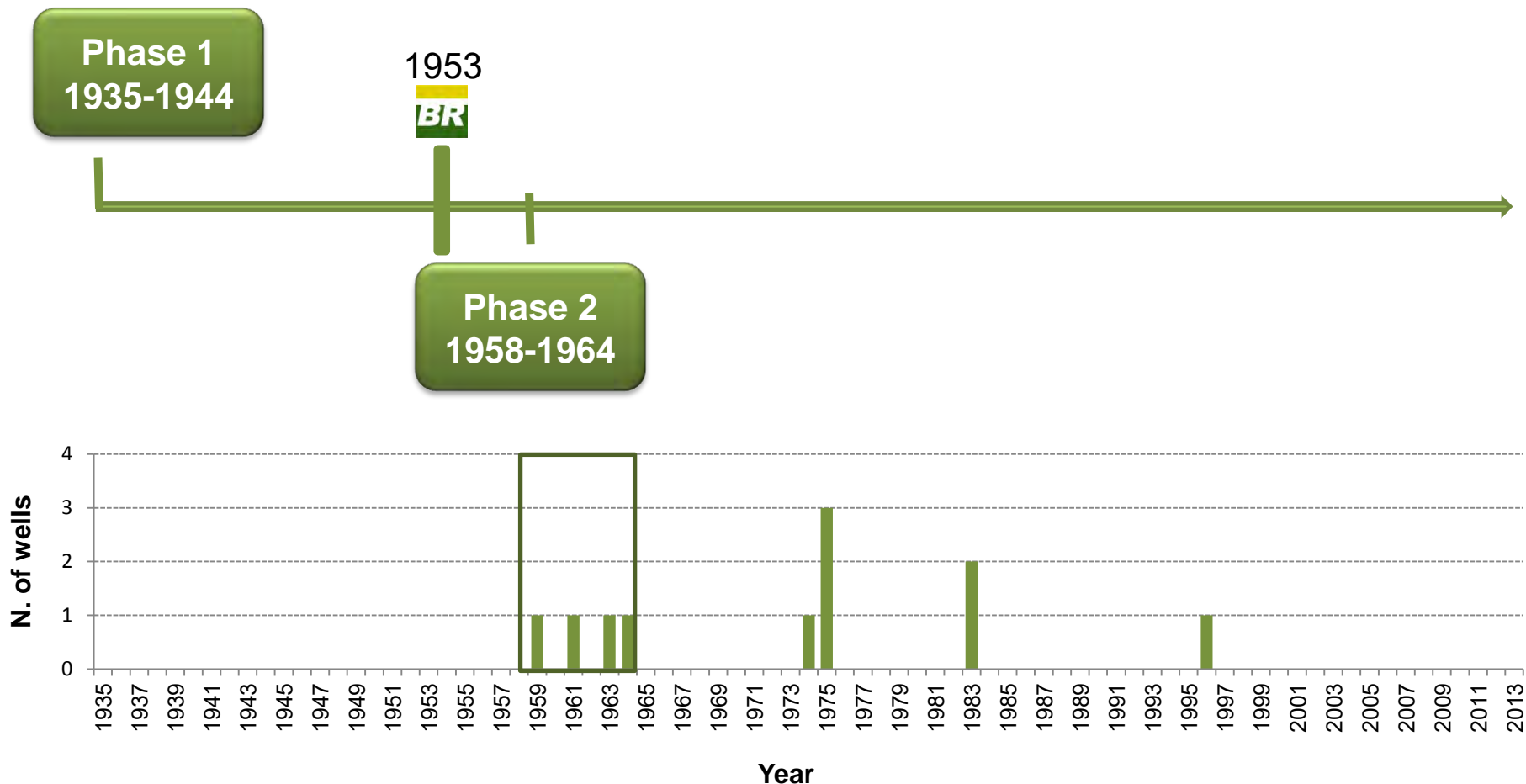
# Exploration Overview

**Phase 1: Geological mapping by National Department of Mineral Production (DNPM) and National Petroleum Council (CNP).**

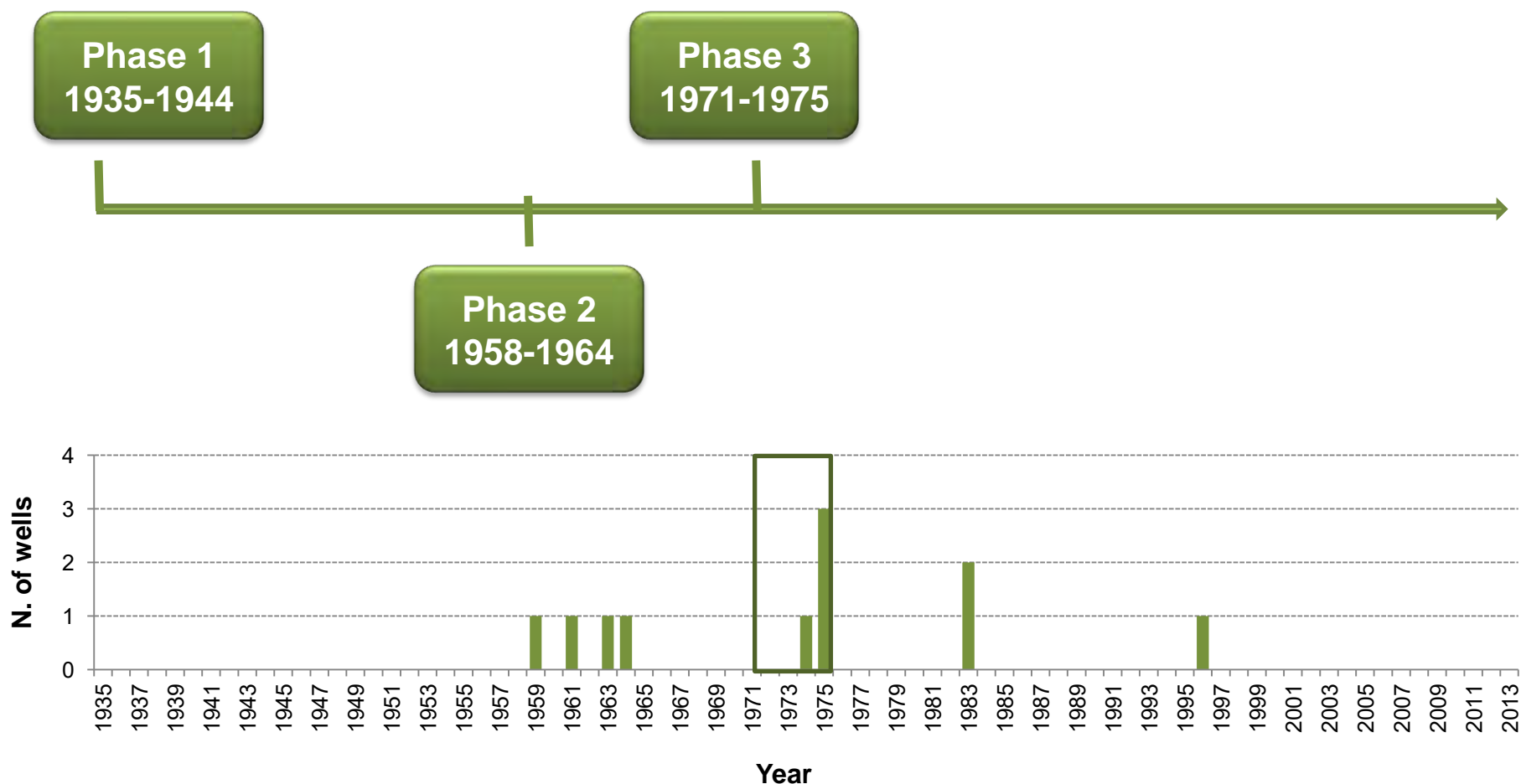
**Phase 1**  
**1935-1944**



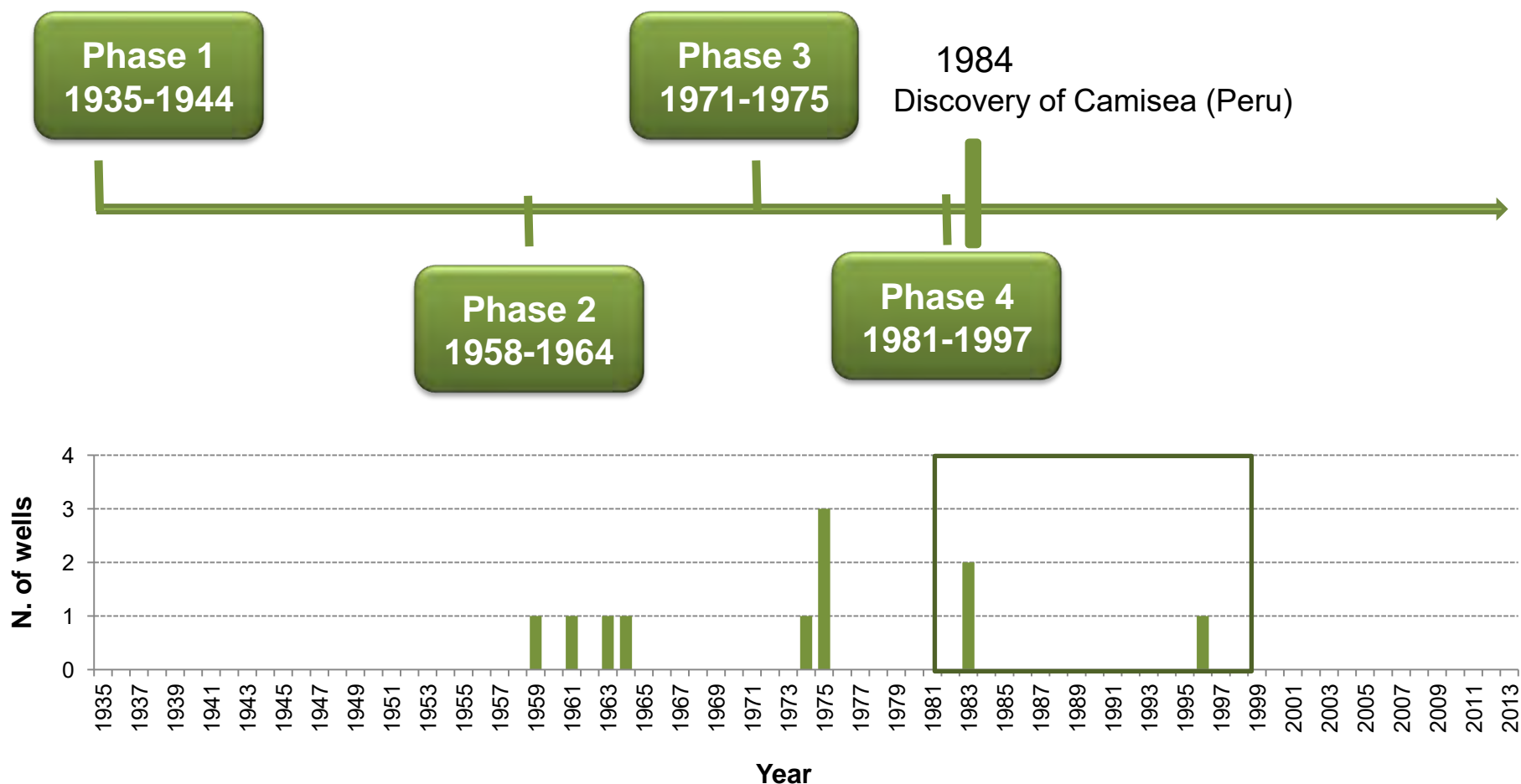
**Phase 2: Petrobras foundation in 1953. After discoveries in Peru, 4 stratigraphic wells drilled by Petrobras. Aerial photography and gravimetric surveys.**



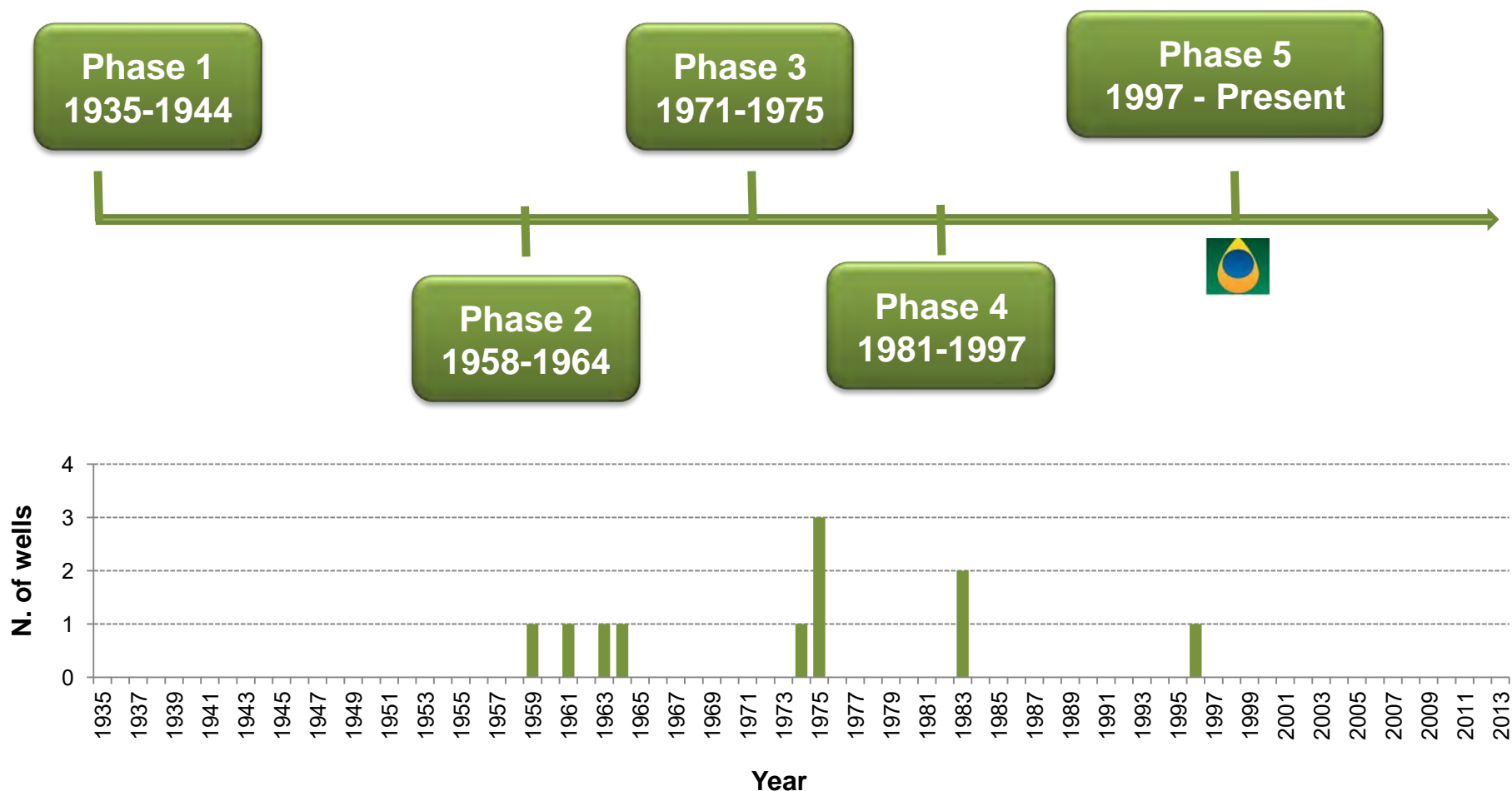
**Phase 3: 4 wildcats wells drilled by Petrobras aiming Cretacic section.**



**Phase 4: 3 wildcats wells drilled by Petrobras, all of them with hydrocarbon shows.**



**Phase 5: ANP foundation. BAC-1 block granted to Petrobras.  
Resume of investments by ANP.**

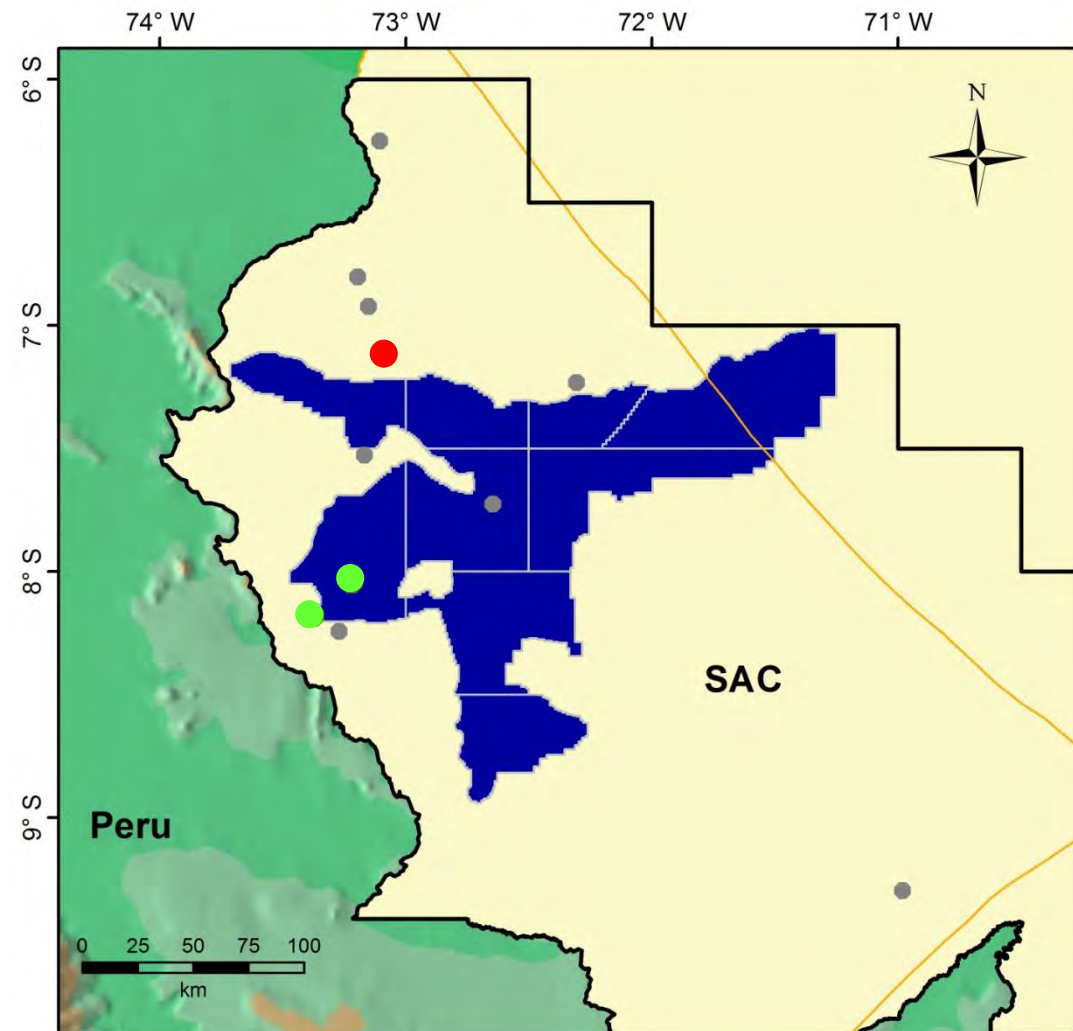




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**12<sup>th</sup>Round**  
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# Exploration Wells



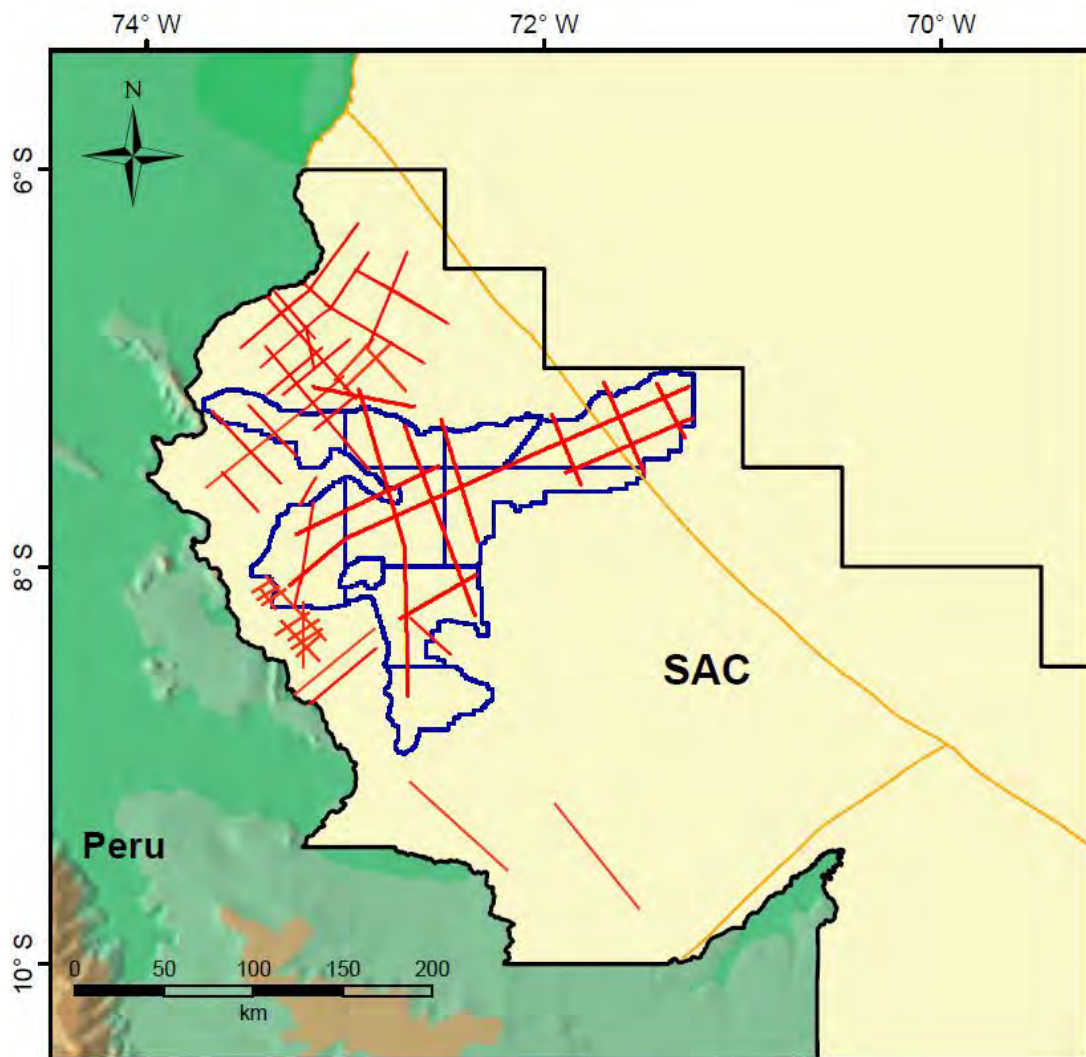
**11 wildcats**

**3 wells with hydrocarbon shows**  
**(1 well in R12 block)**

## Legend





- Gas shows
- Oil shows
- Exploration wells

# Available Data

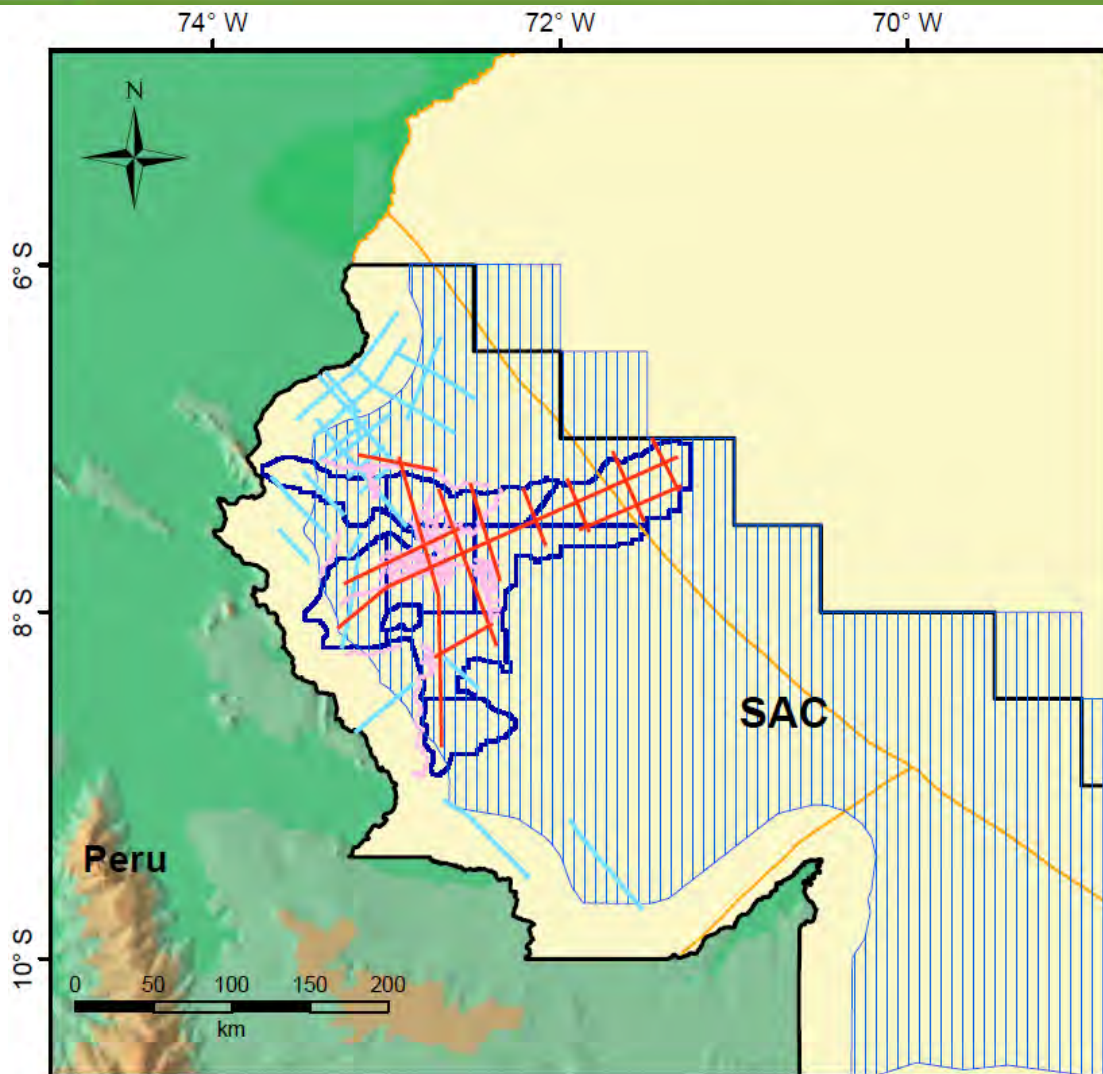


**2D pos-stack seismic:**  
**4,150 km (public)**

- ✓ **Gravimetric survey**
- ✓ **Magnetometric survey**

-  Round 12 blocks
-  Sector
-  2D Seismic
-  Sedimentary basin

# PPA-ANP Investments



**Investments around  
R\$ 81 Million**

## Legend

- Round 12
- Sector
- 2D Seismic
- Geochemical Survey
- Aerial survey
- Processing

Location

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Exploration Overview

**Tectonostratigraphic Evolution**

Petroleum Systems

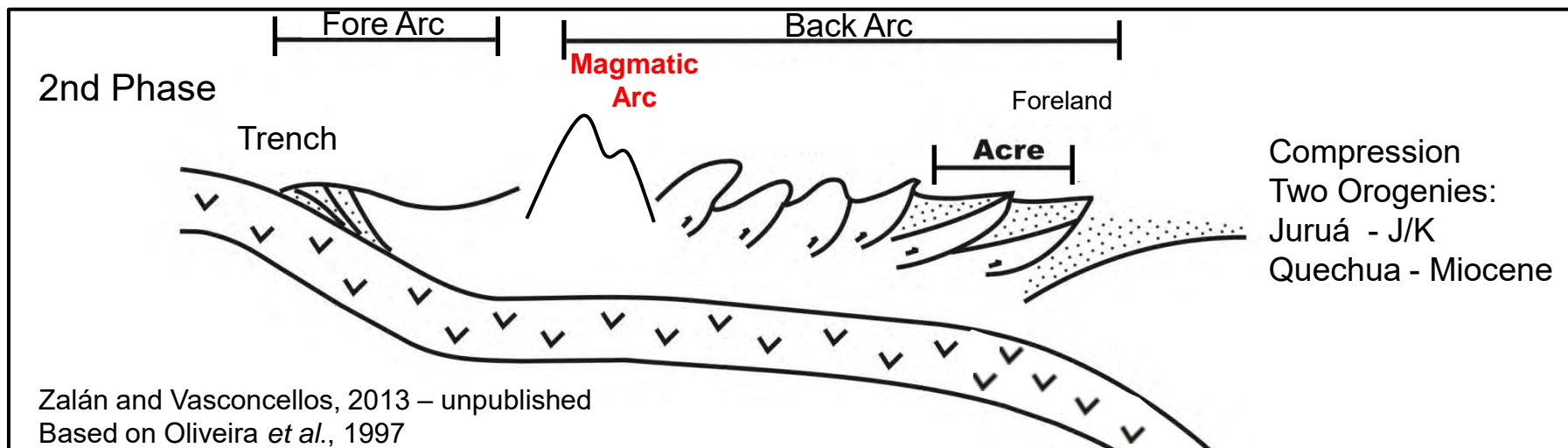
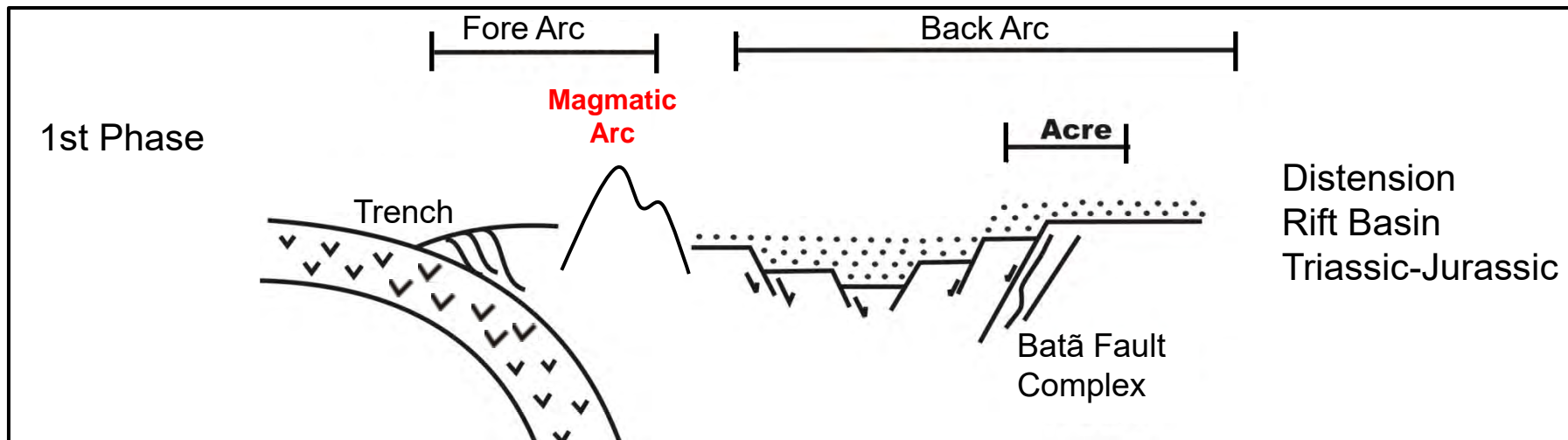
Plays

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# Tectonic Framework

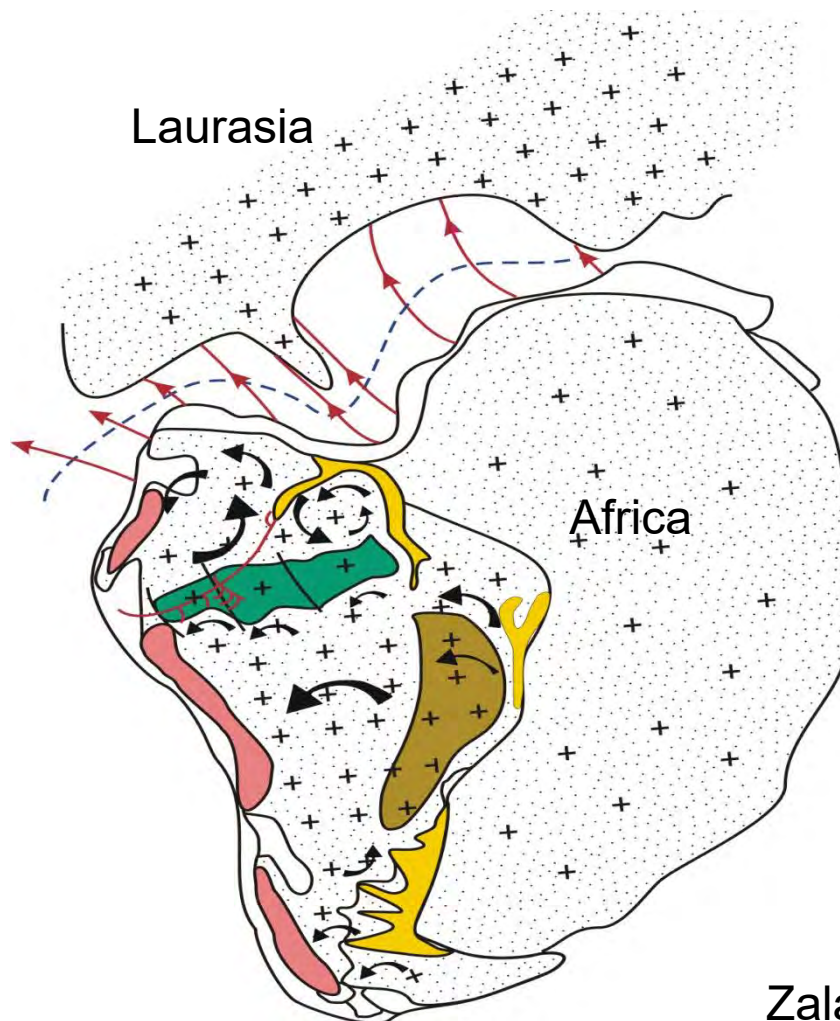




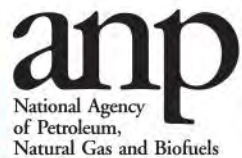
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# Juruá Diastrophism

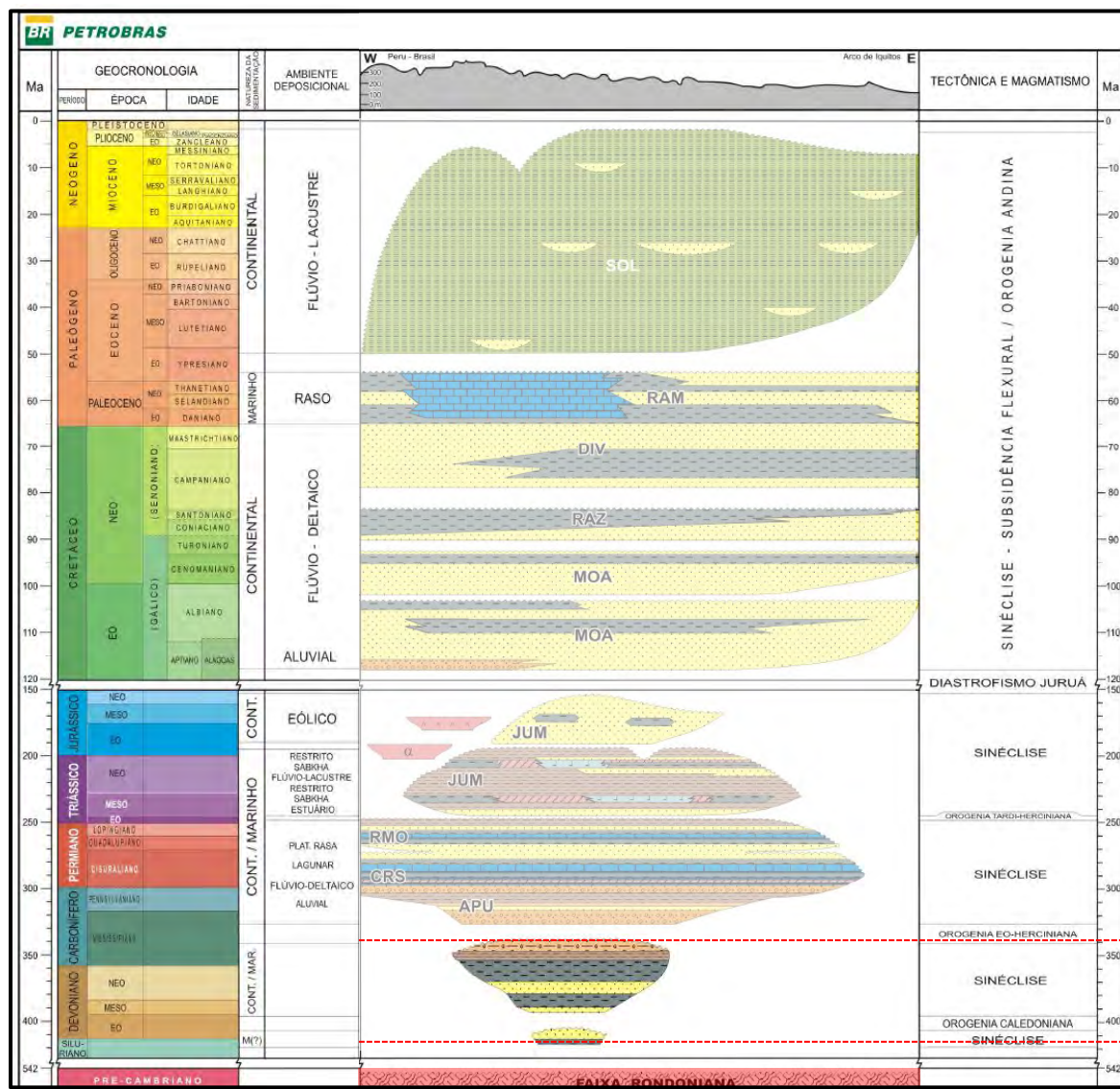


Zalán, 2004



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**12<sup>th</sup> Round**  
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# Stratigraphic Evolution



**Devonian**  
Innominate  
Rift Sequence \*  
marine environment

\* Oliveira *et al.*, 1997.

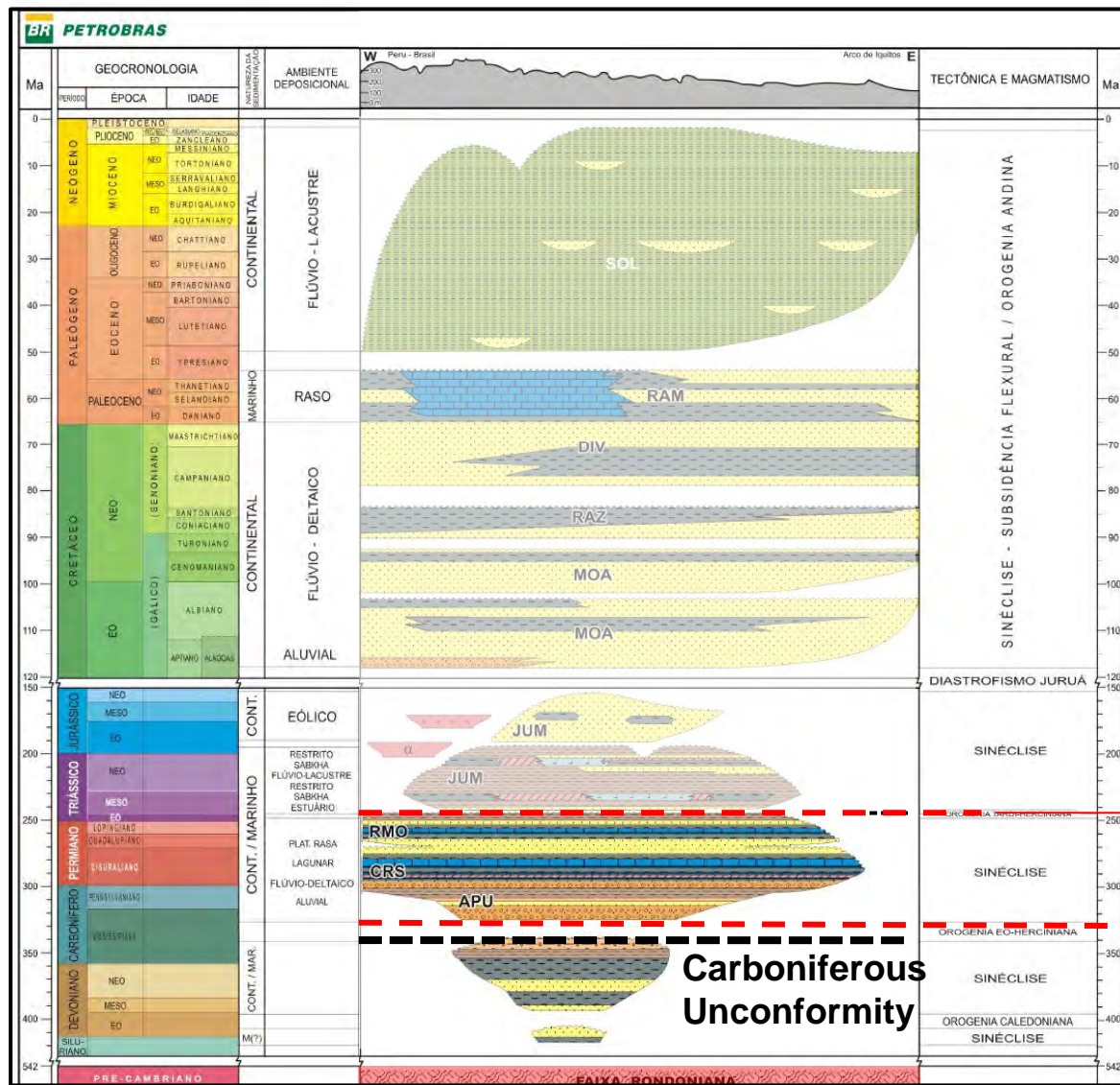
Cunha, 2007



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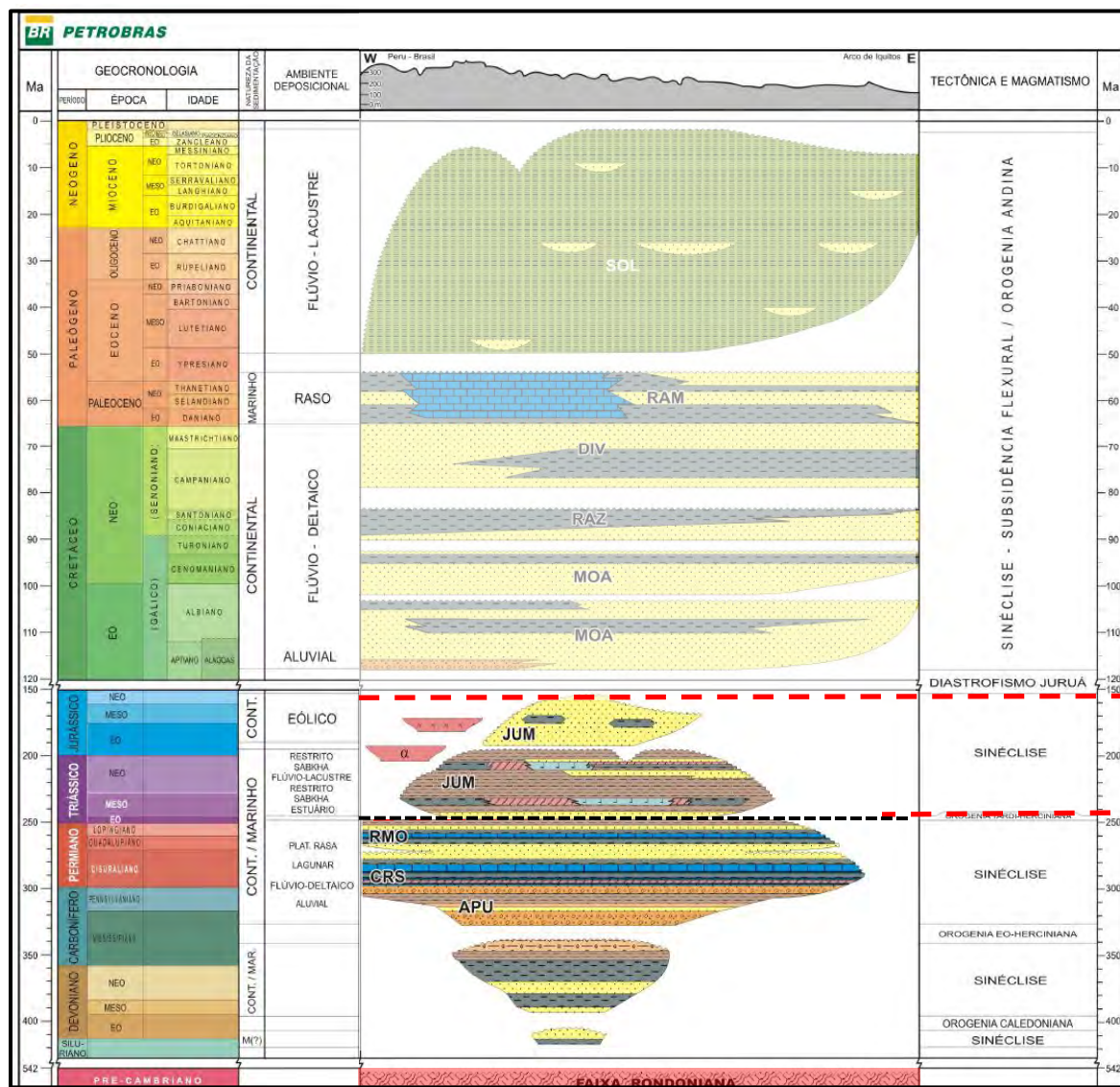
**Brasil**  
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# Stratigraphic Evolution



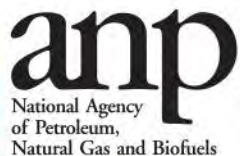
**Permo-carboniferous**  
Apuí, Cruzeiro do Sul and  
Rio do Moura Fm.  
Sediments of shallow water, lagoon,  
fluvial-deltaic and alluvial  
Syncline

# Stratigraphic Evolution



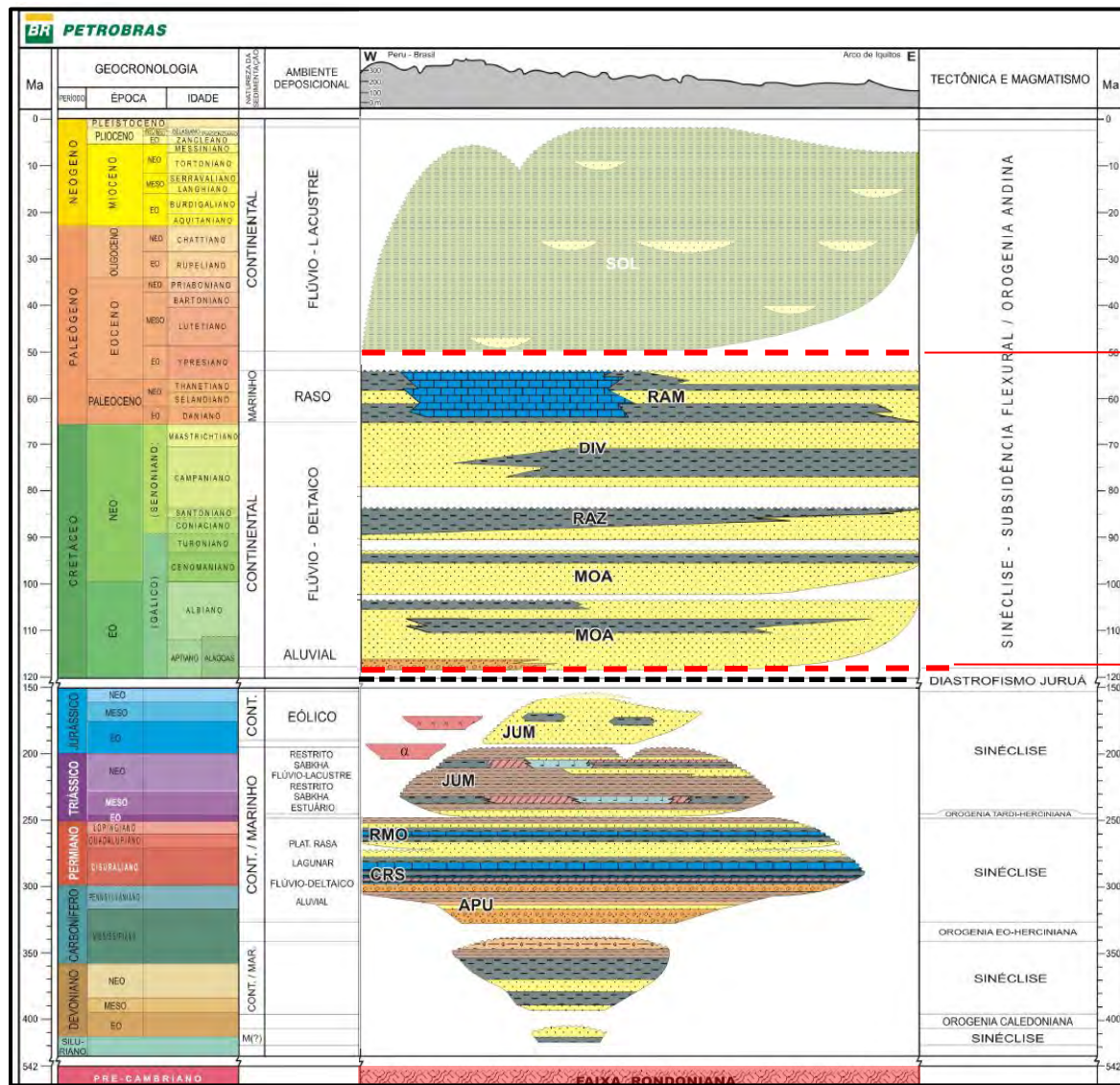
**Jurassic-Triassic**  
Juruá Mirim Fm.  
Sediments of fluvial-lacustrine,  
*sabkha*, restrict and eolian  
Syncline

## Triassic Unconformity



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# Stratigraphic Evolution



**Eocretaceous until Eocene**  
Fluvial-deltaic  
Jaquirana group  
Syncline

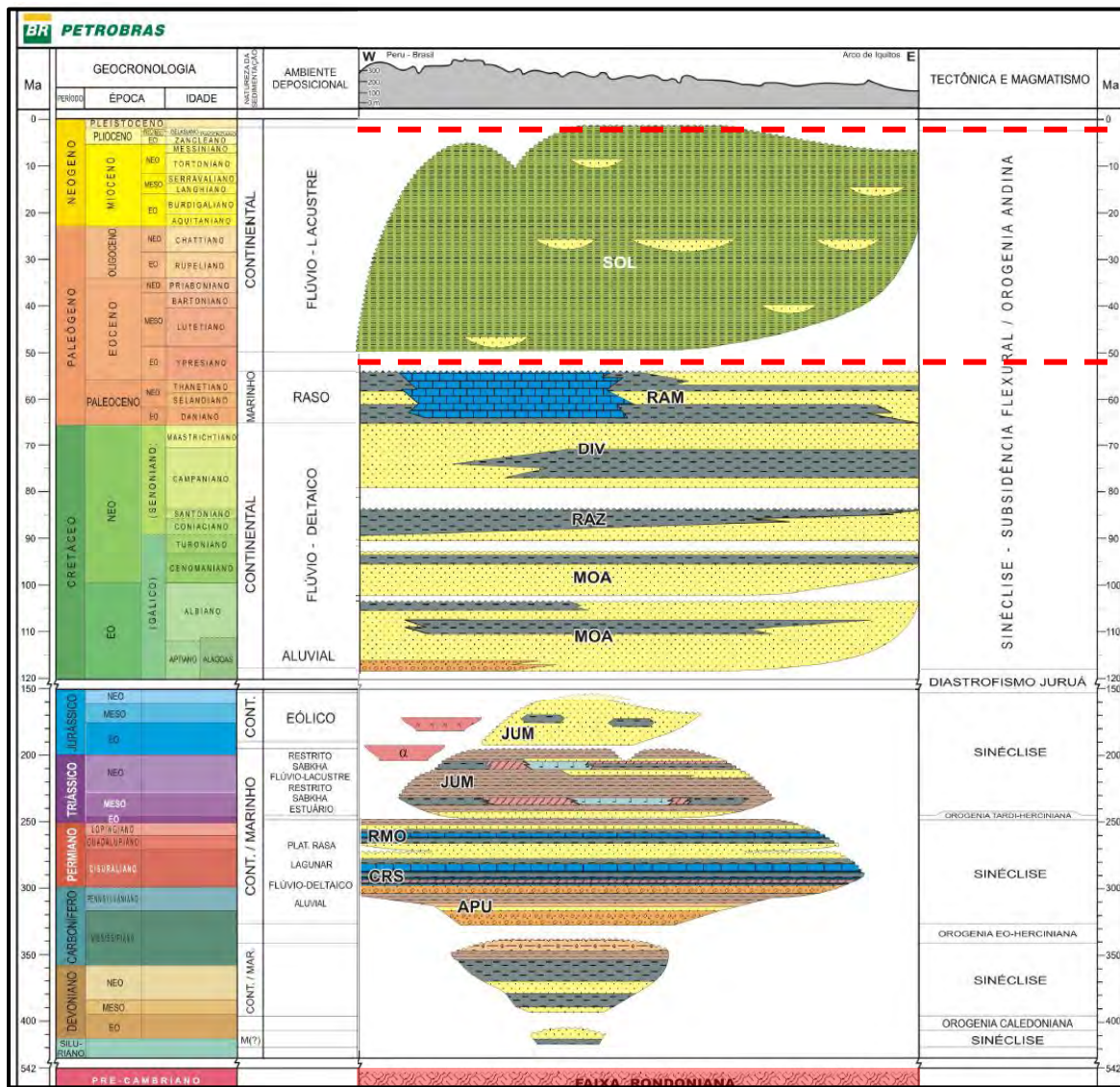
## Juruá Diastrophism



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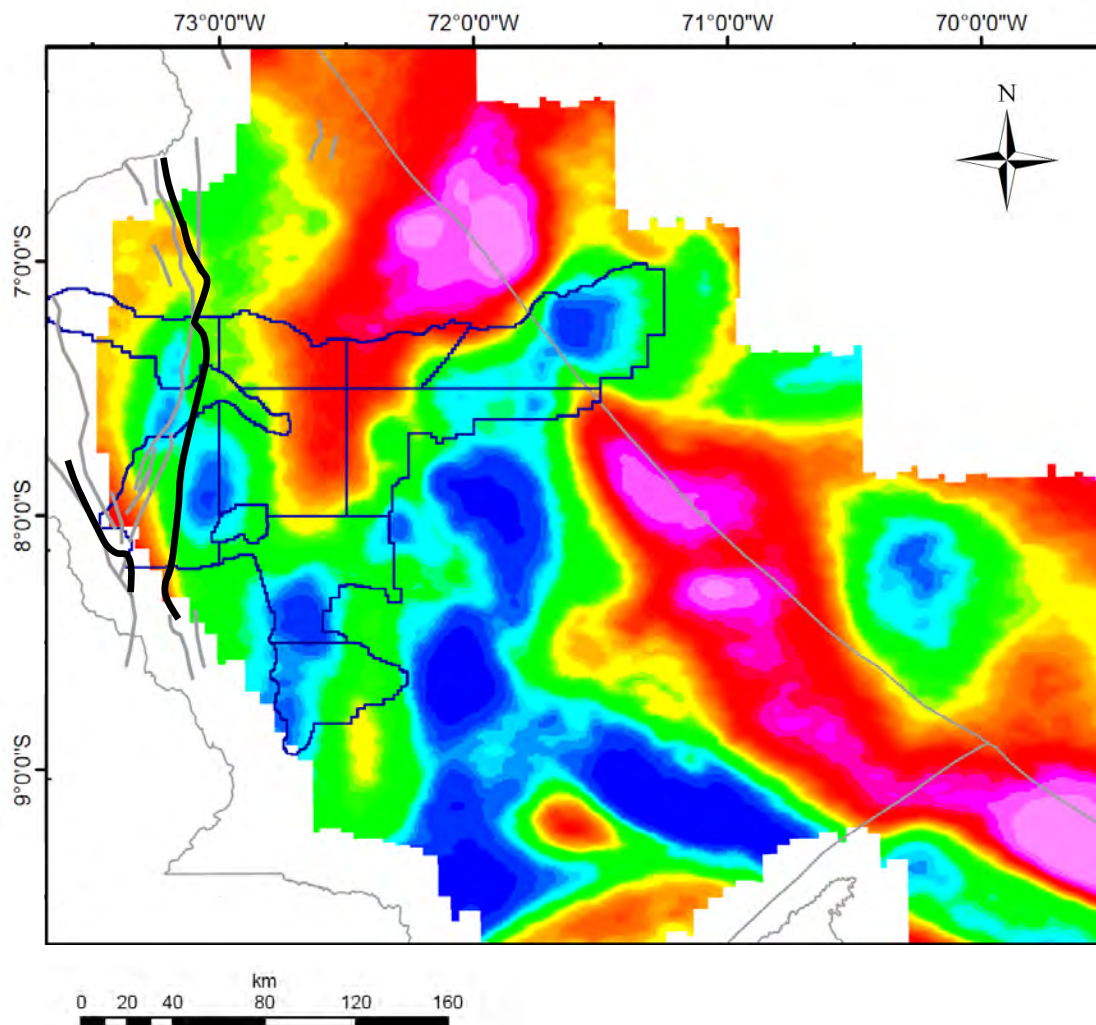
**Brasil**  
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# Stratigraphic Evolution



**Upper Eocene until Pliocene**  
Solimões Formation  
Fluvial-lacustrine  
Syncline/Andean Orogeny




# Gravimetric Data and Structural



## LEGEND



Bouguer Anomaly  
mGal

-  Faults (Oliveira, 1994)
-  Faults in seismic interpretation
-  R12 Blocks

Location

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Exploration Overview

Tectonostratigraphic Evolution

**Petroleum Systems**

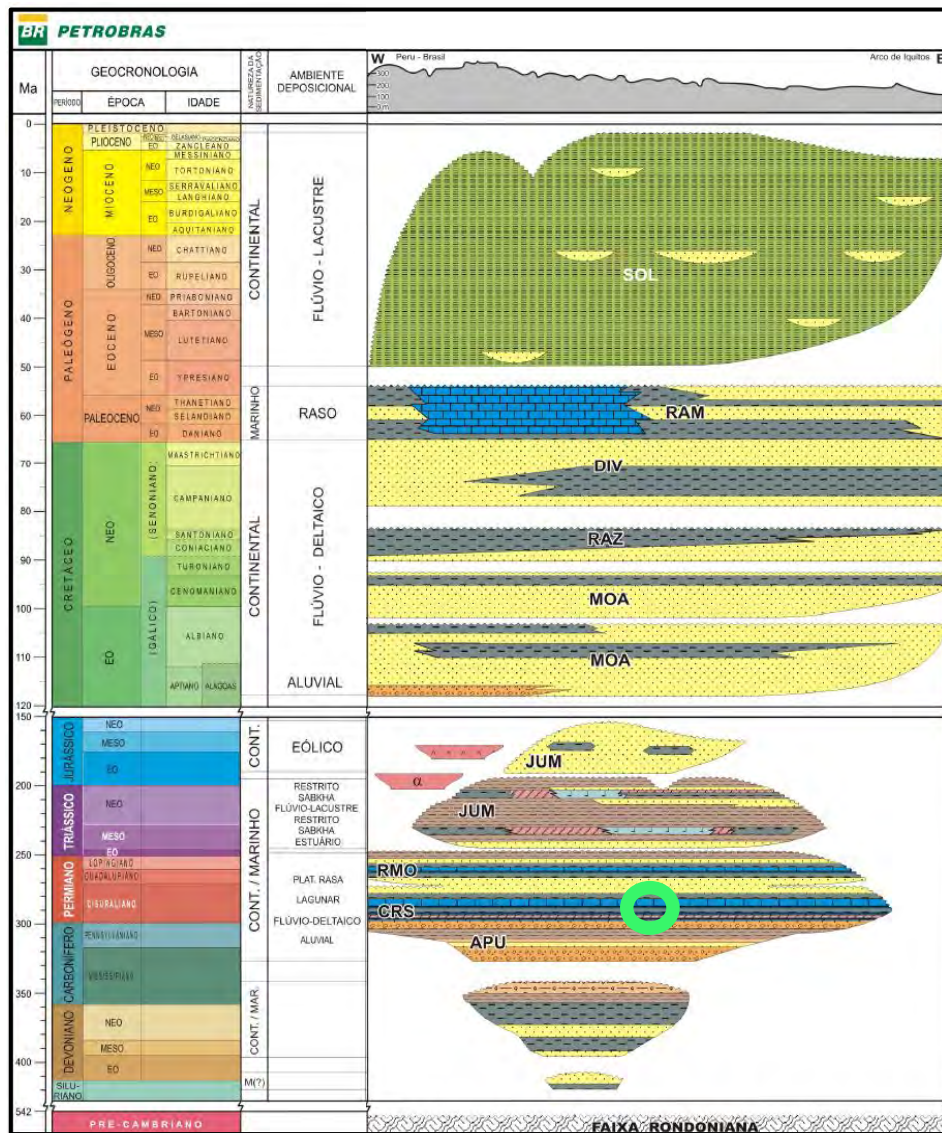
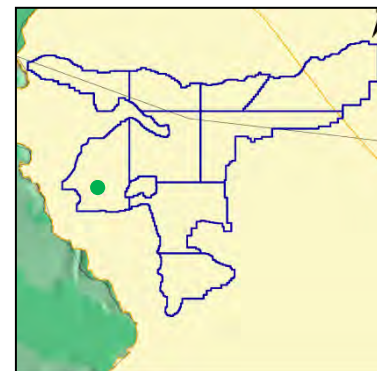
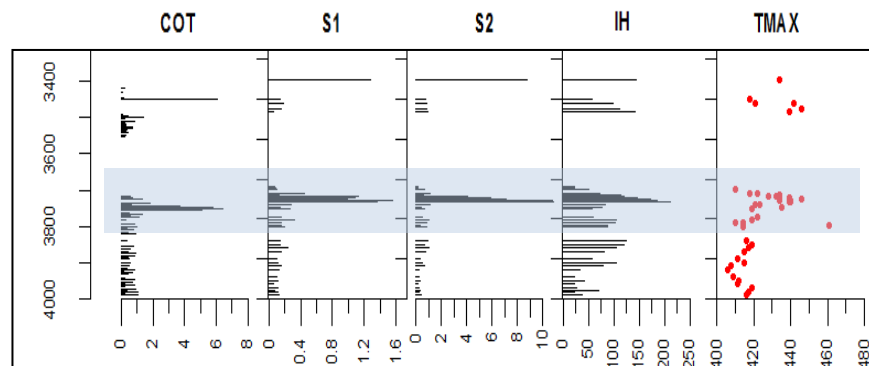
Plays

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Final Remarks

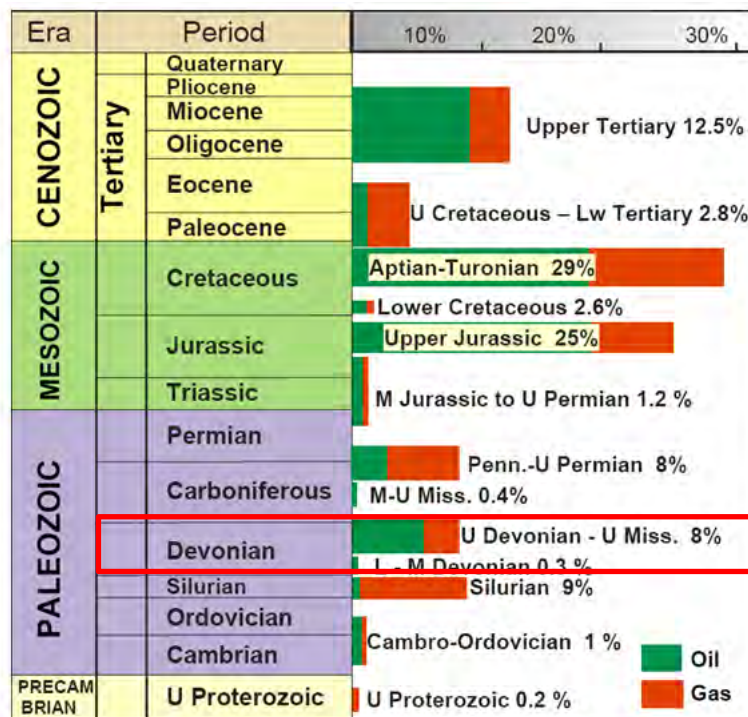
Source Rock:  
Permian – Shales and marls  
Cruzeiro do Sul Fm. – 1 RM 0001 AC  
TOC levels up to 6%



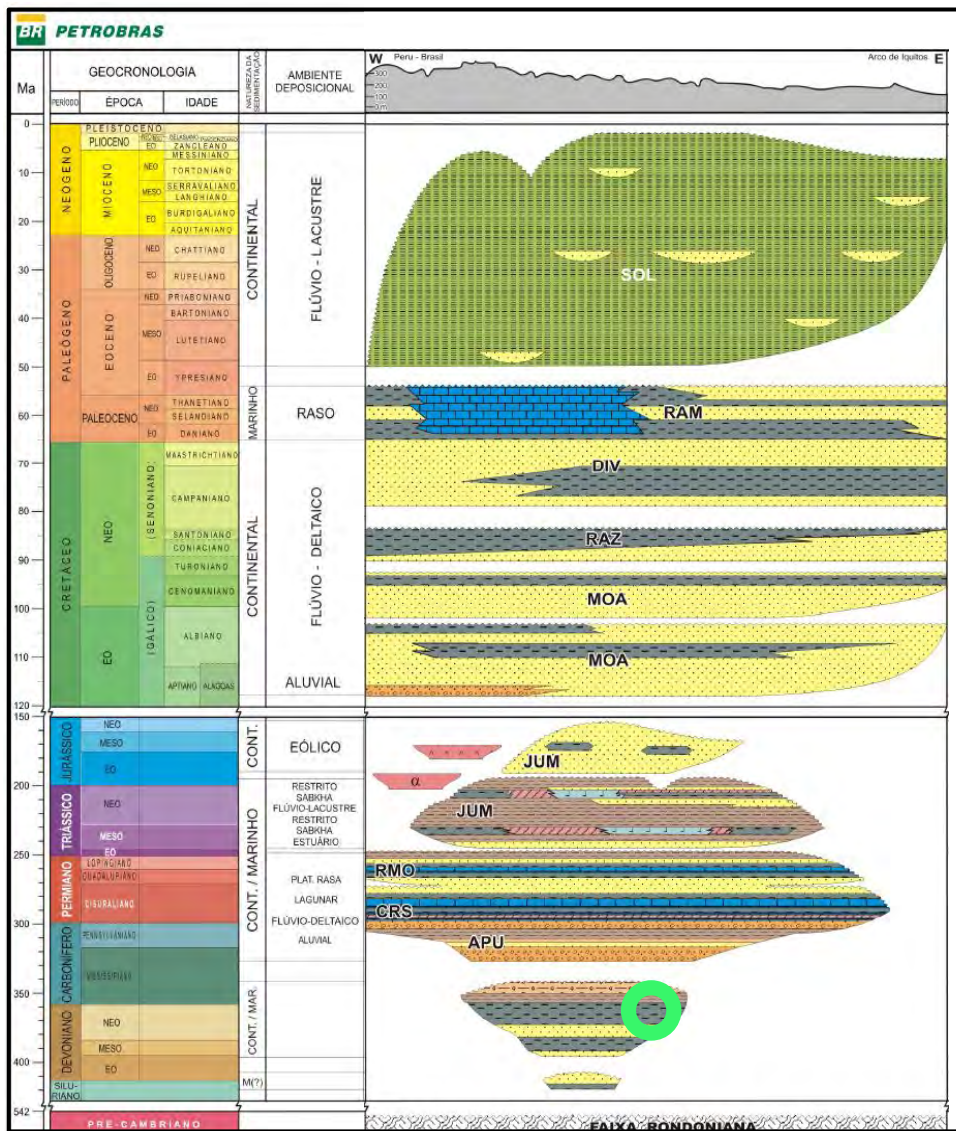
# Source Rocks

Source Rock:  
Devonian Shales

## Main source rocks worldwide:

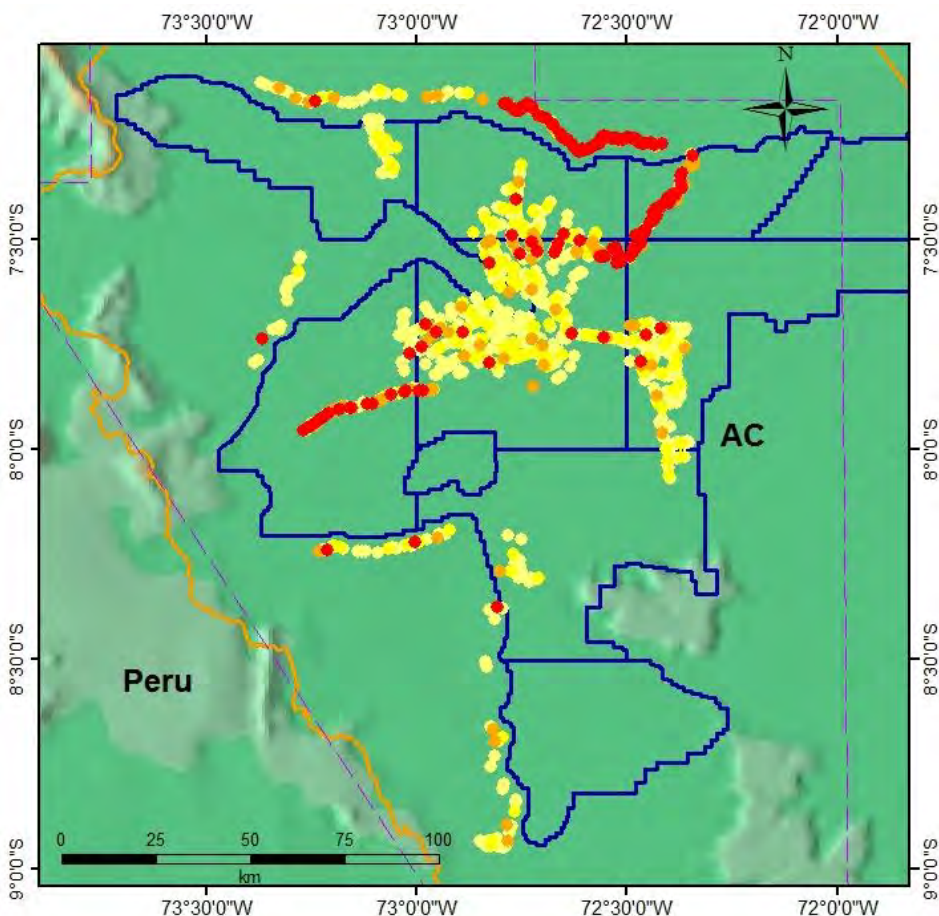


Kendall et al., 2009

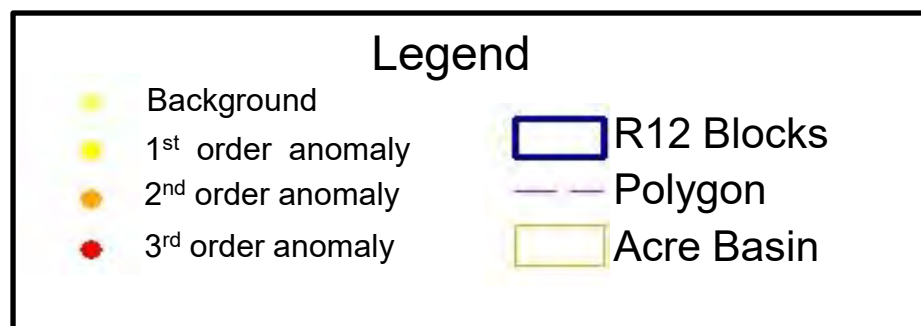
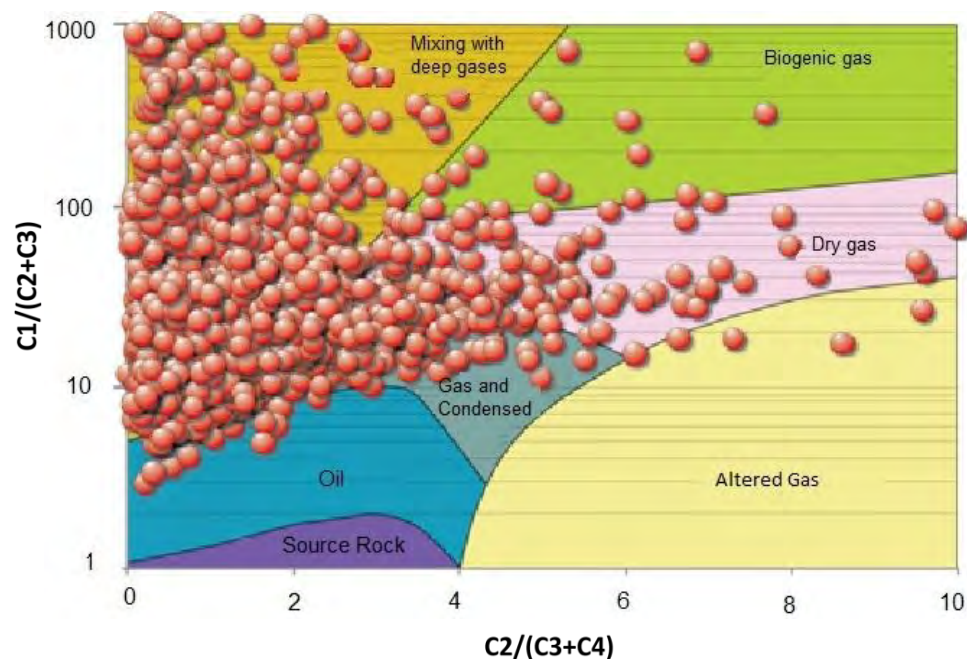


Cunha, 2007

# Geochemical Data



Headspace analysis: C2-C5 concentrations

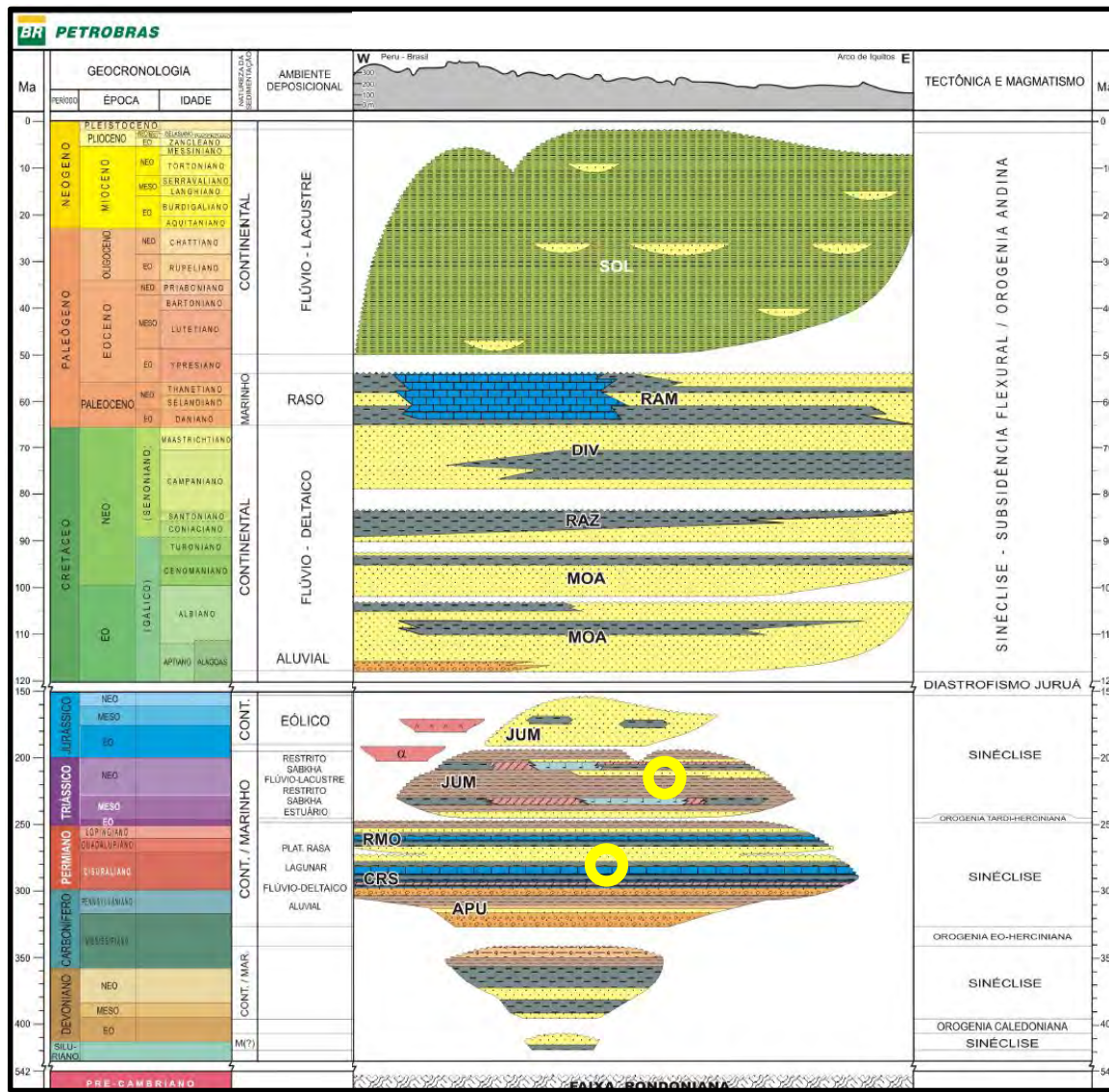




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# Reservoirs



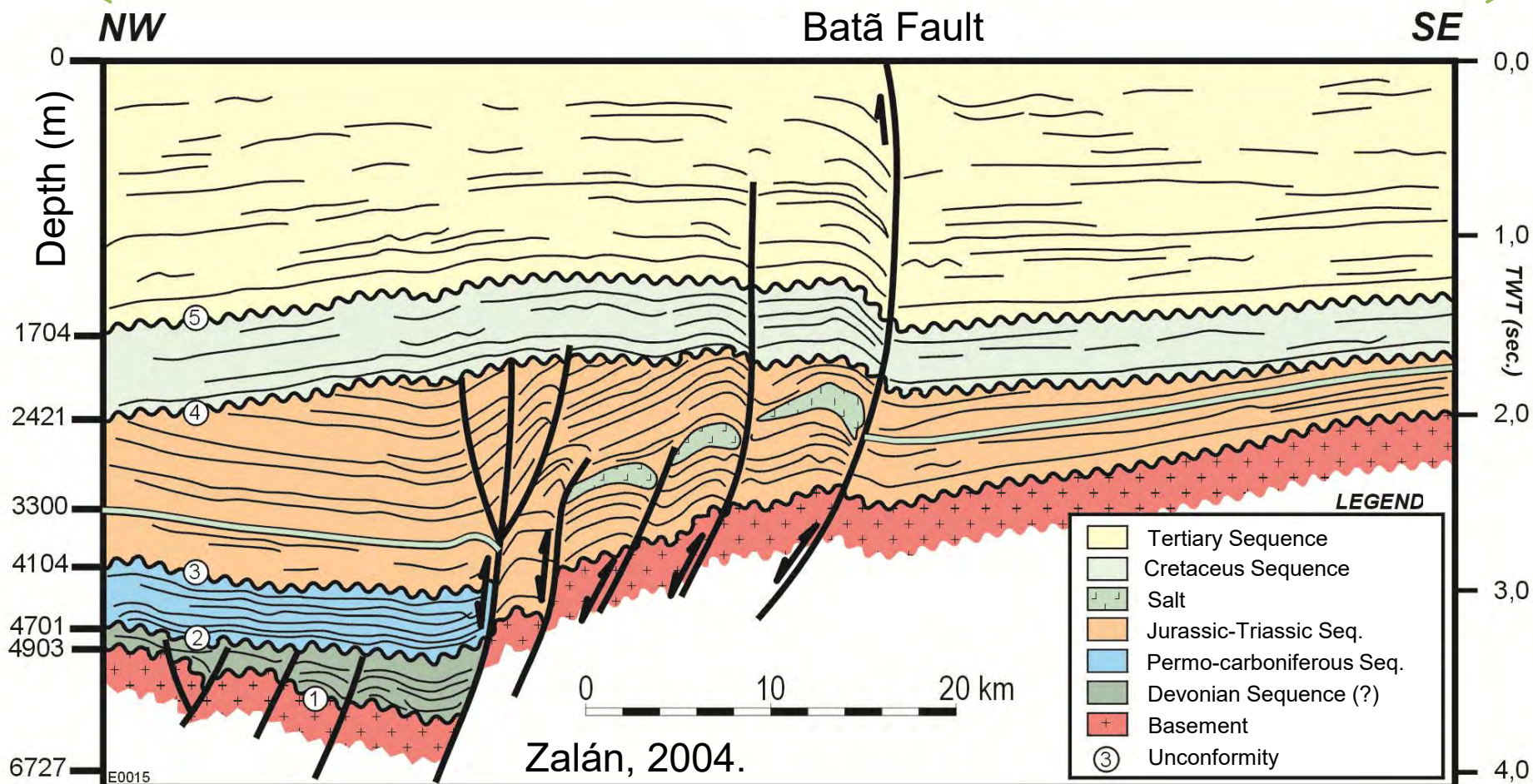
Jurassic-Triassic  
sandstones  
Juruá-Mirim Fm.

Sandstones and  
carbonates  
Permo-carboniferous  
Cruzeiro do Sul Fm.

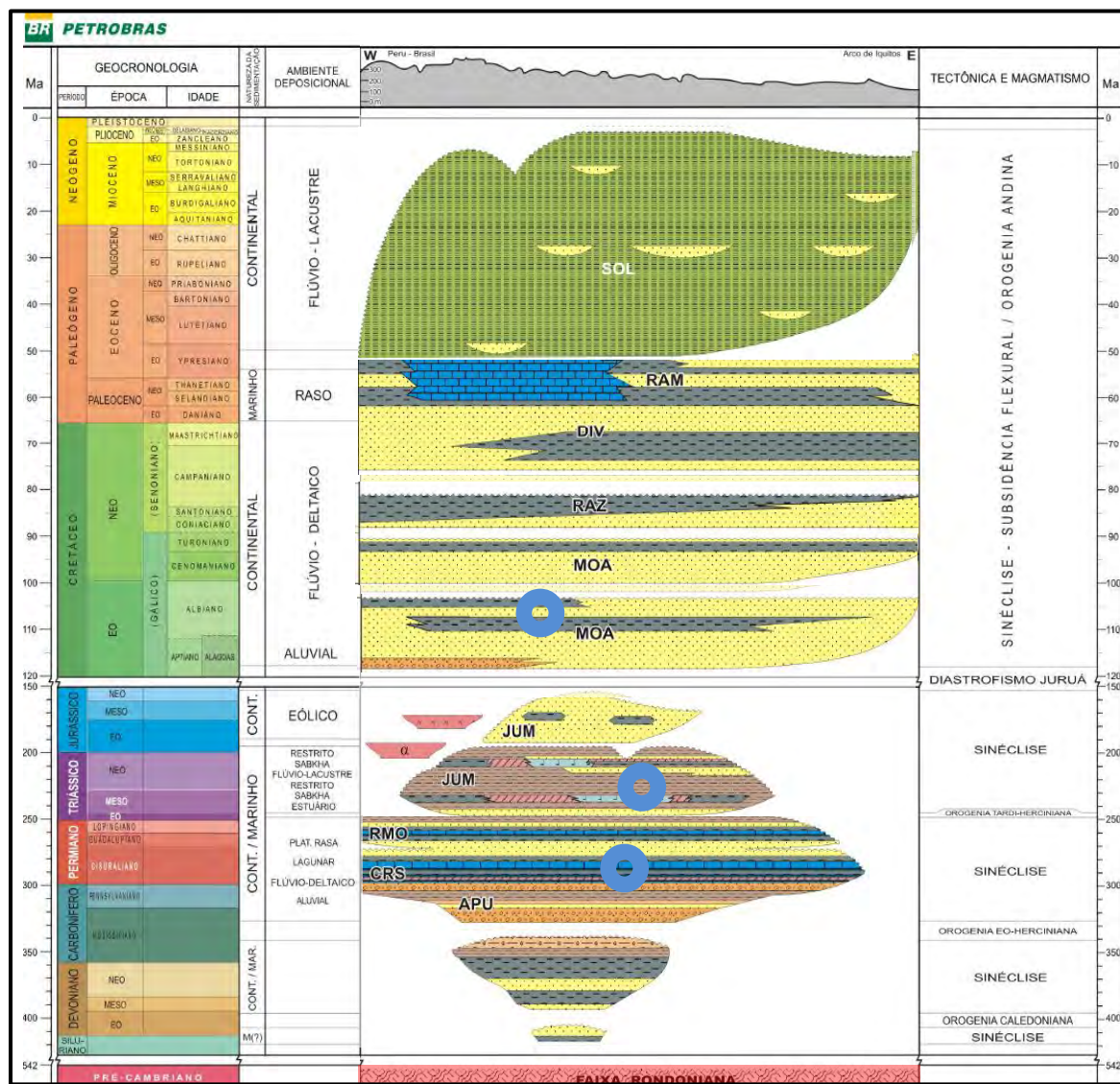
# Migration and Traps

Structural traps

Combined traps



# Seals



Shales - Moa Fm.  
(eventual)

## Anhydrite and Halite Juruá-Mirim Fm.

Shales, marls and  
calcilutites - Cruzeiro  
do Sul Fm.

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**Plays**

Analogous Exploration Successes

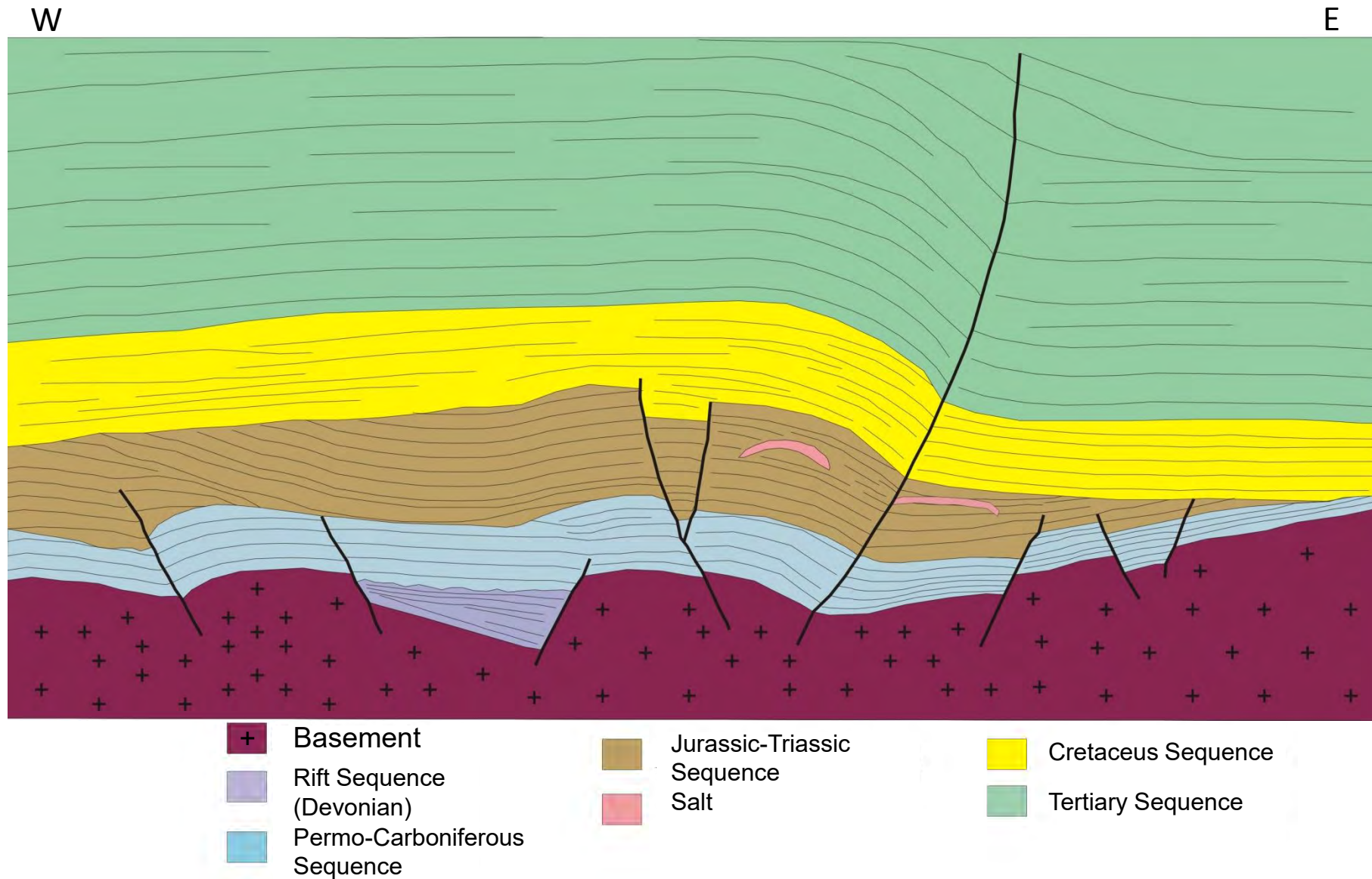
Area on Offer

Final Remarks

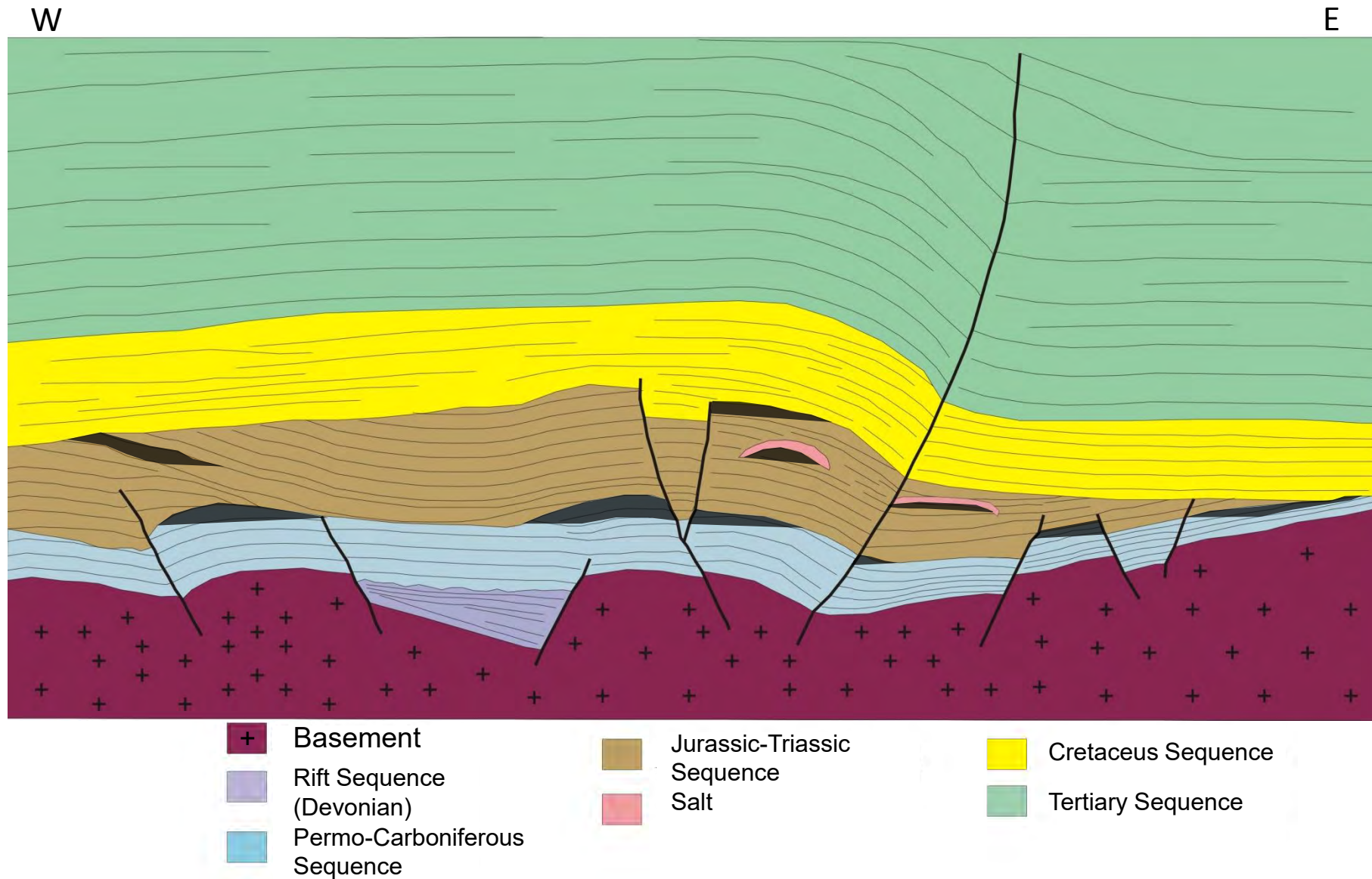
# Plays Summary

PLAYS	FORMATION
Permian Sandstones and carbonates	Cruzeiro do Sul
Jurassic-Triassic Sandstones	Juruá-Mirim

# Plays



# Plays



Location

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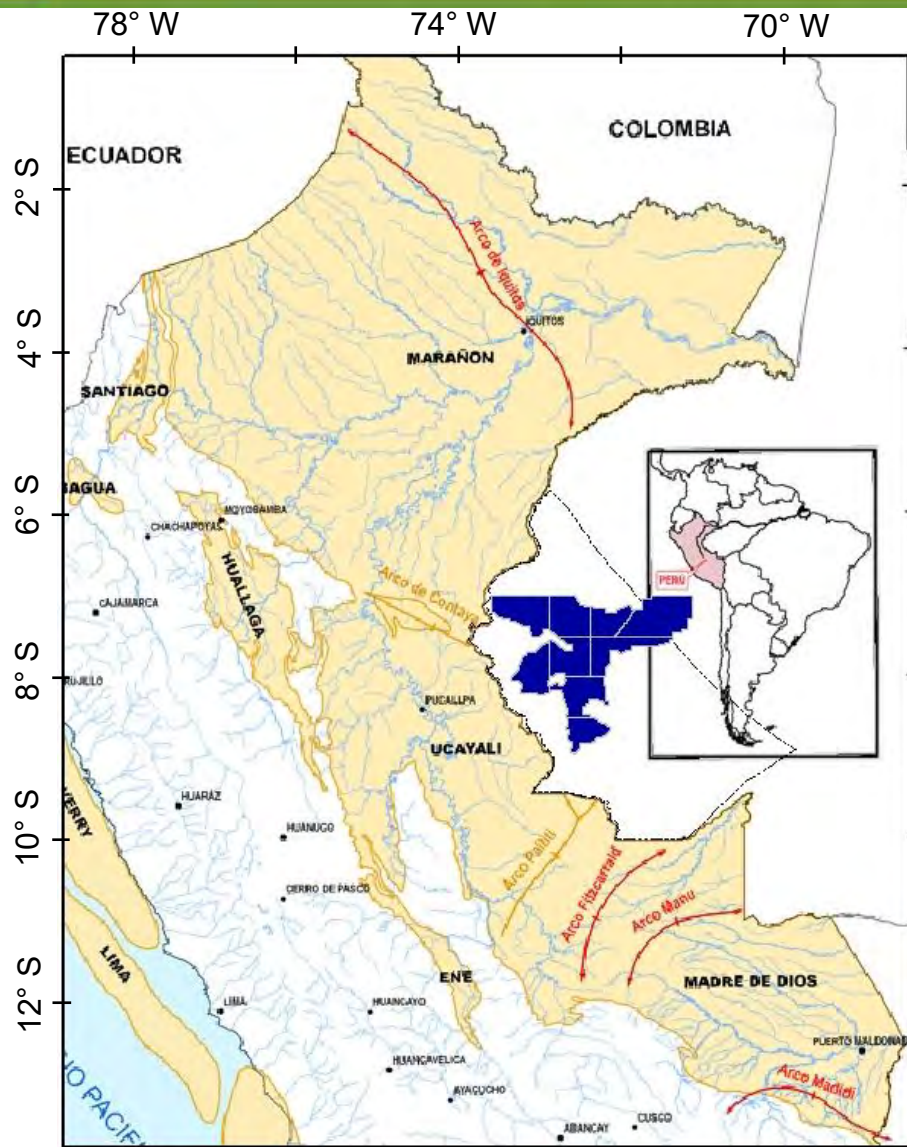
Plays

**Analogous Exploration Successes**

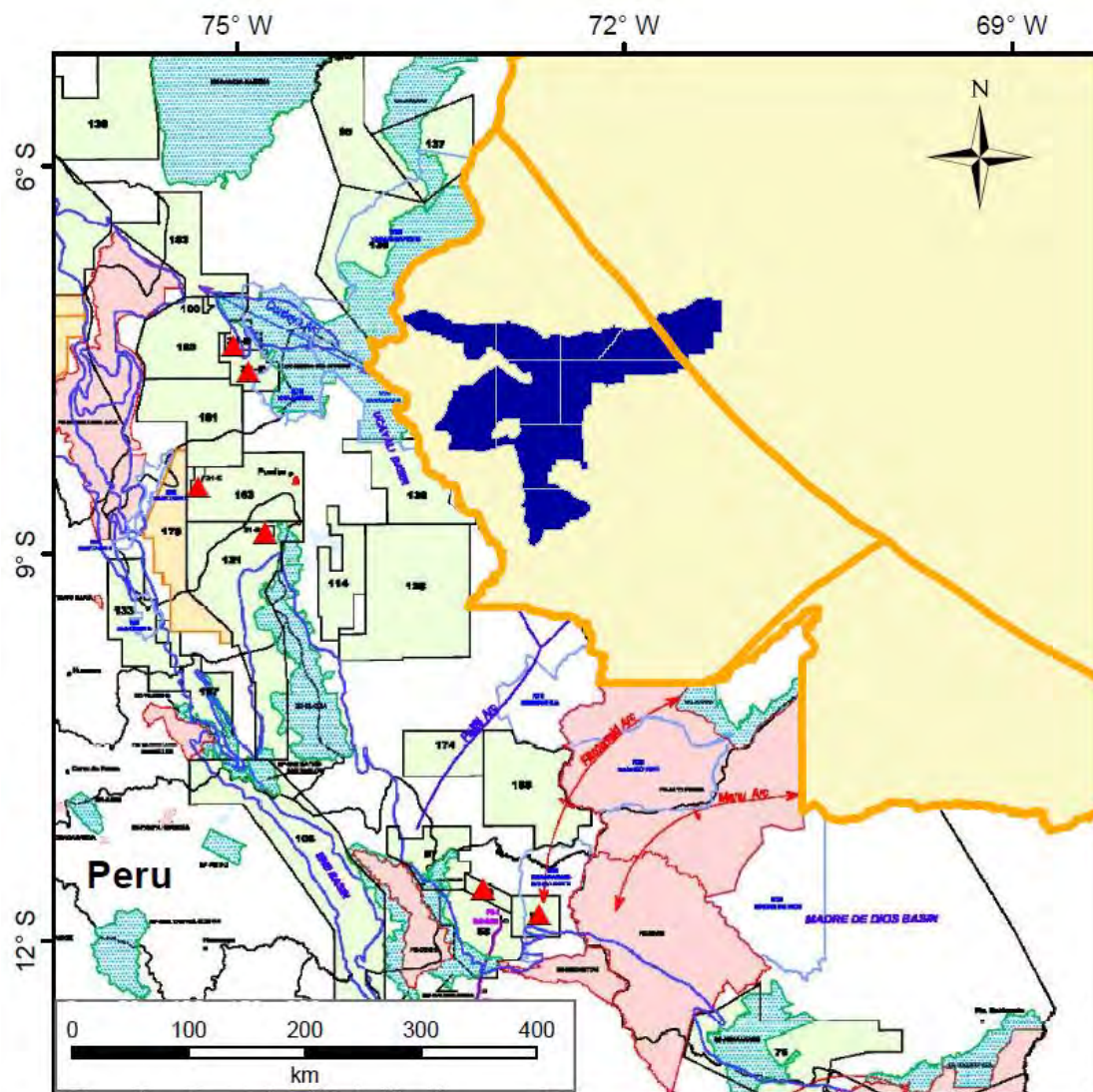
Area on Offer

Final Remarks

# Basins in Peru



# Concessions in Peru



## Legend

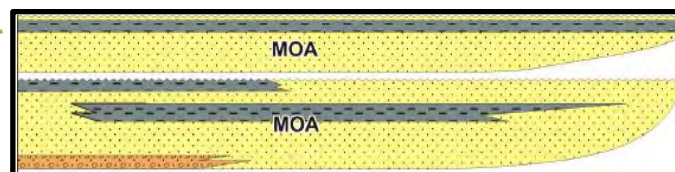
- Round 12 Blocks
- Sedimentary Basin
- Producer Lots

Source: Perupetro, 2013

# Relation between Source Rocks

## Marañón Basin

Chonta Fm.	Oil
Pucara Fm.	Oil

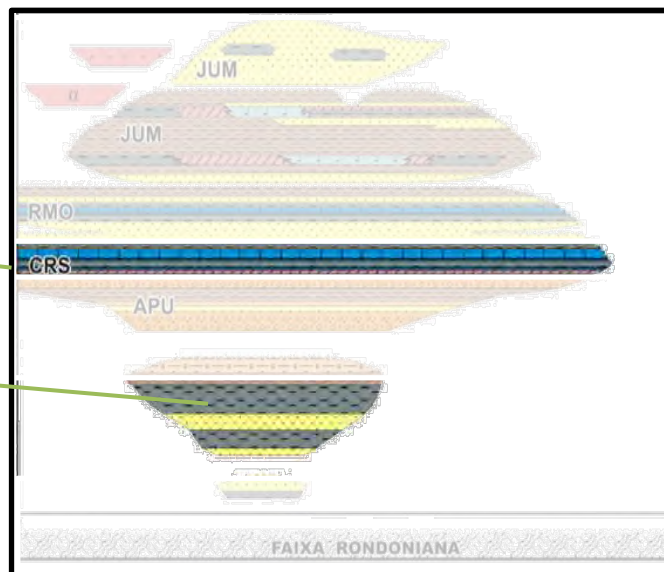


100  
110  
120

Cenomanian
Albian
Aptian
Alagoas

## Ucayali Basin

Copacabana and Ene Fm.	Oil
Cabanillas Fm.	Gas and condensate



150  
200  
250  
300  
350  
400  
542

Jurassic
Triassic
Permian
Carboniferous
Devonian
Silurian
Precambrian

Source: Perupetro

Cunha, 2007

# Camisea and Pagoreni Complex

Gas and condensate fields

## Ucayali Basin

Accumulated

31 MMbbl oil

130 MMbbl cond.

0.8 TCF gas

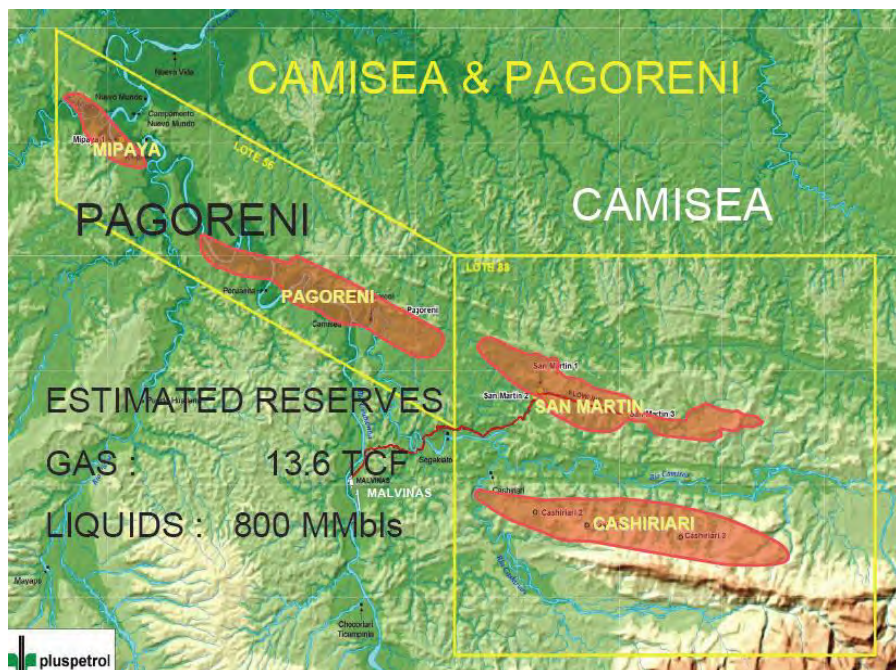
## Estimated Reserves of Camisea and Pagoreni

Gas

13.6 TCF

HC Liquids

800 MMbbl



S

Ucayali

Cashiriari

San Martin

N

km

5  
0  
-5  
-10  
-15

50 Km

Cenozoic  
Cretaceous  
Paleozoic  
Basement

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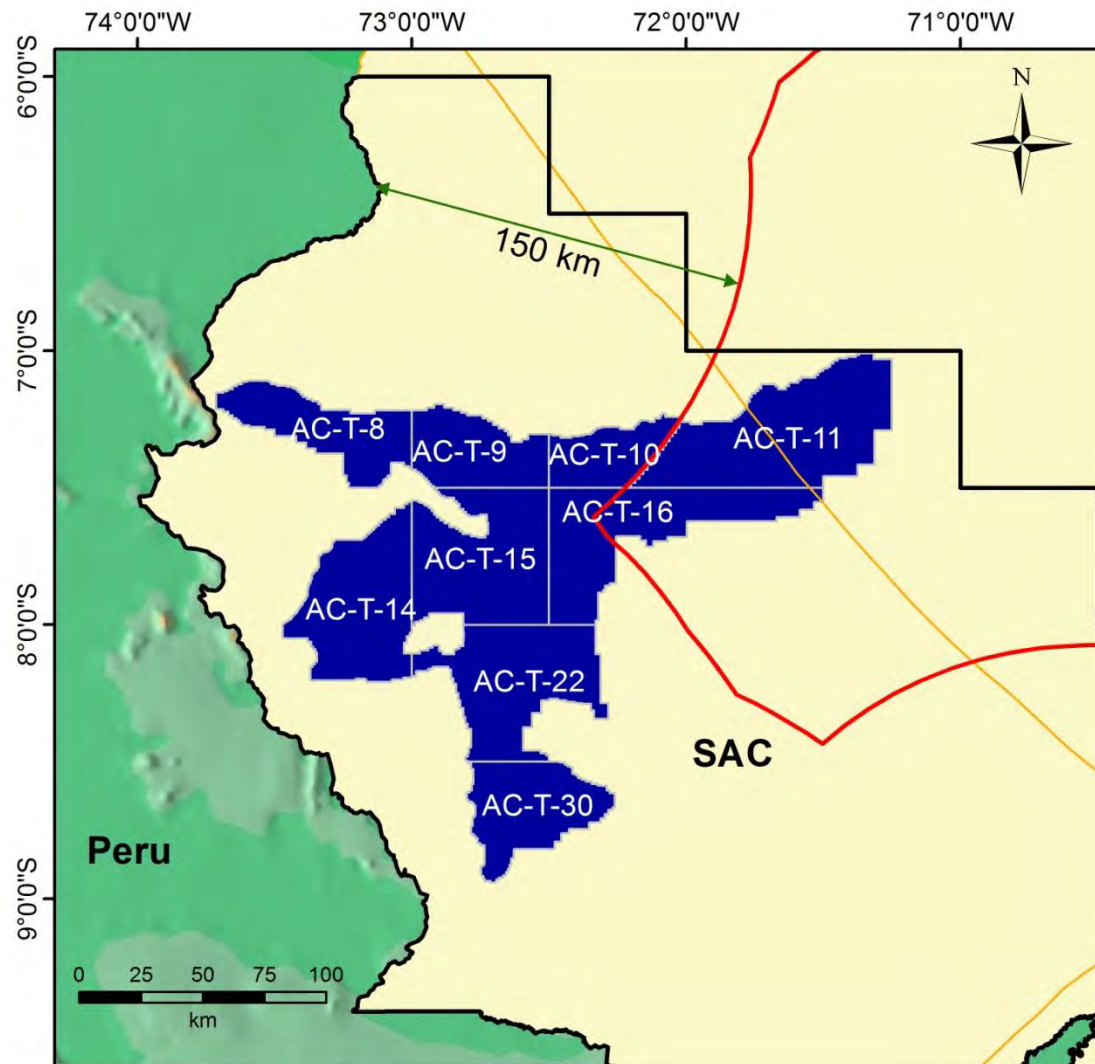
Plays

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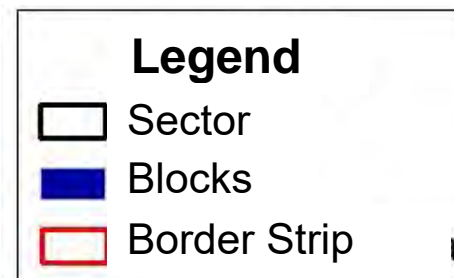
**Area on Offer**

Final Remarks

# Area on Offer



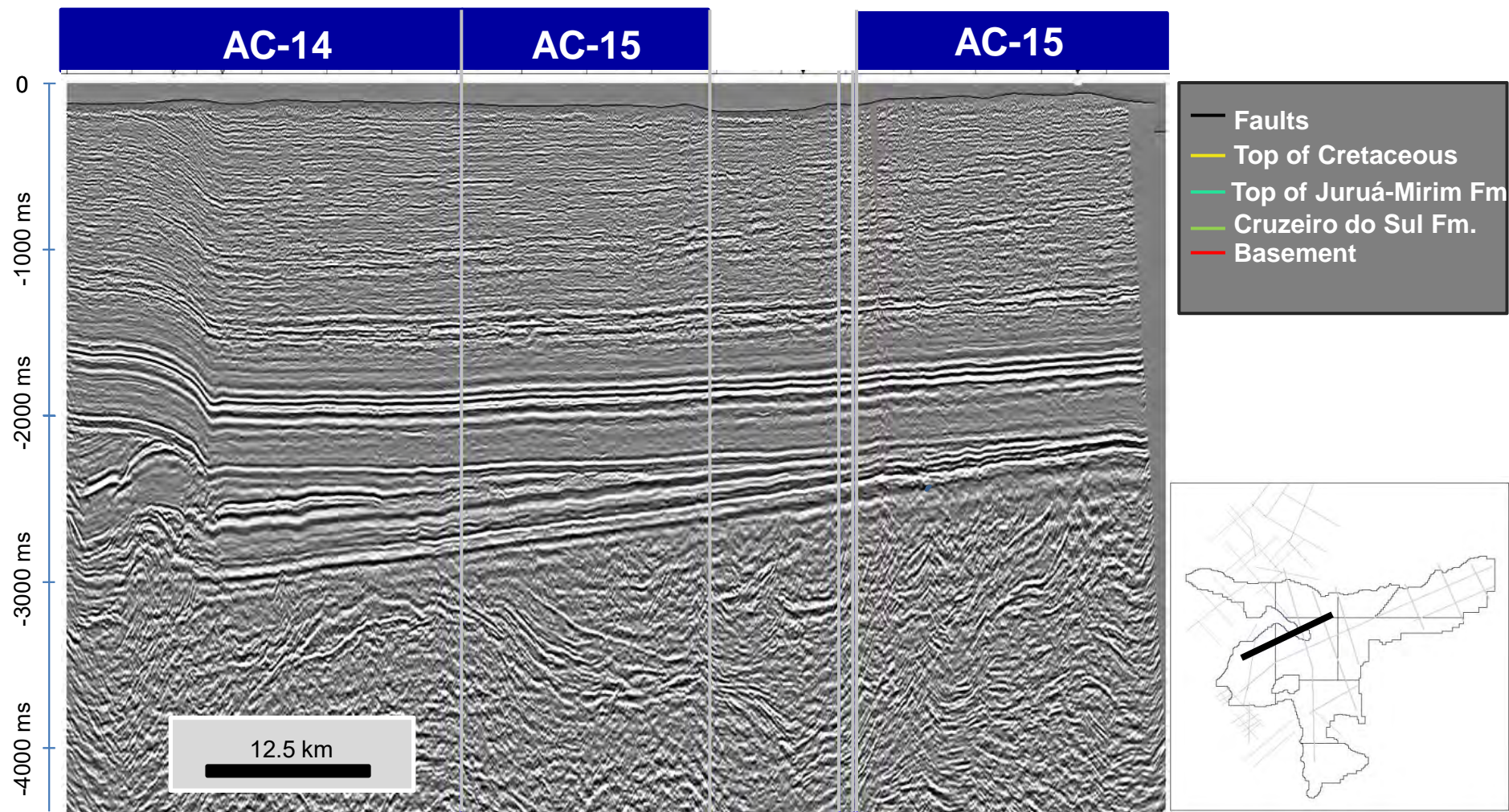
**Sector :**  
**SAC = 9 blocks**  
**Total area: 19,719 km<sup>2</sup>**



# Leads

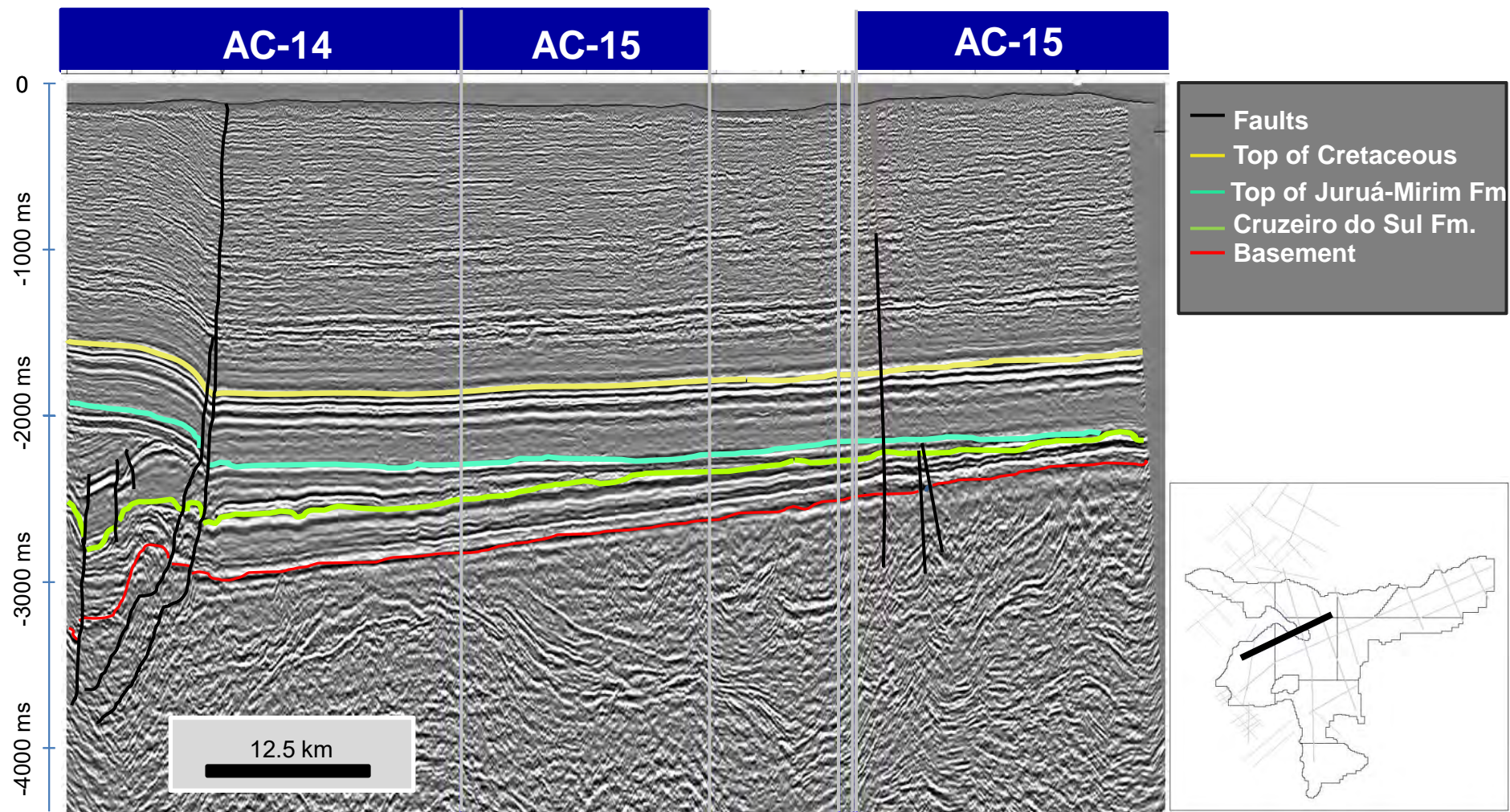
0301-0009

0301\_2D\_BACIA\_DO\_ACRE



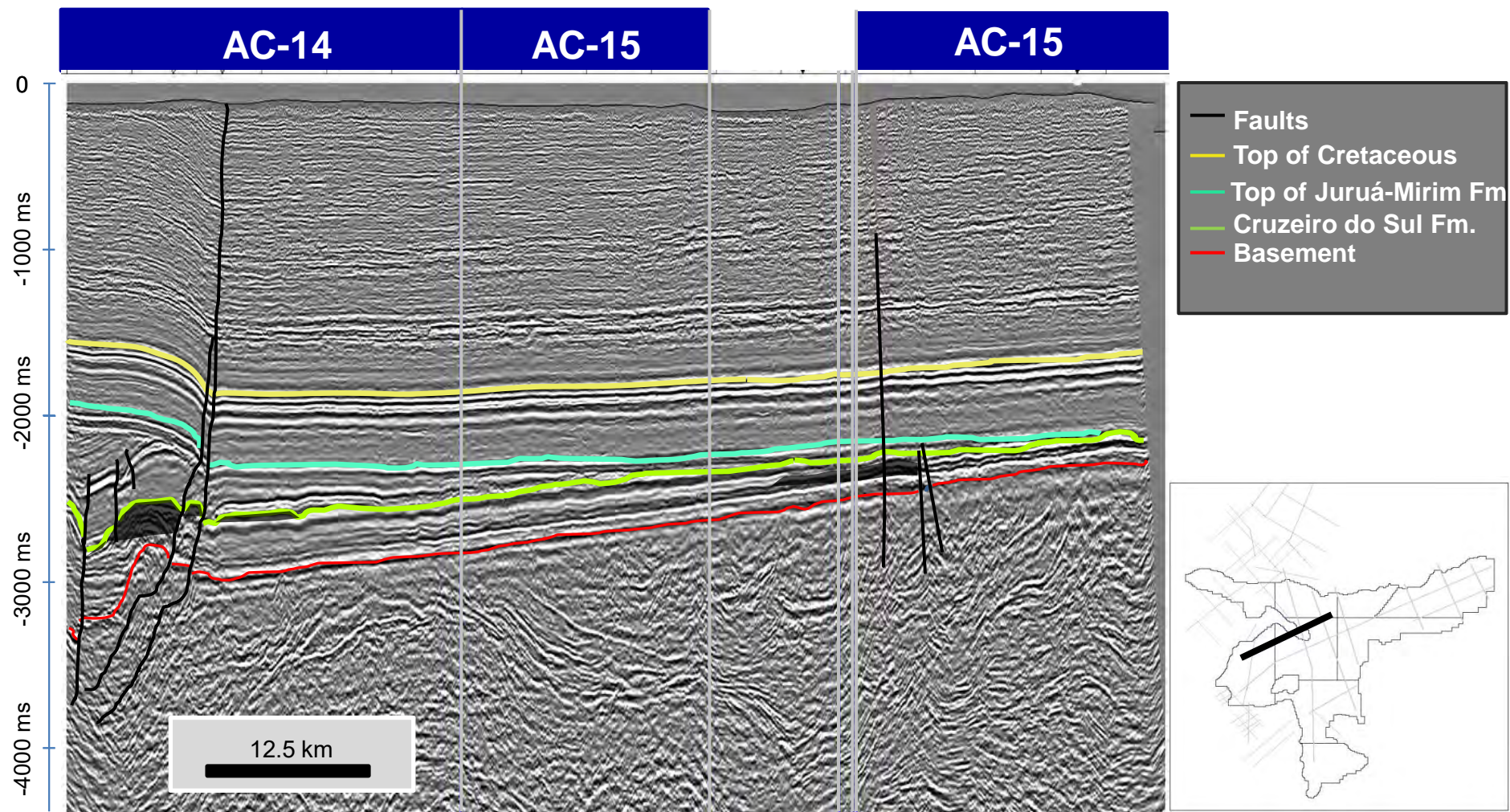
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0301\_2D\_BACIA\_DO\_ACRE



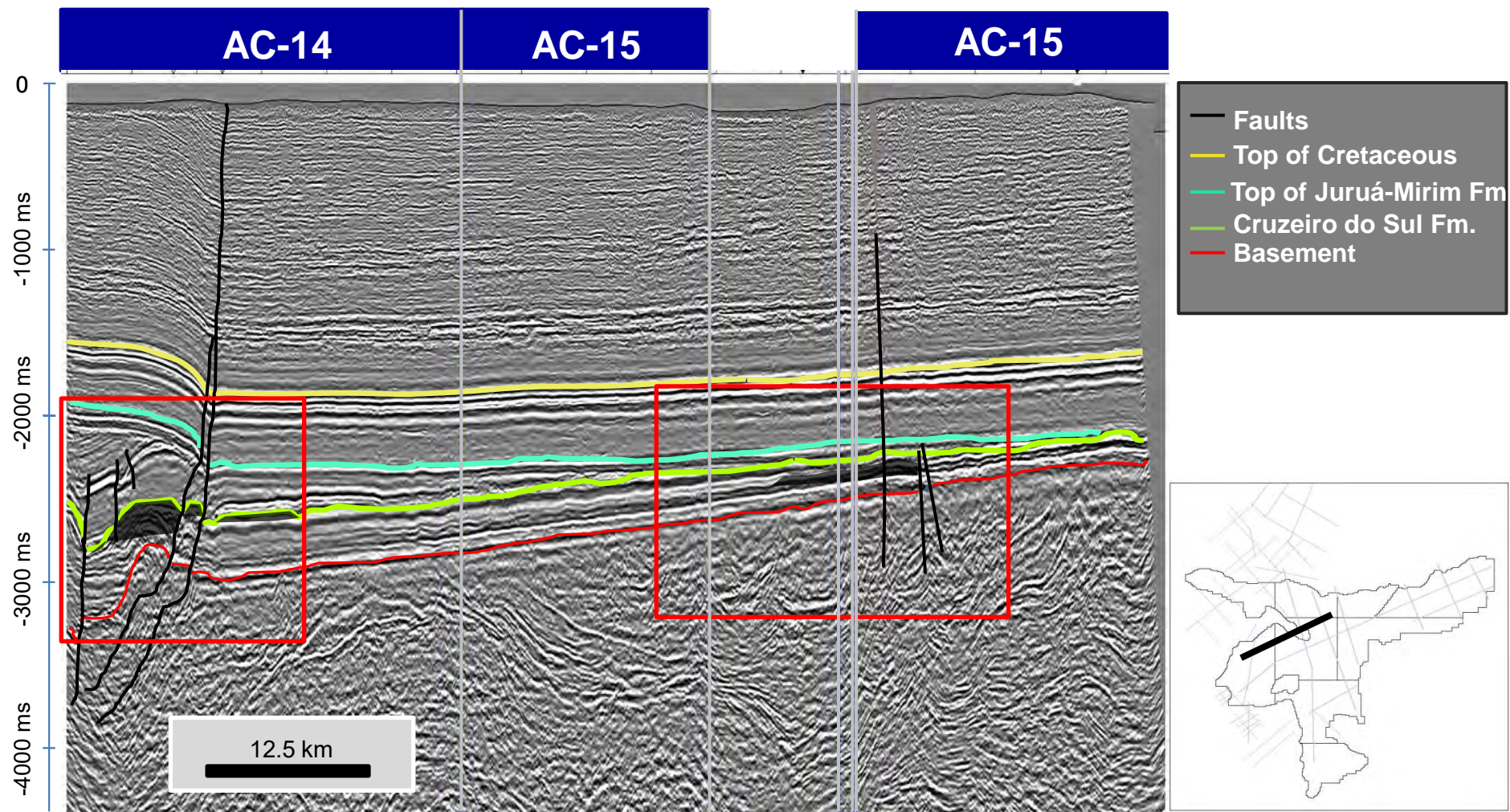
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0301\_2D\_BACIA\_DO\_ACRE



0301-0009

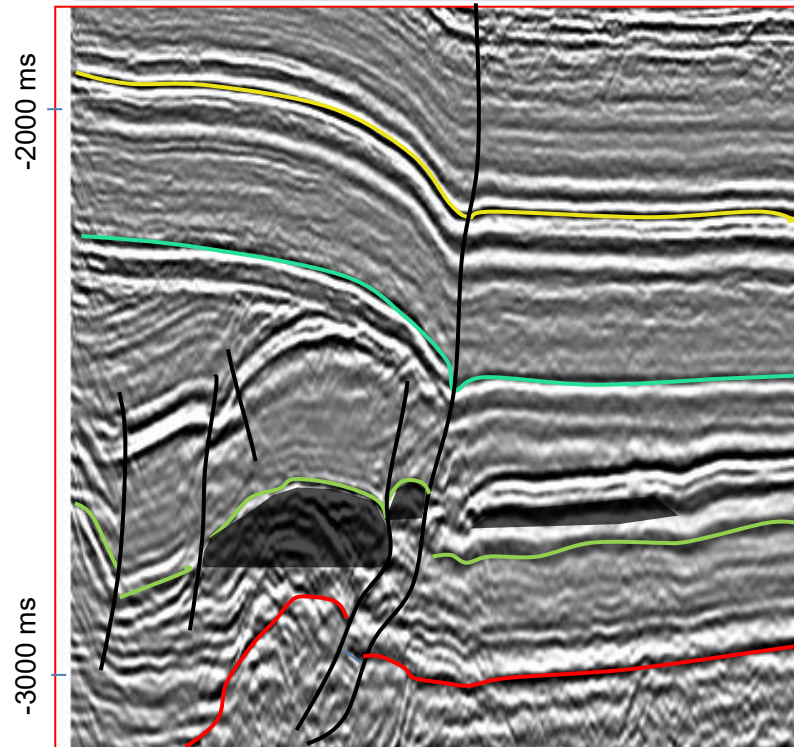
0301\_2D\_BACIA\_DO\_ACRE



# Leads

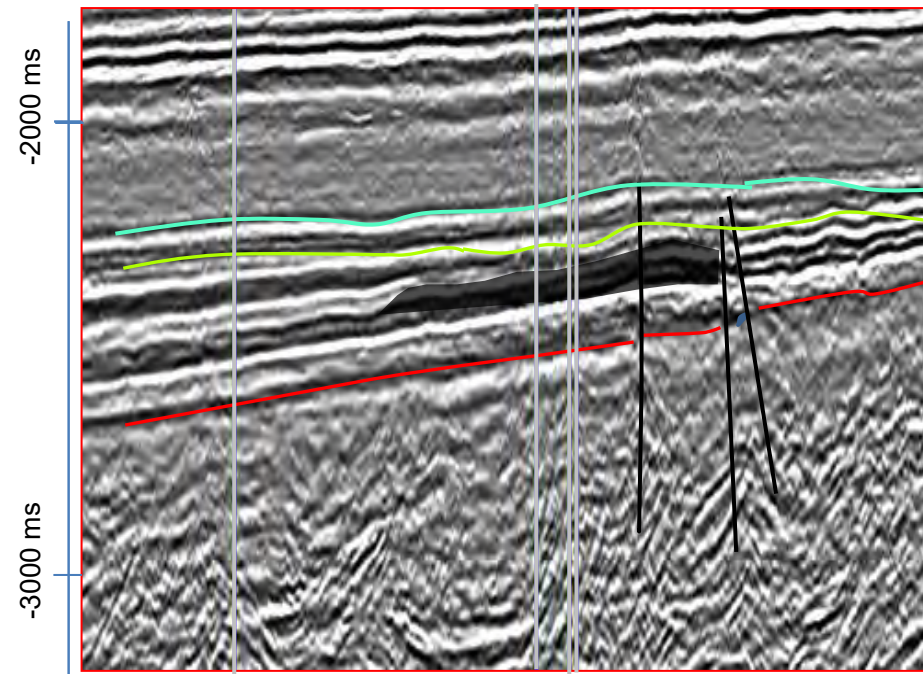
## 0301-0009 - Detail

**AC-14**



7 km

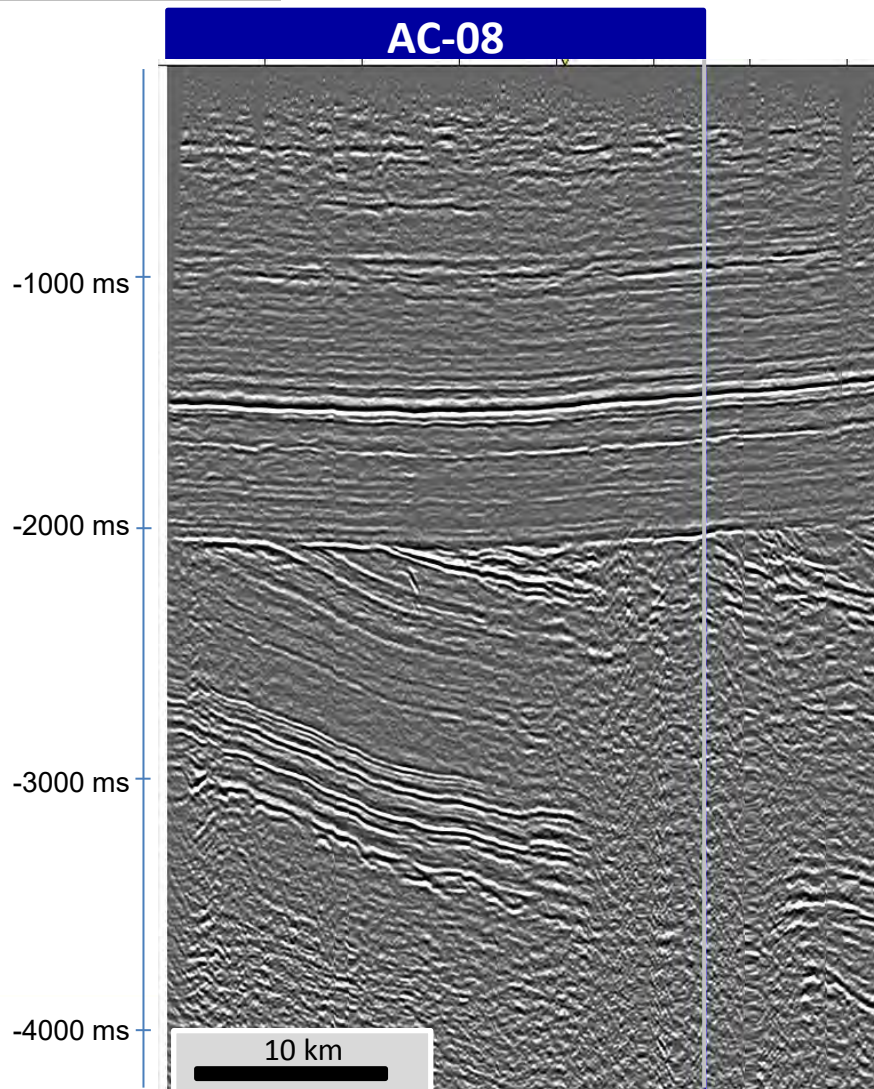
**AC-15**



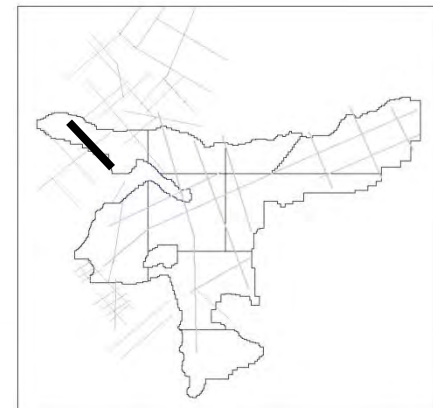
12.5 km

# Leads

0040-0049

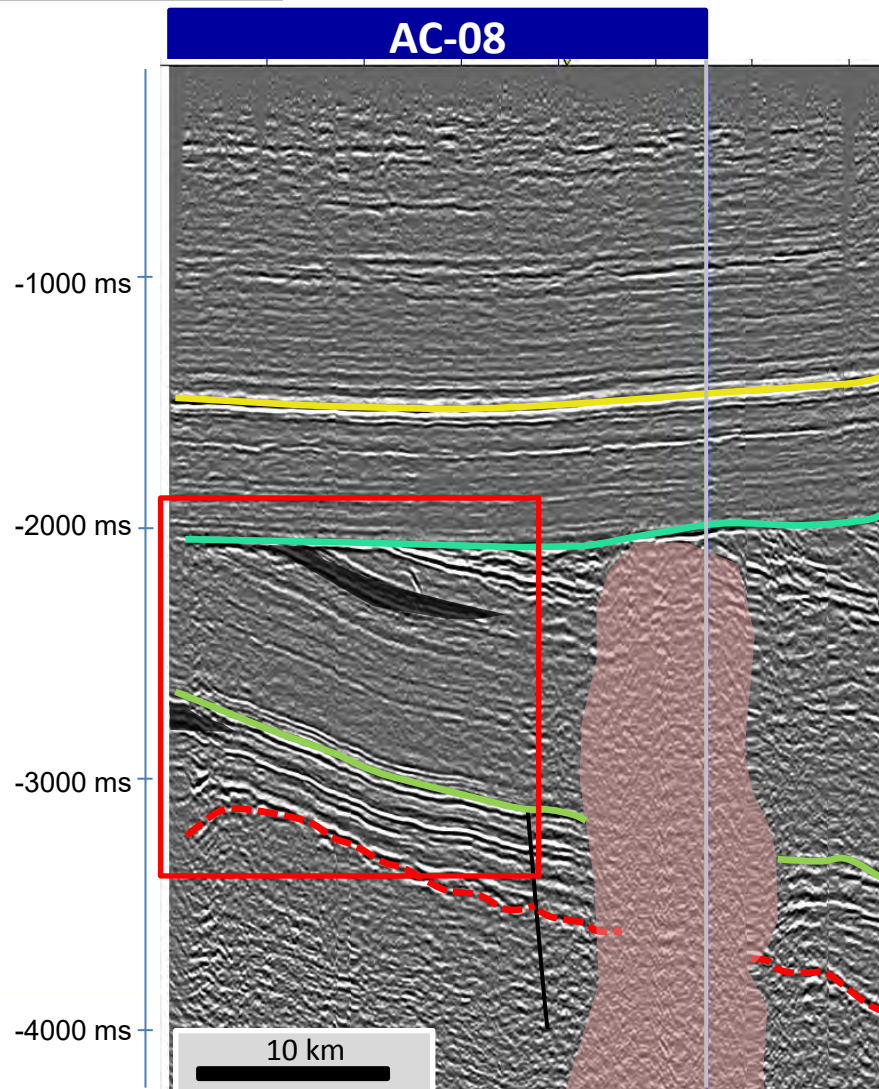


- Top of Cretaceous
- Juruá-Mirim Fm.
- Cruzeiro do Sul Fm.
- Basement
- Faults

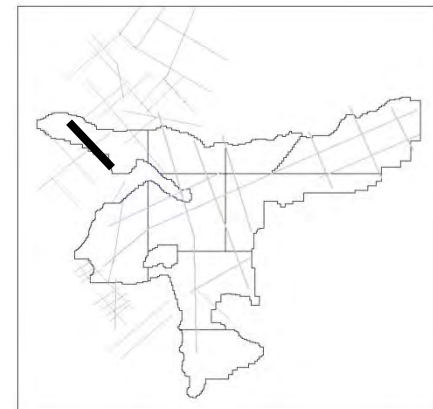


# Leads

0040-0049

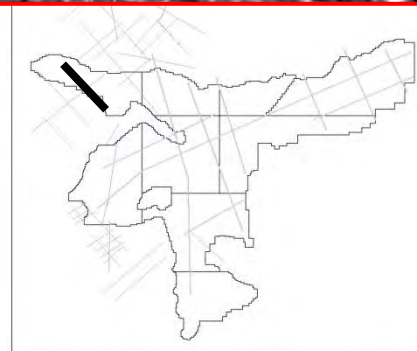
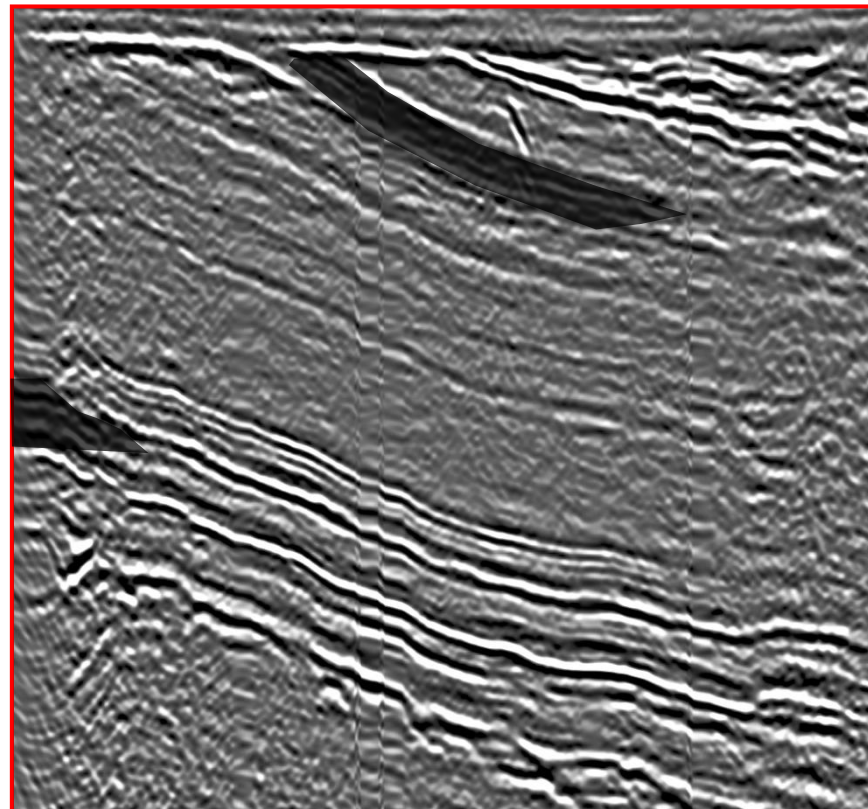
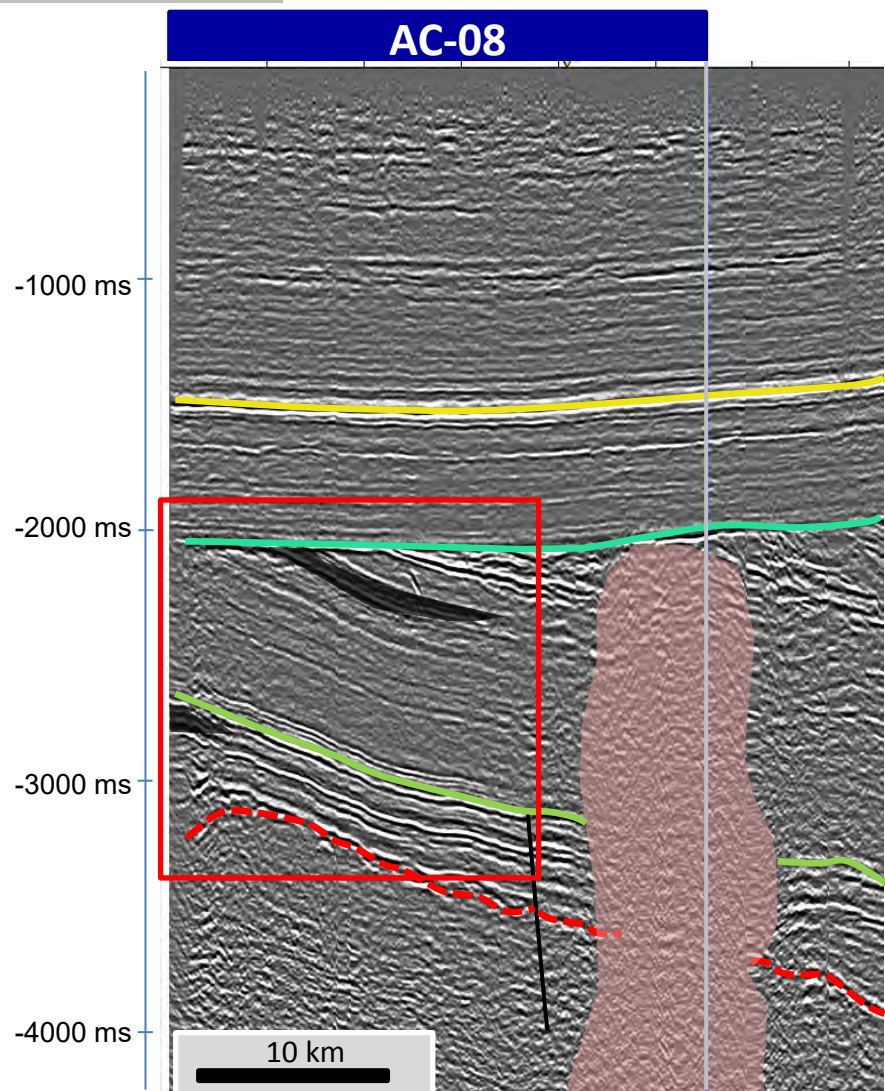


- Top of Cretaceous
- Juruá-Mirim Fm.
- Cruzeiro do Sul Fm.
- Basement
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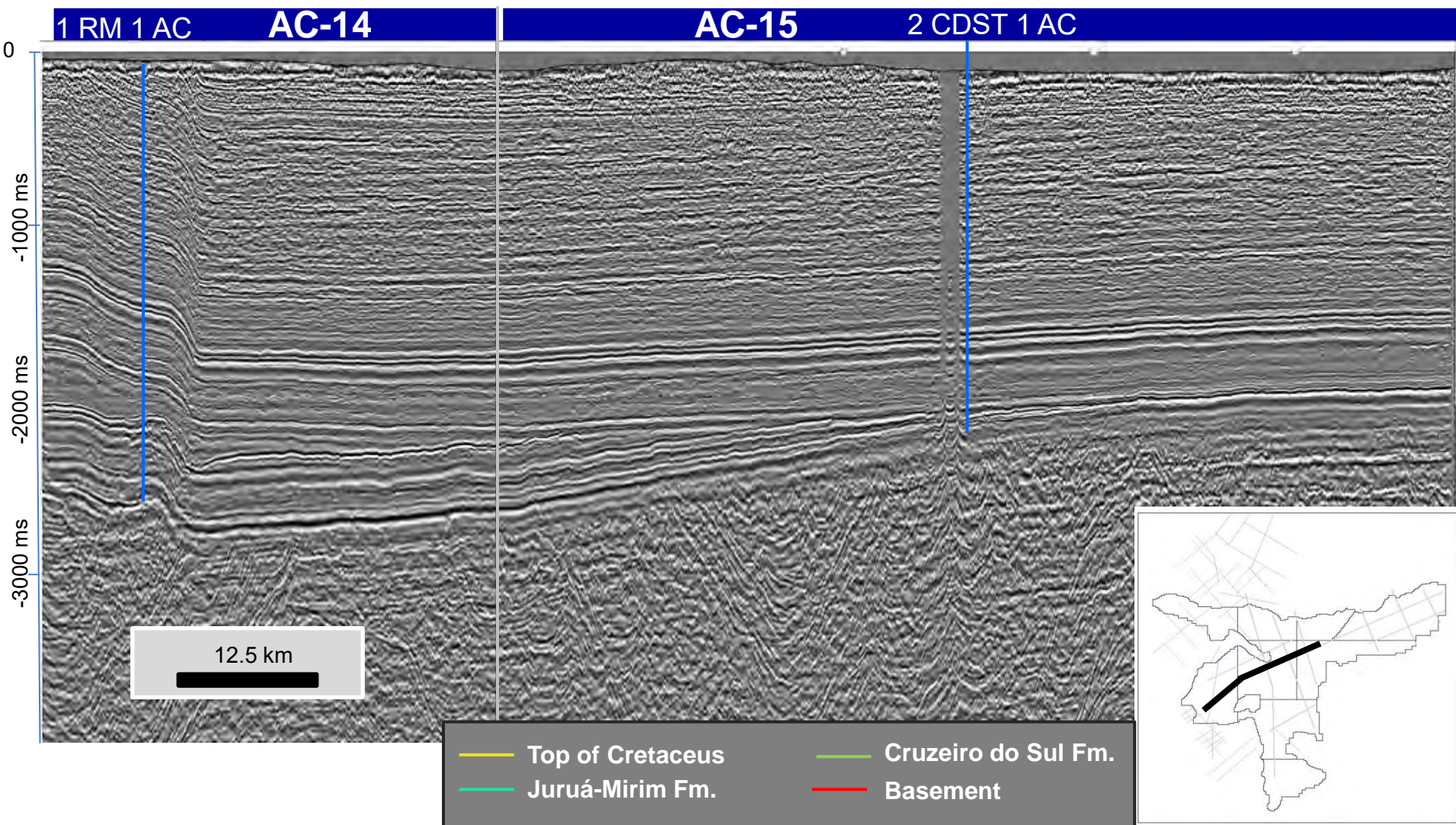
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0040-0049



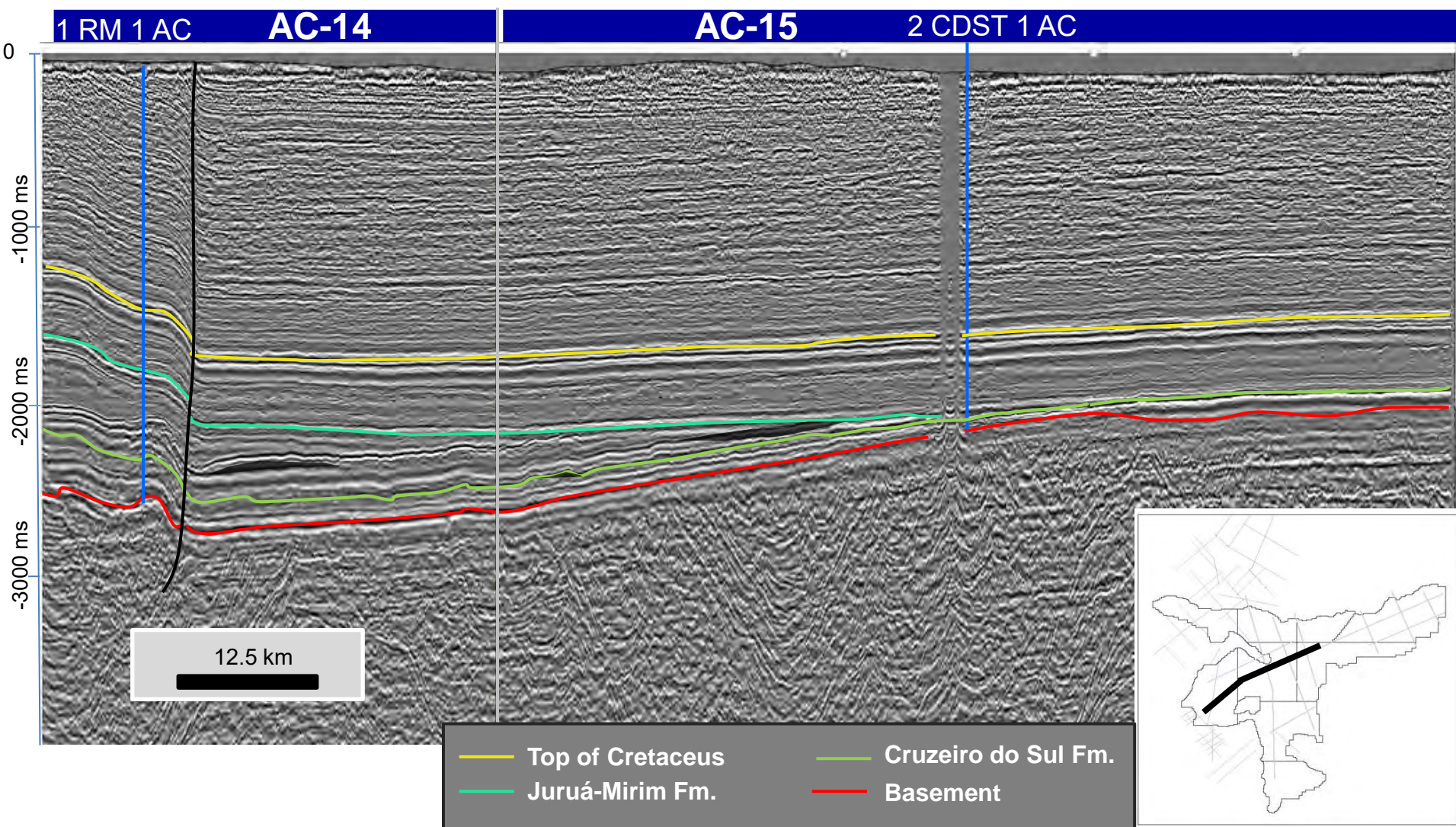
0301-0010

0301\_2D\_BACIA\_DO\_ACRE



0301-0010

0301\_2D\_BACIA\_DO\_ACRE

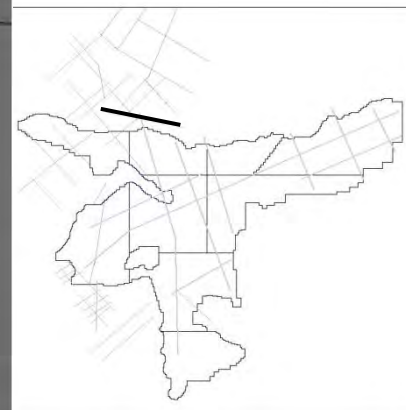
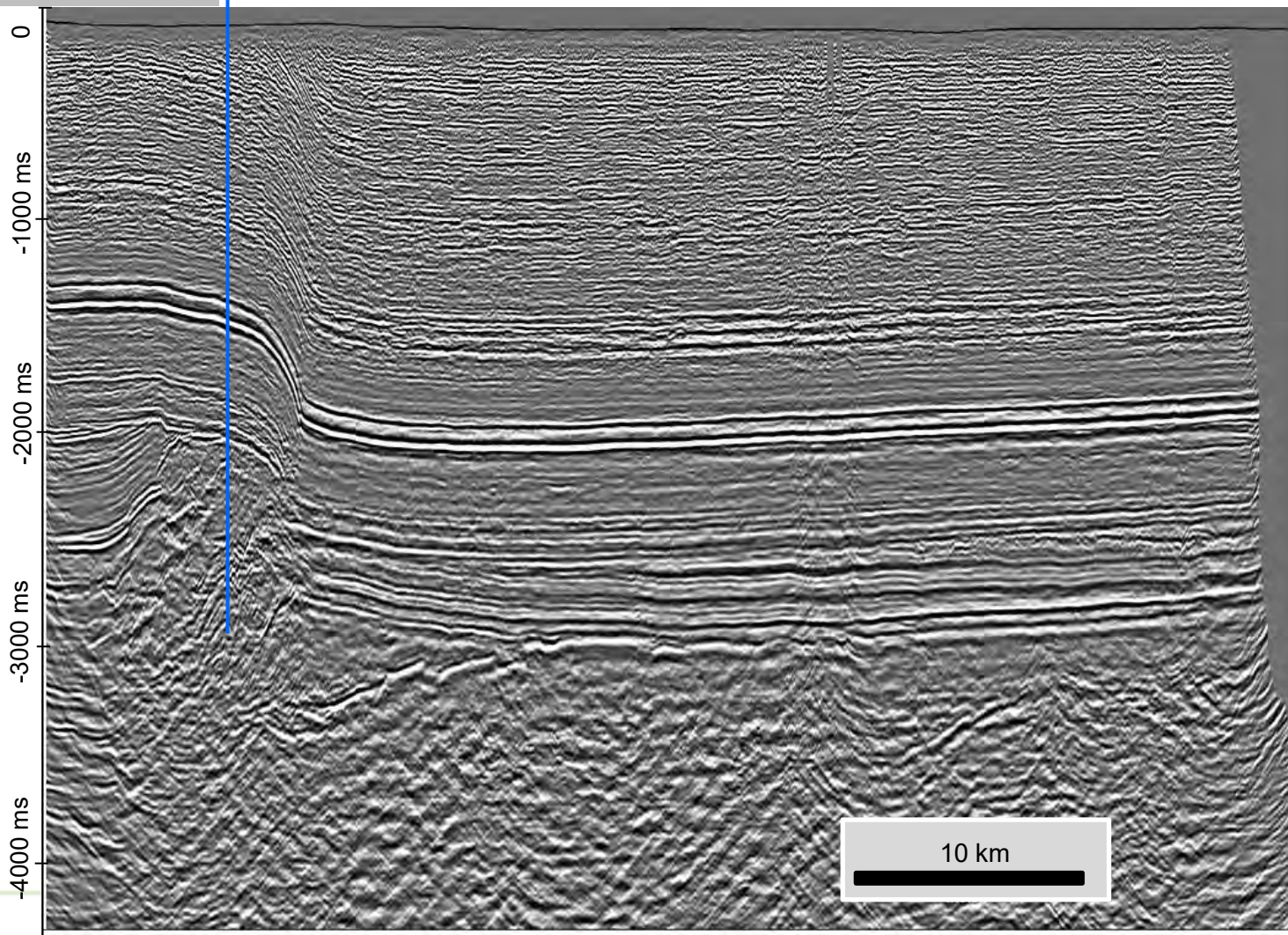


# Leads

**0301-0008**

1RPX 1 AM

0301\_2D\_BACIA\_DO\_ACRE



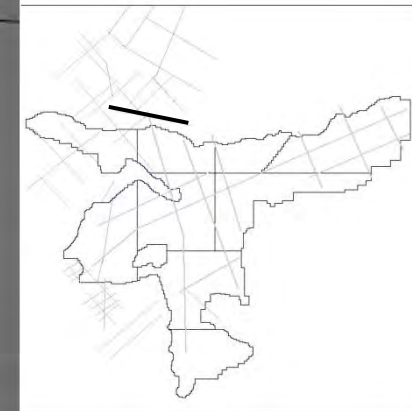
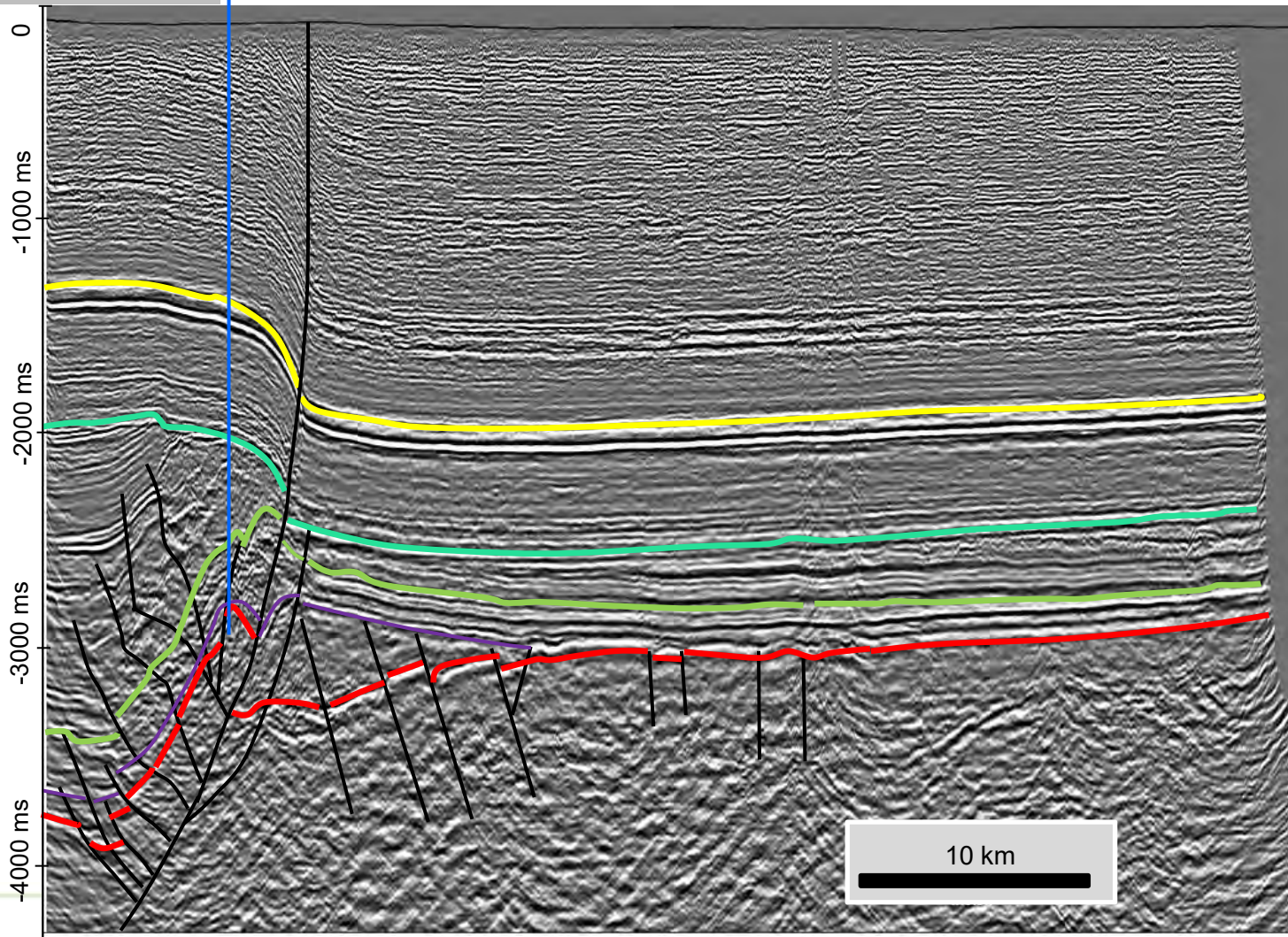
- Cretaceous
- Top of Juruá-Mirim
- Cruzeiro do Sul
- Devonian/  
Apuí Fm.
- Basement
- Faults

# Leads

**0301-0008**

1RPX 1 AM

0301\_2D\_BACIA\_DO\_ACRE

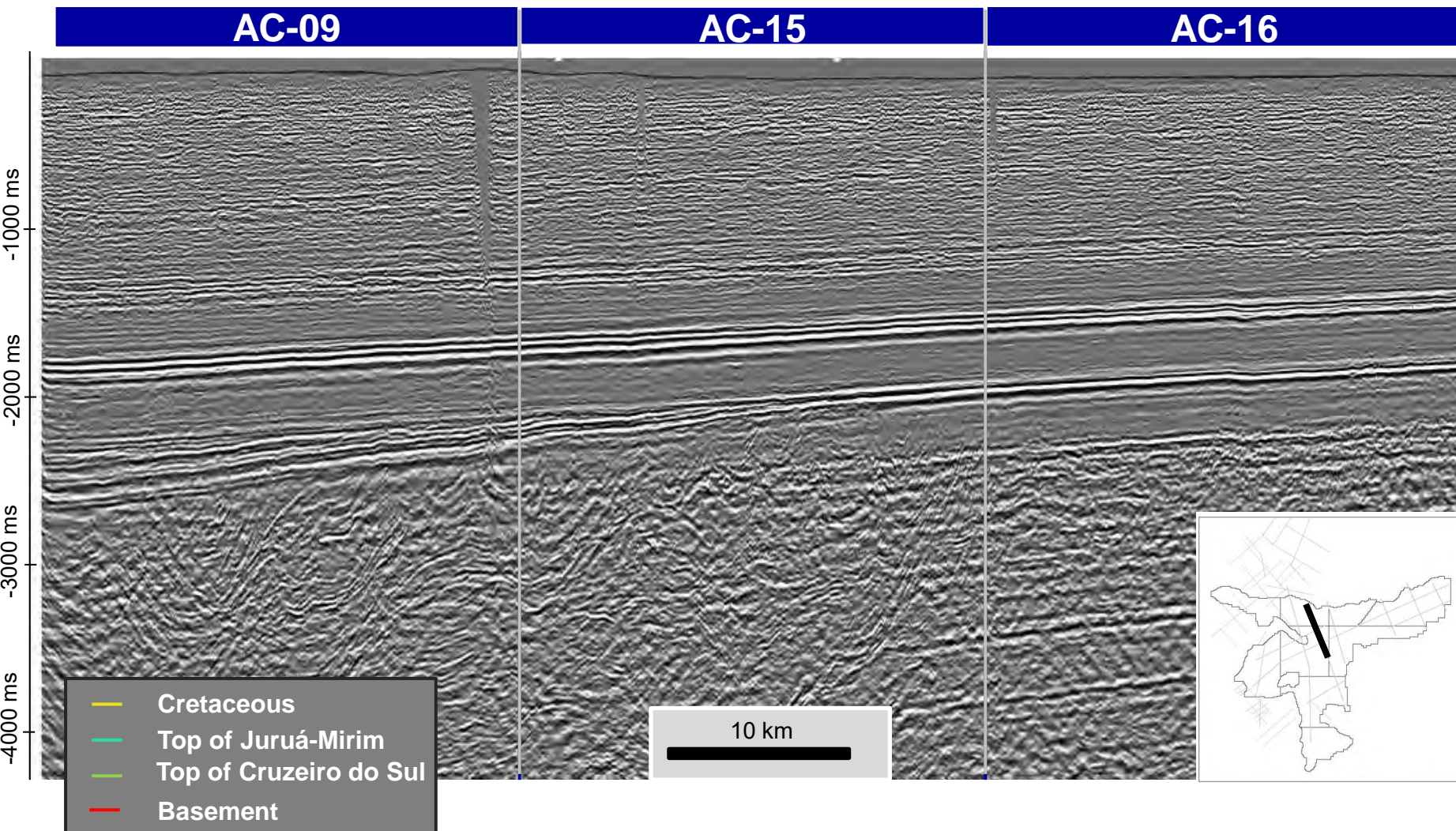


- Cretaceous
- Top of Juruá-Mirim
- Cruzeiro do Sul
- Devonian/  
Apuí Fm.
- Basement
- Faults

# Leads

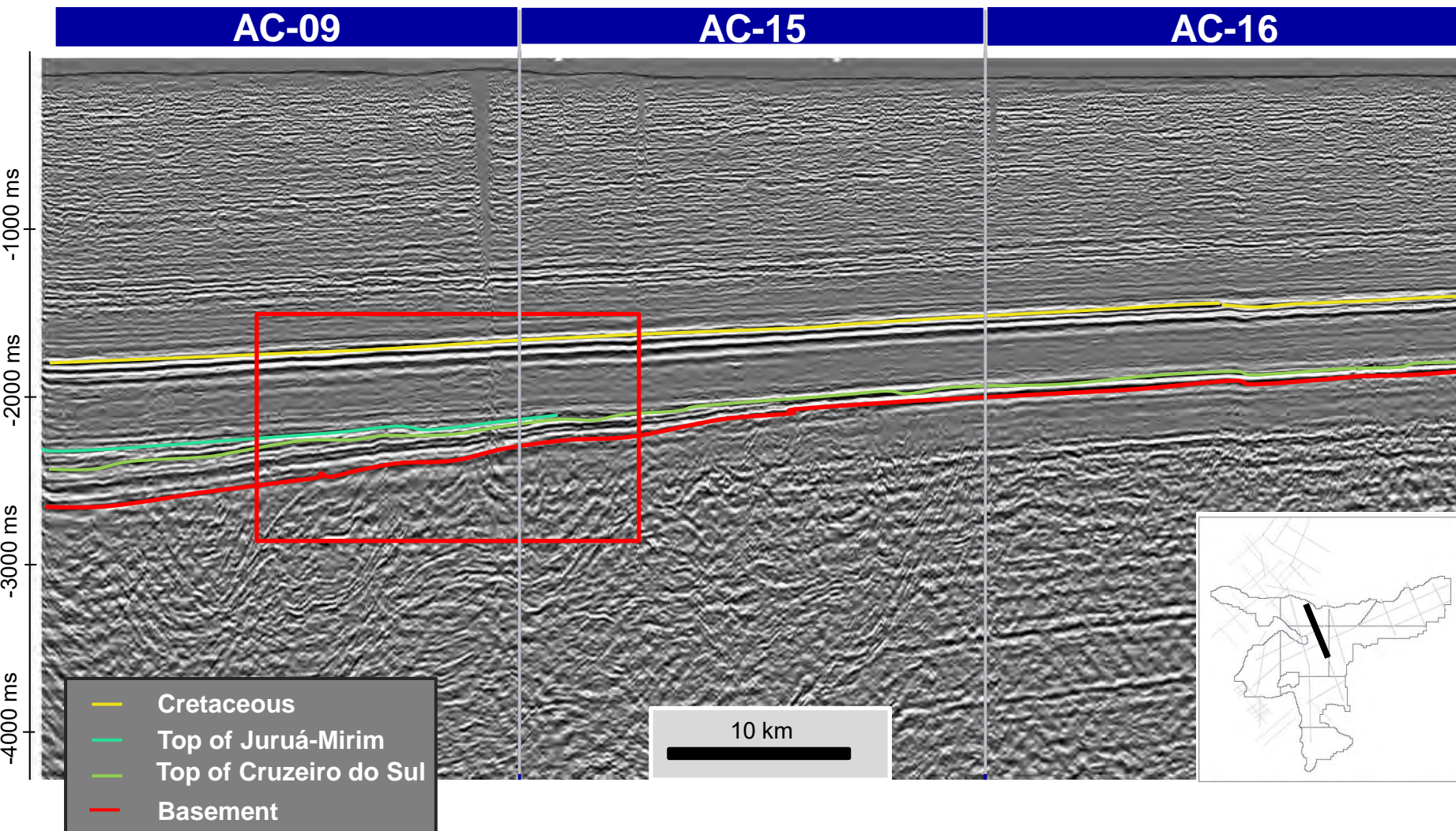
0301-0014

0301\_2D\_BACIA\_DO\_ACRE



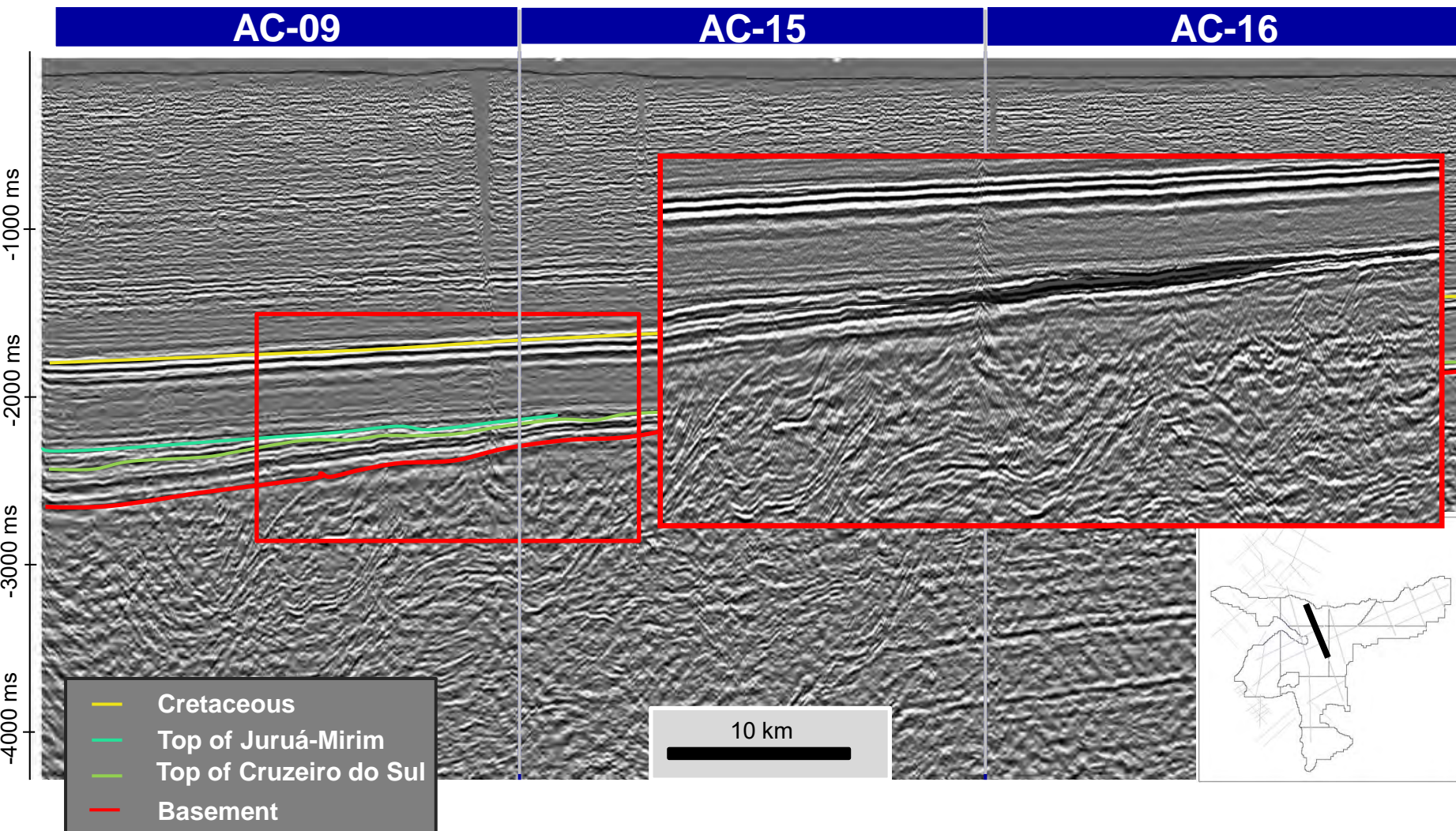
0301-0014

0301\_2D\_BACIA\_DO\_ACRE

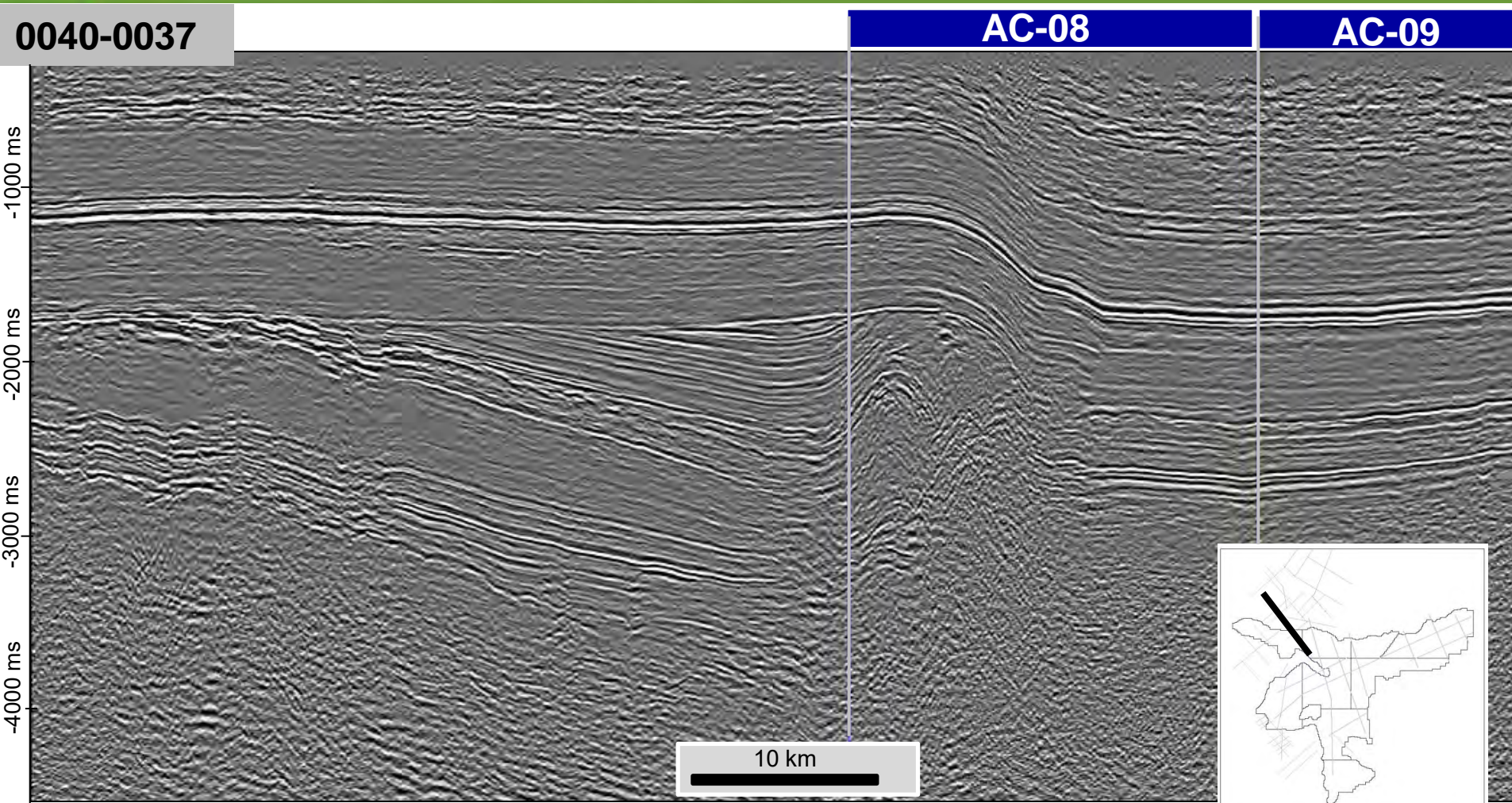


0301-0014

0301\_2D\_BACIA\_DO\_ACRE



# Leads

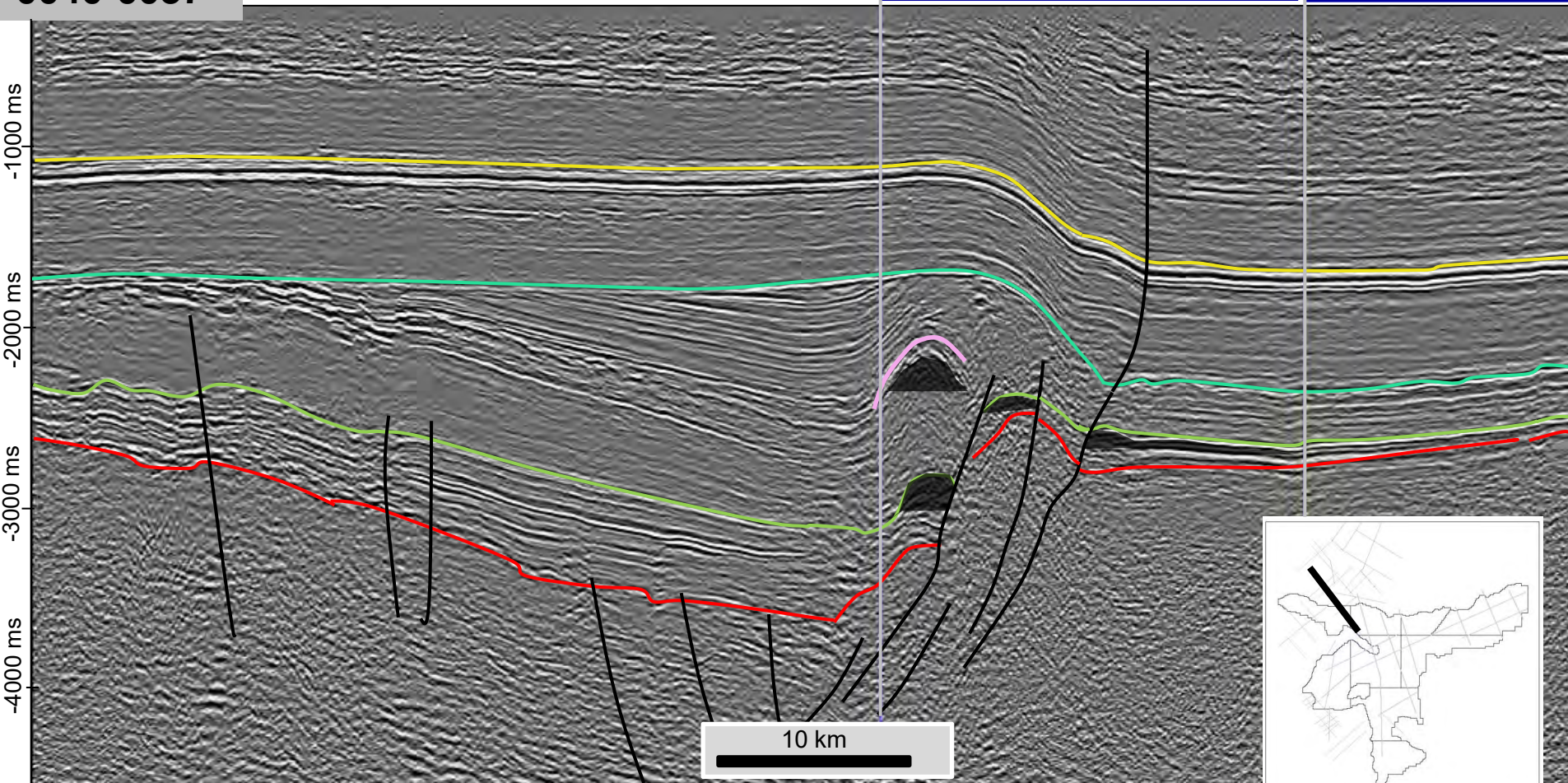


- |   |   |
|---|---|
| <span style="color: yellow;">—</span> Cretaceous                | <span style="color: red;">—</span> Basement |
| <span style="color: cyan;">—</span> Top of Juruá-Mirim Fm.      | <span style="color: black;">—</span> Faults |
| <span style="color: green;">—</span> Top of Cruzeiro do Sul Fm. | <span style="color: magenta;">—</span> Salt |

0040-0037

AC-08

AC-09

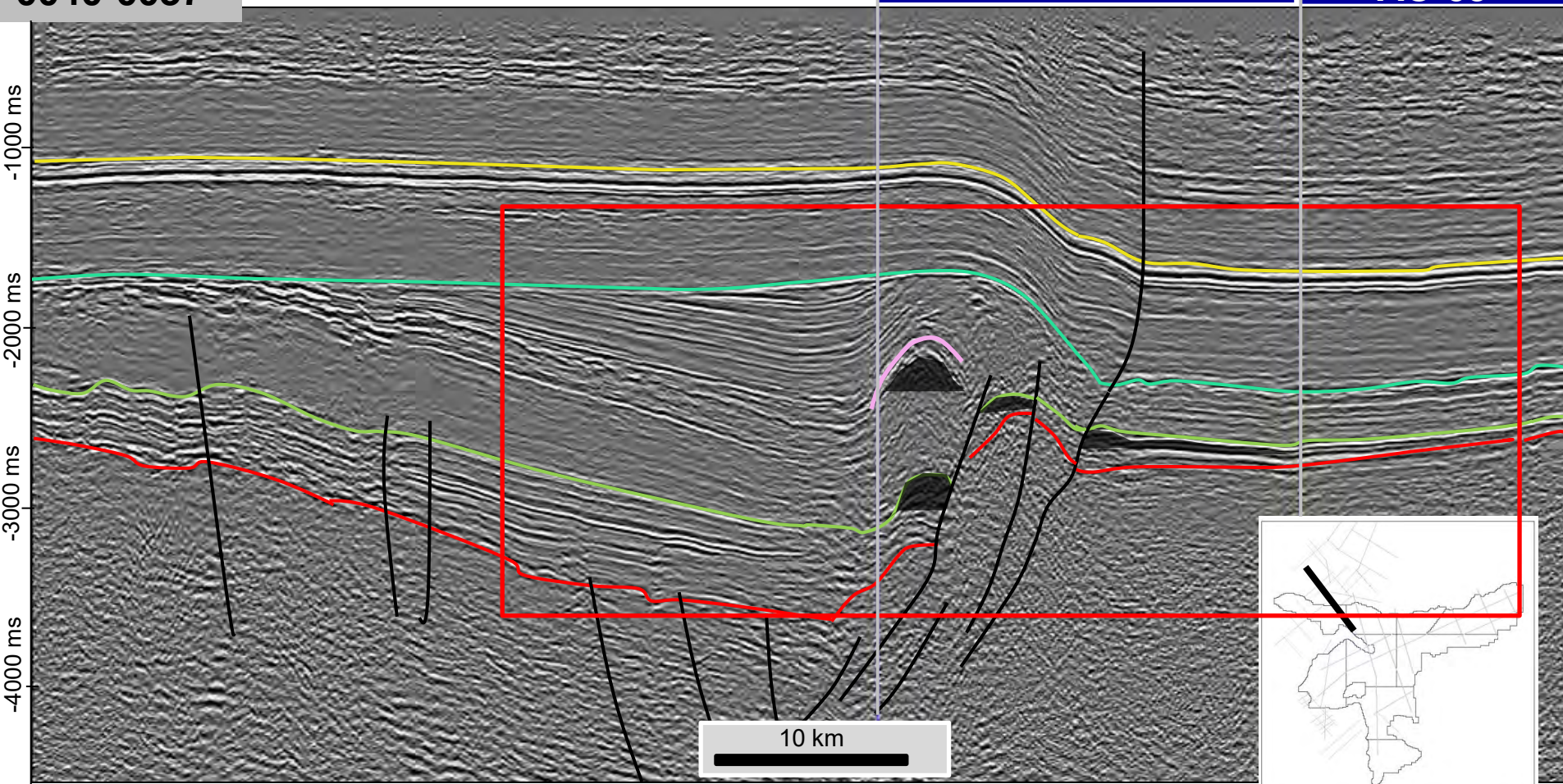


- |   |   |
|---|---|
| <span style="color: yellow;">—</span> Cretaceous                | <span style="color: red;">—</span> Basement |
| <span style="color: cyan;">—</span> Top of Juruá-Mirim Fm.      | <span style="color: black;">—</span> Faults |
| <span style="color: green;">—</span> Top of Cruzeiro do Sul Fm. | <span style="color: magenta;">—</span> Salt |

0040-0037

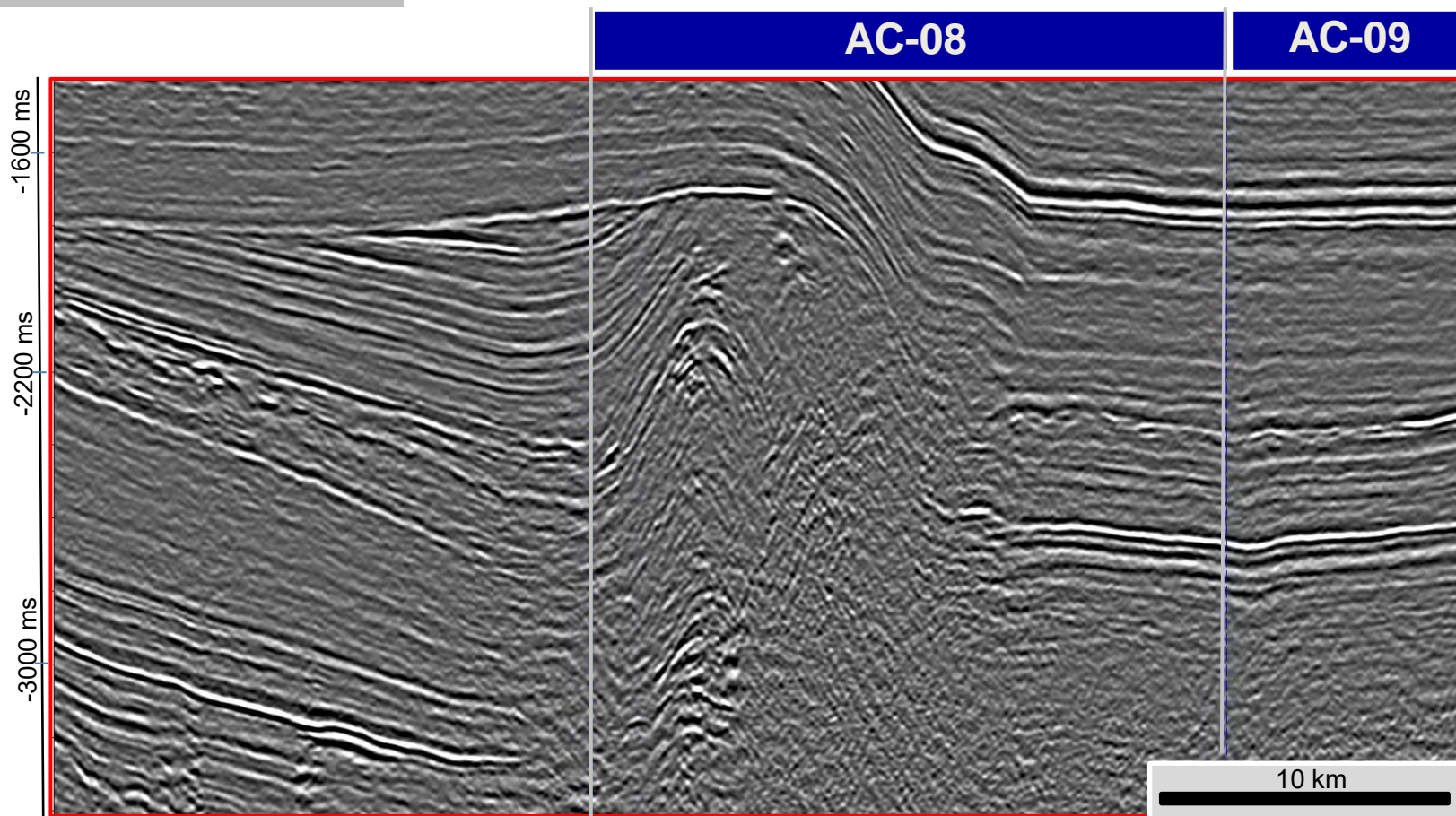
AC-08

AC-09



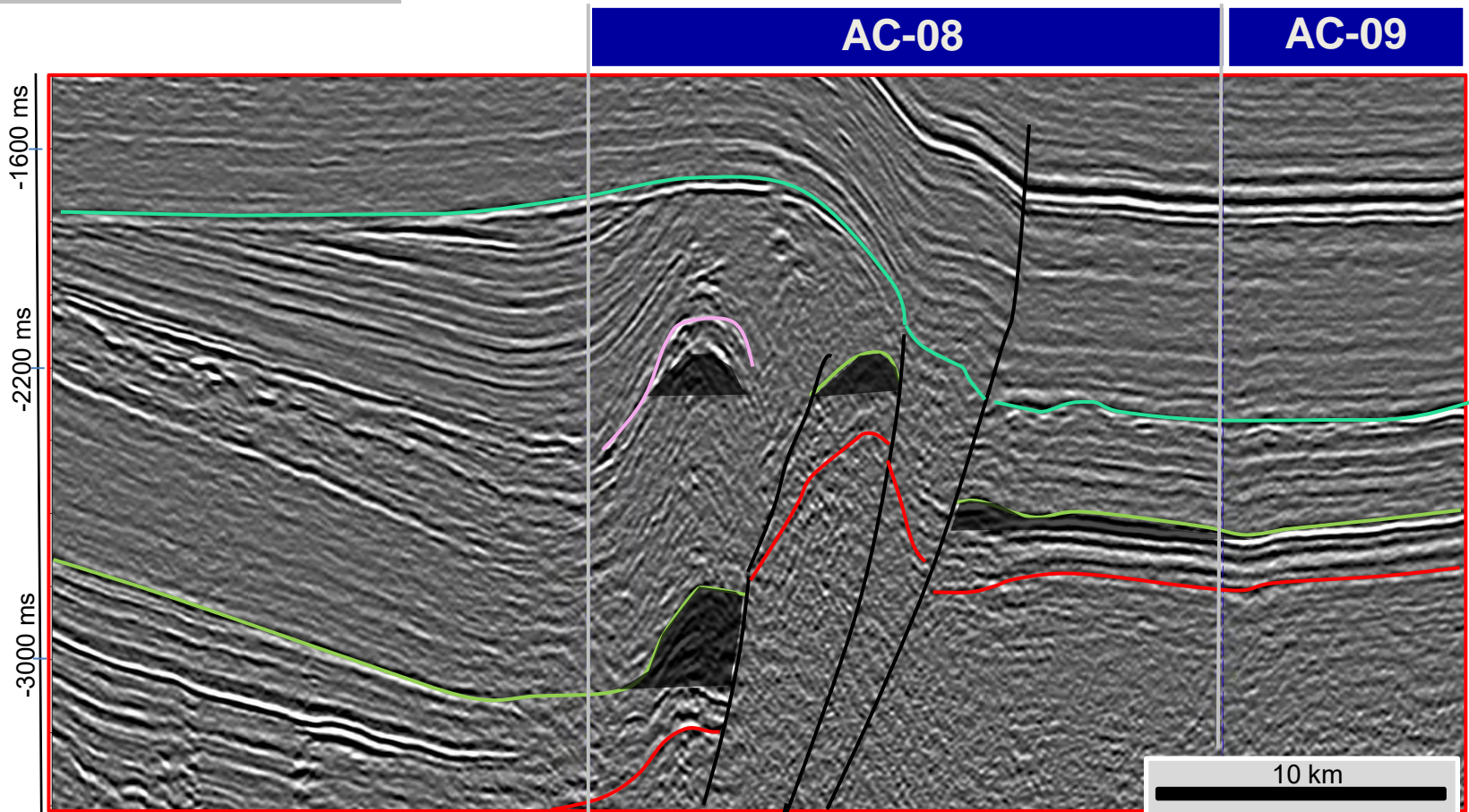
- |   |   |
|---|---|
| <span style="color: yellow;">—</span> Cretaceous                | <span style="color: red;">—</span> Basement |
| <span style="color: cyan;">—</span> Top of Juruá-Mirim Fm.      | <span style="color: black;">—</span> Faults |
| <span style="color: green;">—</span> Top of Cruzeiro do Sul Fm. | <span style="color: magenta;">—</span> Salt |

## 0040-0037- Detail



- |                              |            |
|------------------------------|------------|
| — Top of Cretaceous          | — Basement |
| — Top of Juruá-Mirim Fm.     | — Faults   |
| — Top of Cruzeiro do Sul Fm. | — Salt     |

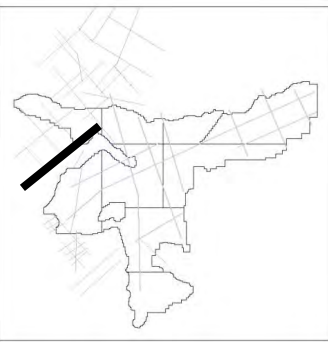
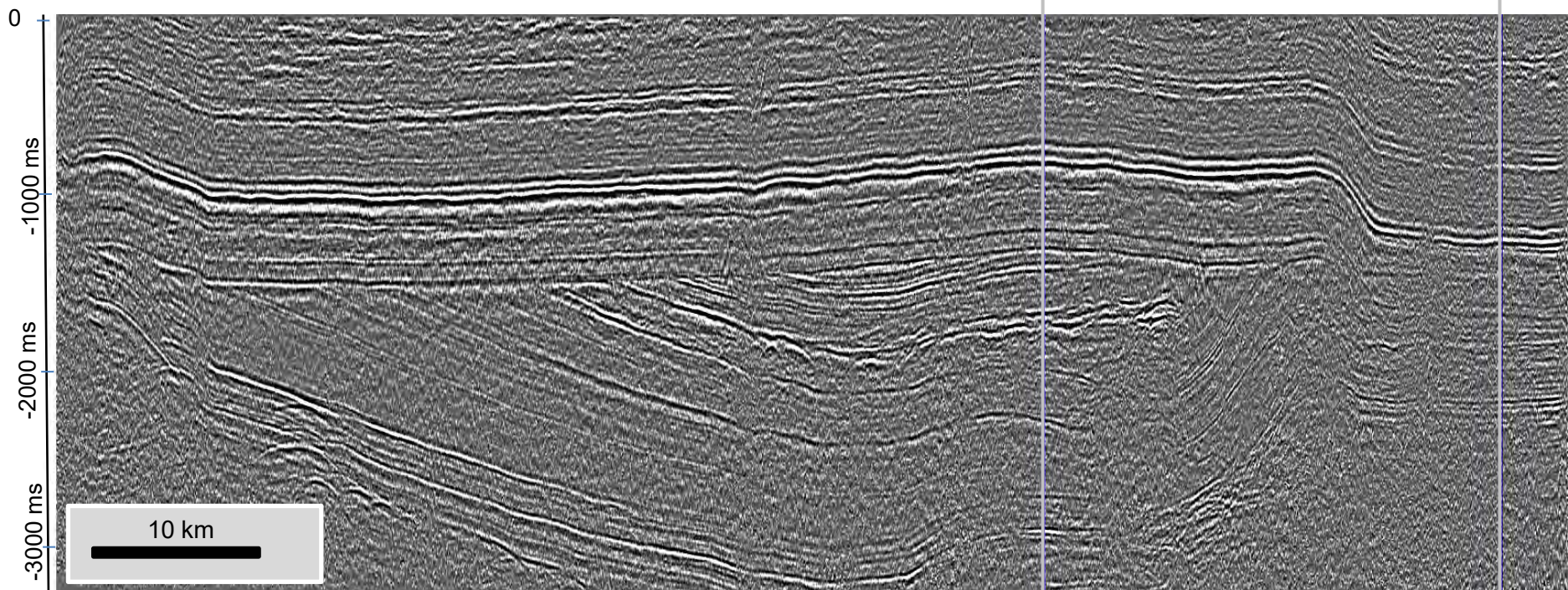
## 0040-0037- Detail



- |                              |            |
|------------------------------|------------|
| — Top of Cretaceous          | — Basement |
| — Top of Juruá-Mirim Fm.     | — Faults   |
| — Top of Cruzeiro do Sul Fm. | — Salt     |

0031-0178

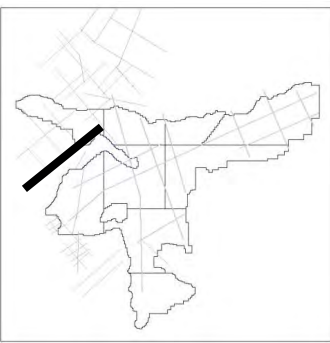
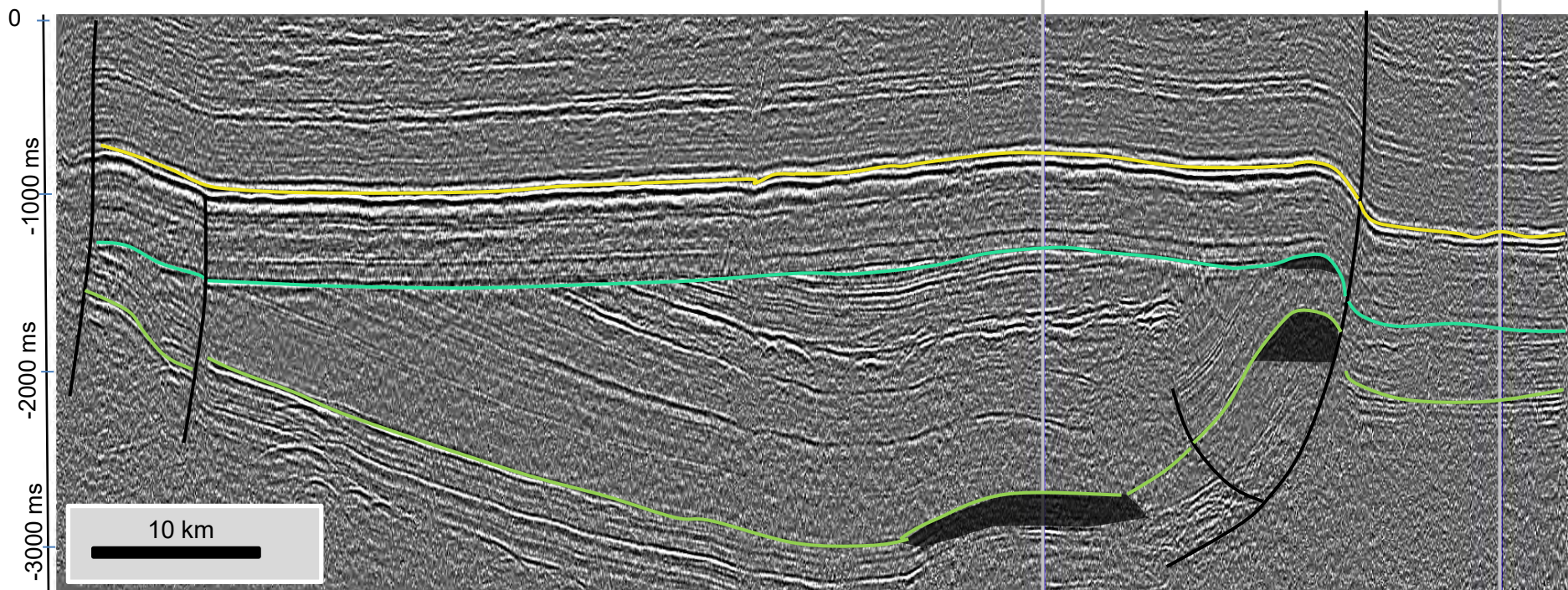
AC-08



- Top of Cretaceous
- Top of Juruá-Mirim
- Top of Cruzeiro do Sul Fm.
- Faults

0031-0178

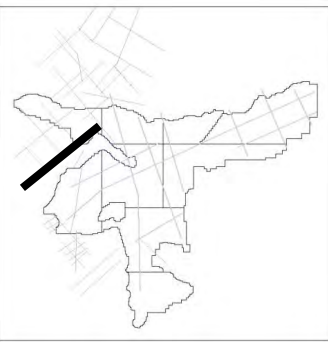
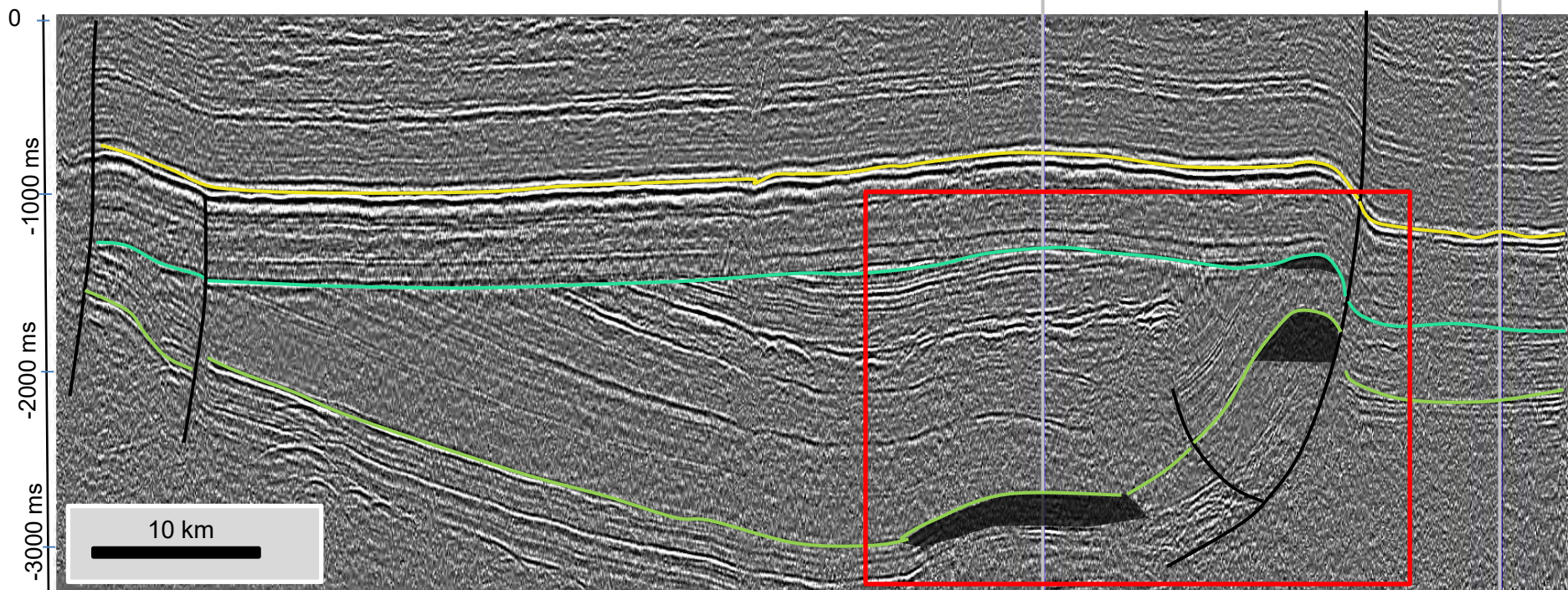
AC-08



- Top of Cretaceous
- Top of Juruá-Mirim
- Top of Cruzeiro do Sul Fm.
- Faults

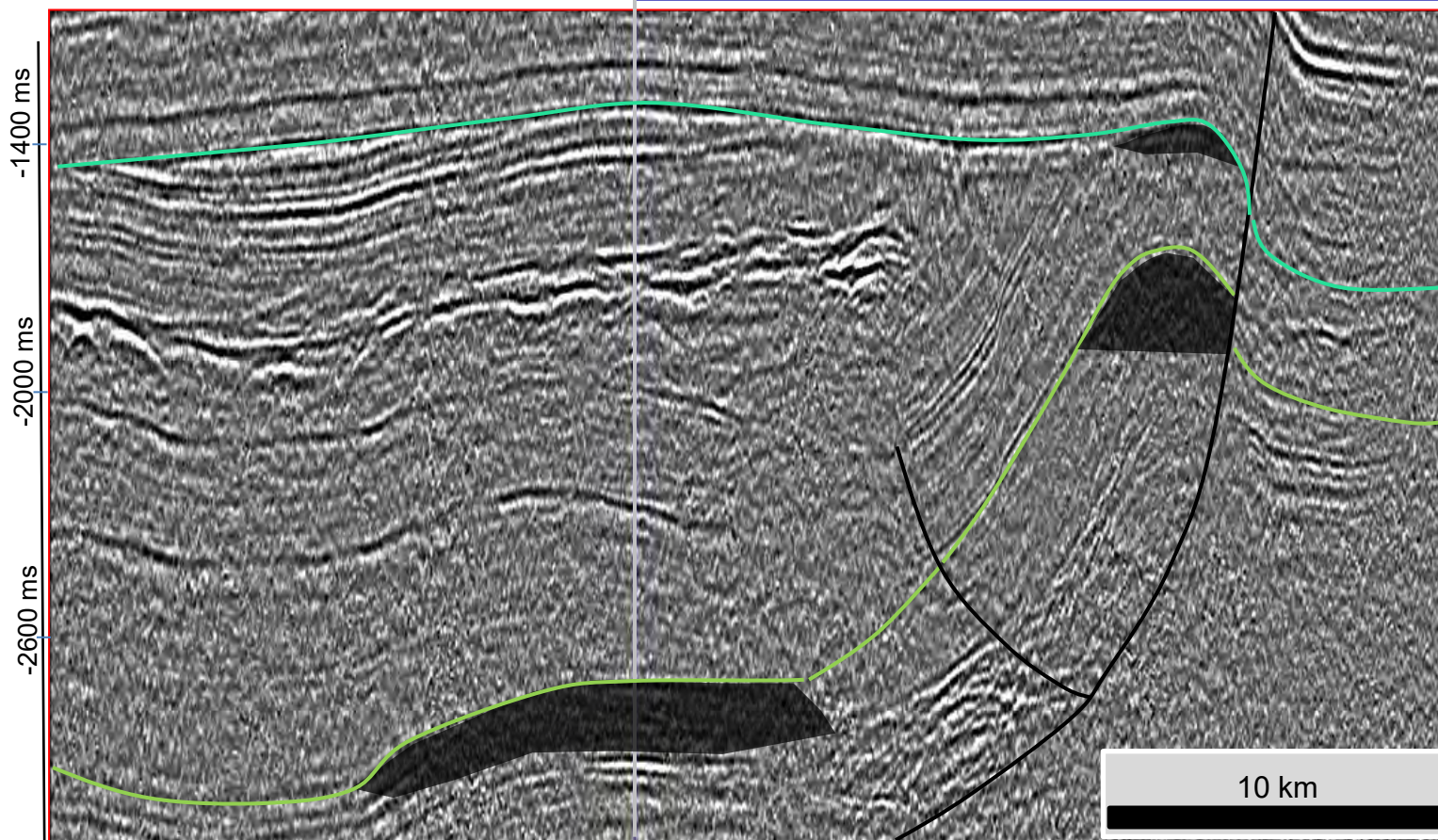
0031-0178

AC-08



0031-0178 - Detail

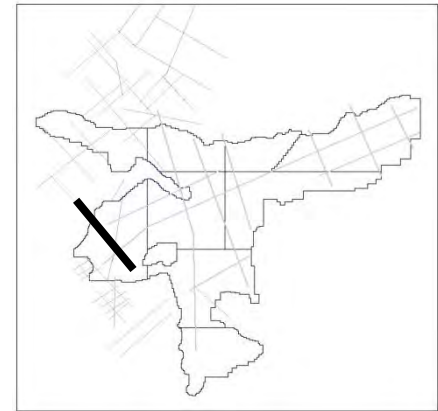
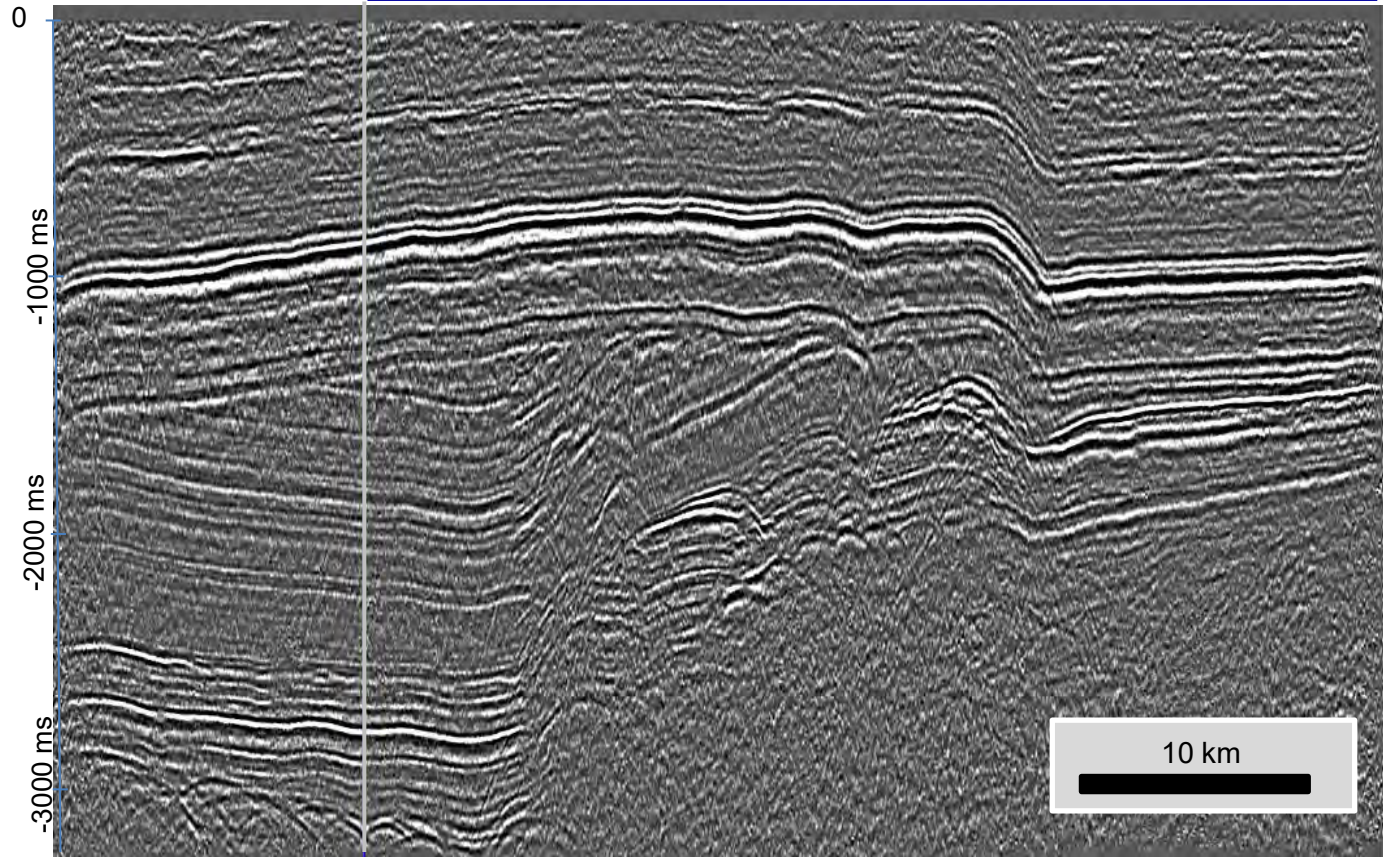
AC-08



— Top of Juruá-Mirim Fm. — Faults  
— Top of Cruzeiro do Sul Fm.

0031-0183

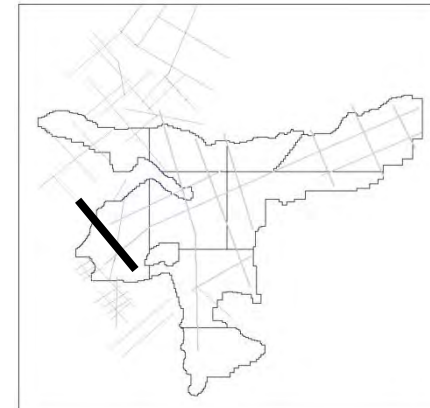
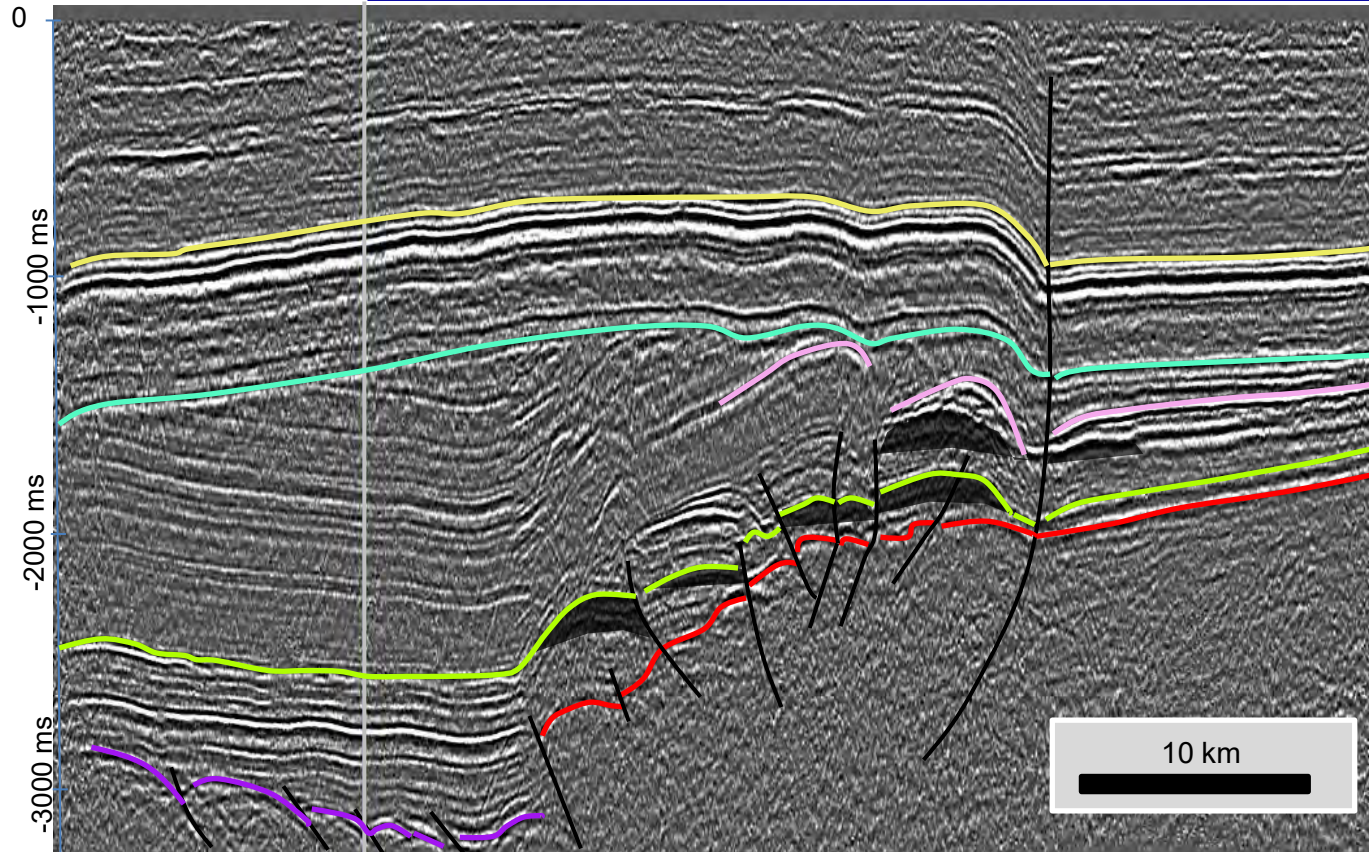
**AC-14**



- |   |                            |   |                 |
|---|----------------------------|---|-----------------|
|  | Top of Cretaceous          |  | Salt            |
|  | Top of Juruá-Mirim Fm.     |  | Top of Devonian |
|  | Top of Cruzeiro do Sul Fm. |   |                 |
|  | Top of Basement            |   |                 |
|  | Faults                     |   |                 |

0031-0183

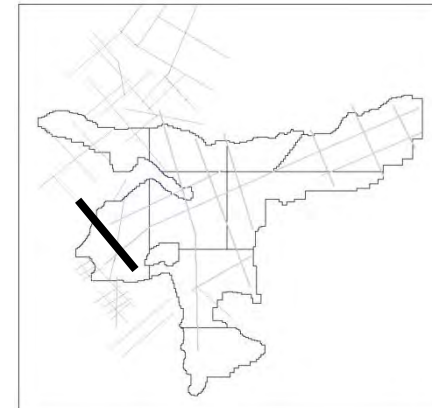
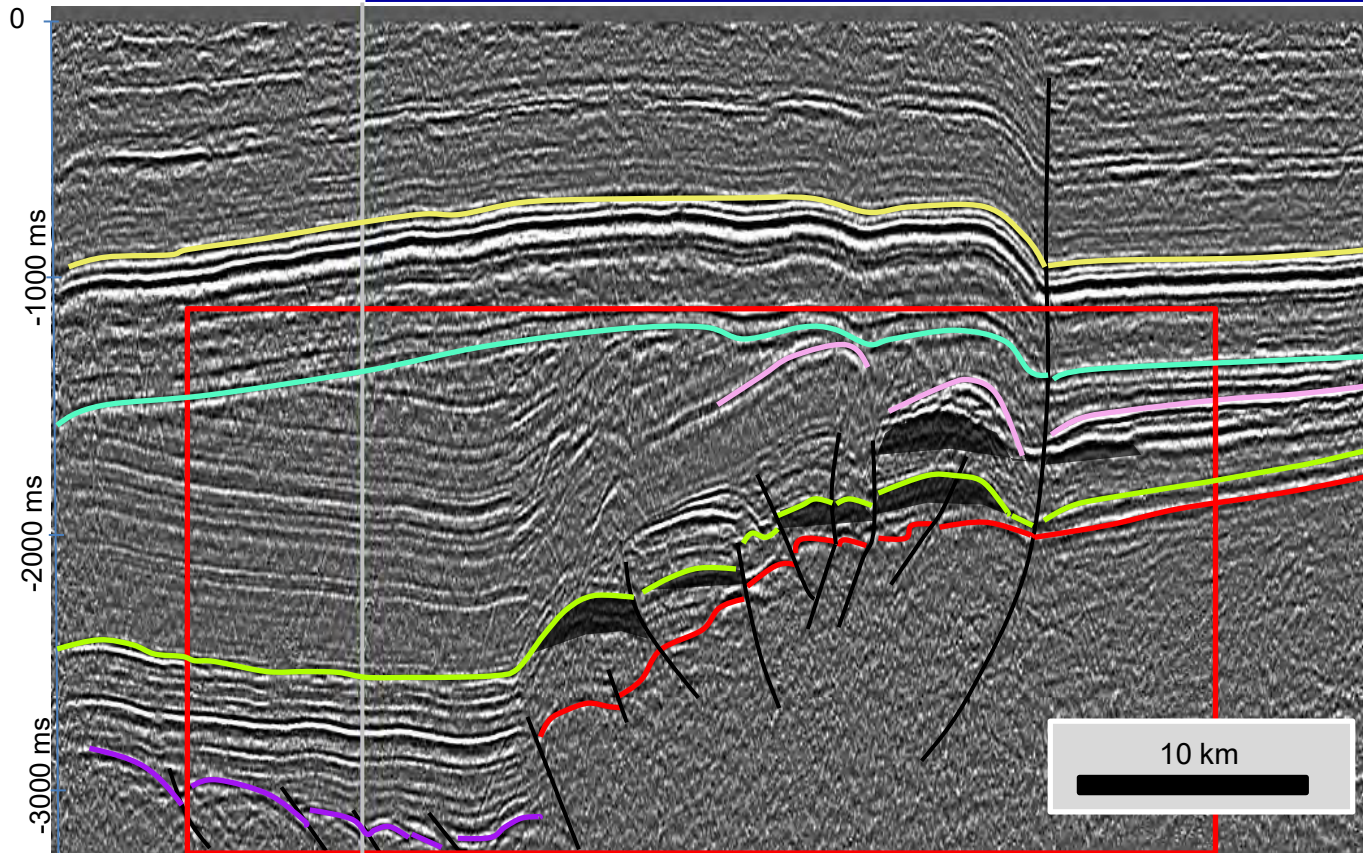
**AC-14**



- Top of Cretaceous
- Top of Juruá-Mirim Fm.
- Top of Cruzeiro do Sul Fm.
- Top of Basement
- Faults
- Salt
- Top of Devonian

0031-0183

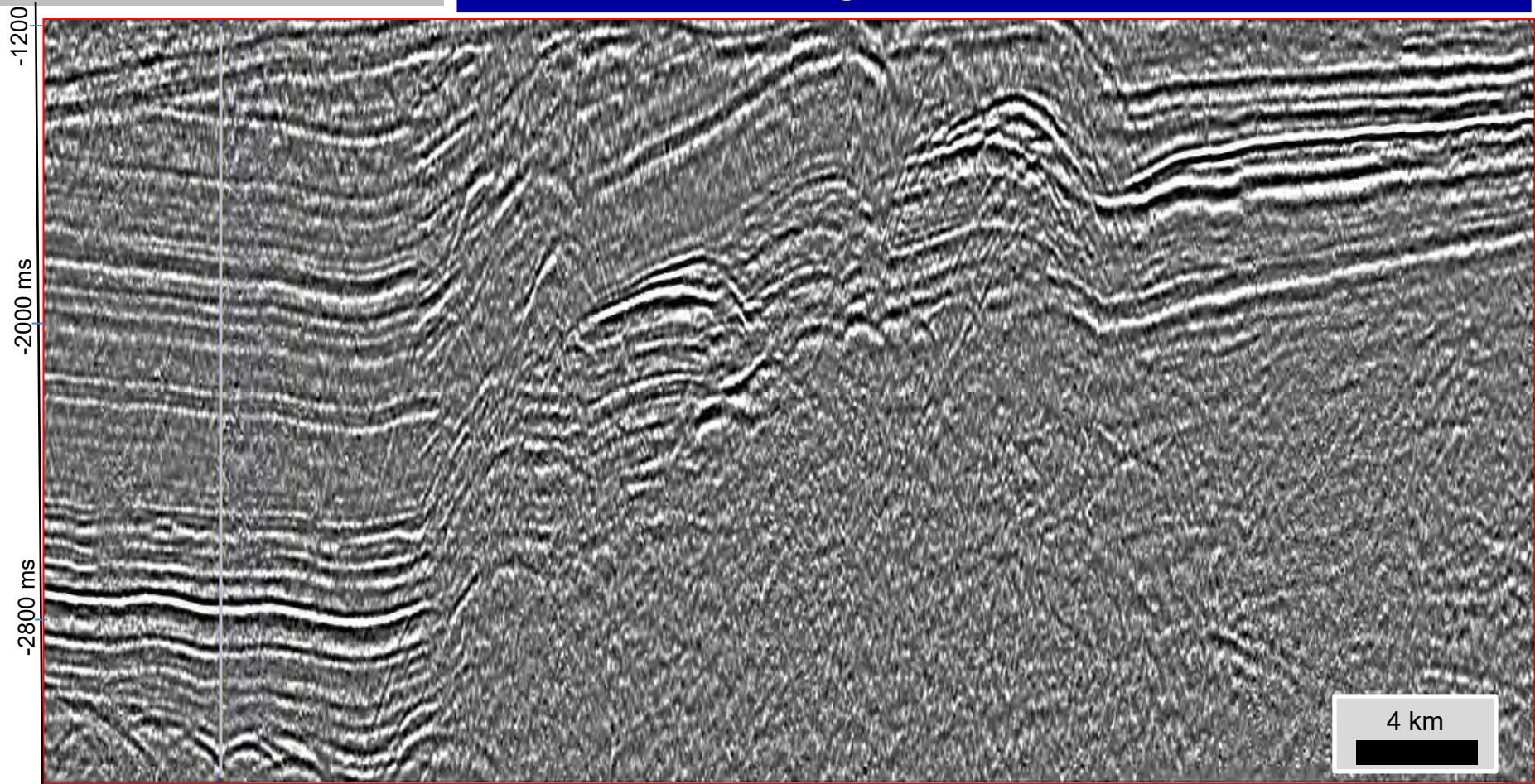
**AC-14**



- |                              |                   |
|------------------------------|-------------------|
| — Top of Cretaceous          | — Salt            |
| — Top of Juruá-Mirim Fm.     | — Top of Devonian |
| — Top of Cruzeiro do Sul Fm. |                   |
| — Top of Basement            |                   |
| — Faults                     |                   |

**0031-0183 - detail**

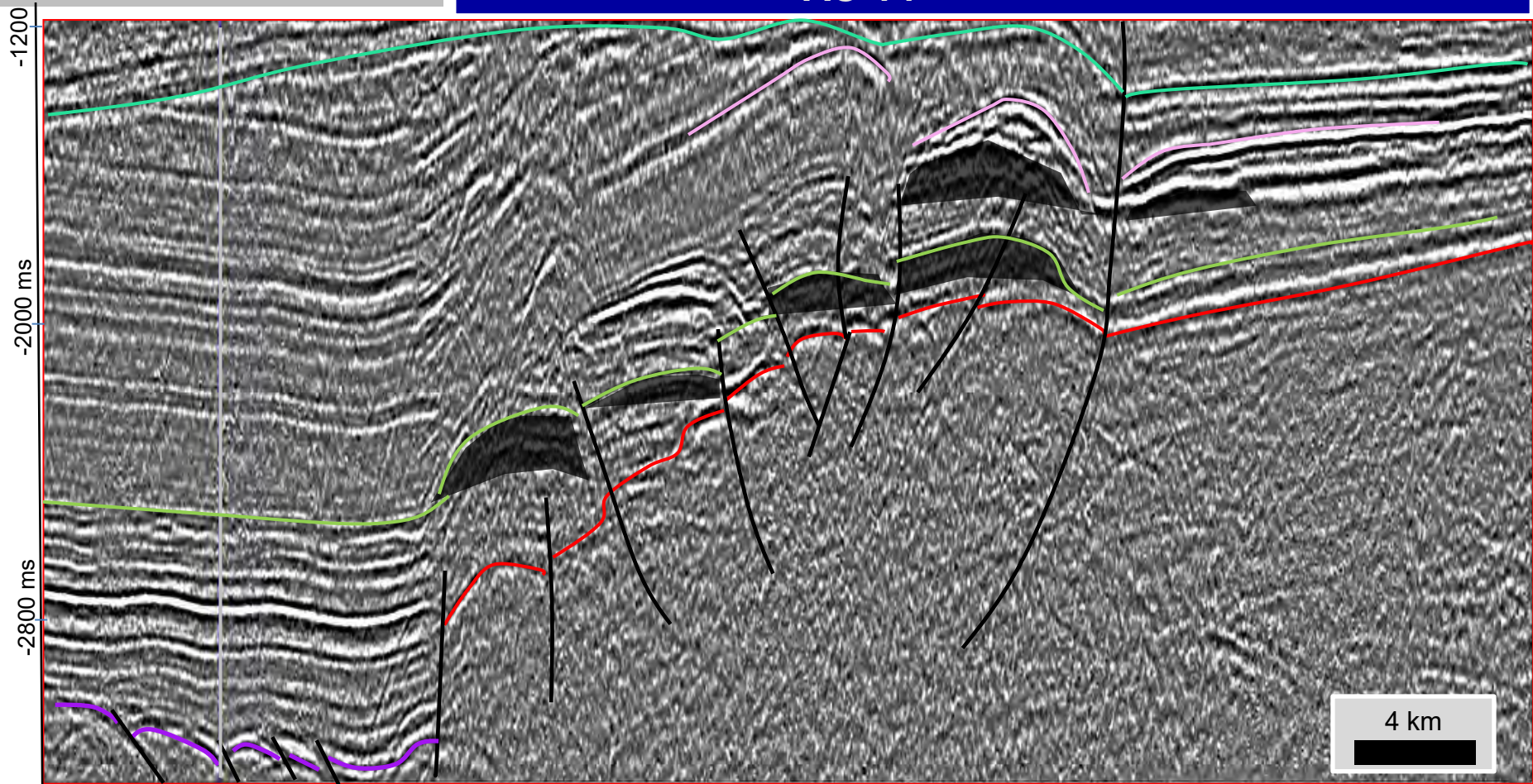
**AC-14**



- |   |                            |   |                 |
|---|----------------------------|---|-----------------|
|  | Top of Juruá-Mirim Fm.     |  | Salt            |
|  | Top of Cruzeiro do Sul Fm. |  | Top of Devonian |
|  | Top of Basement            |  | Faults          |

**0031-0183 - detail**

**AC-14**



- |   |   |
|---|---|
| <span style="color: cyan;">—</span> Top of Juruá-Mirim Fm.      | <span style="color: magenta;">—</span> Salt           |
| <span style="color: green;">—</span> Top of Cruzeiro do Sul Fm. | <span style="color: purple;">—</span> Top of Devonian |
| <span style="color: red;">—</span> Top of Basement              | <span style="color: black;">—</span> Faults           |

# Leads

0301-0013

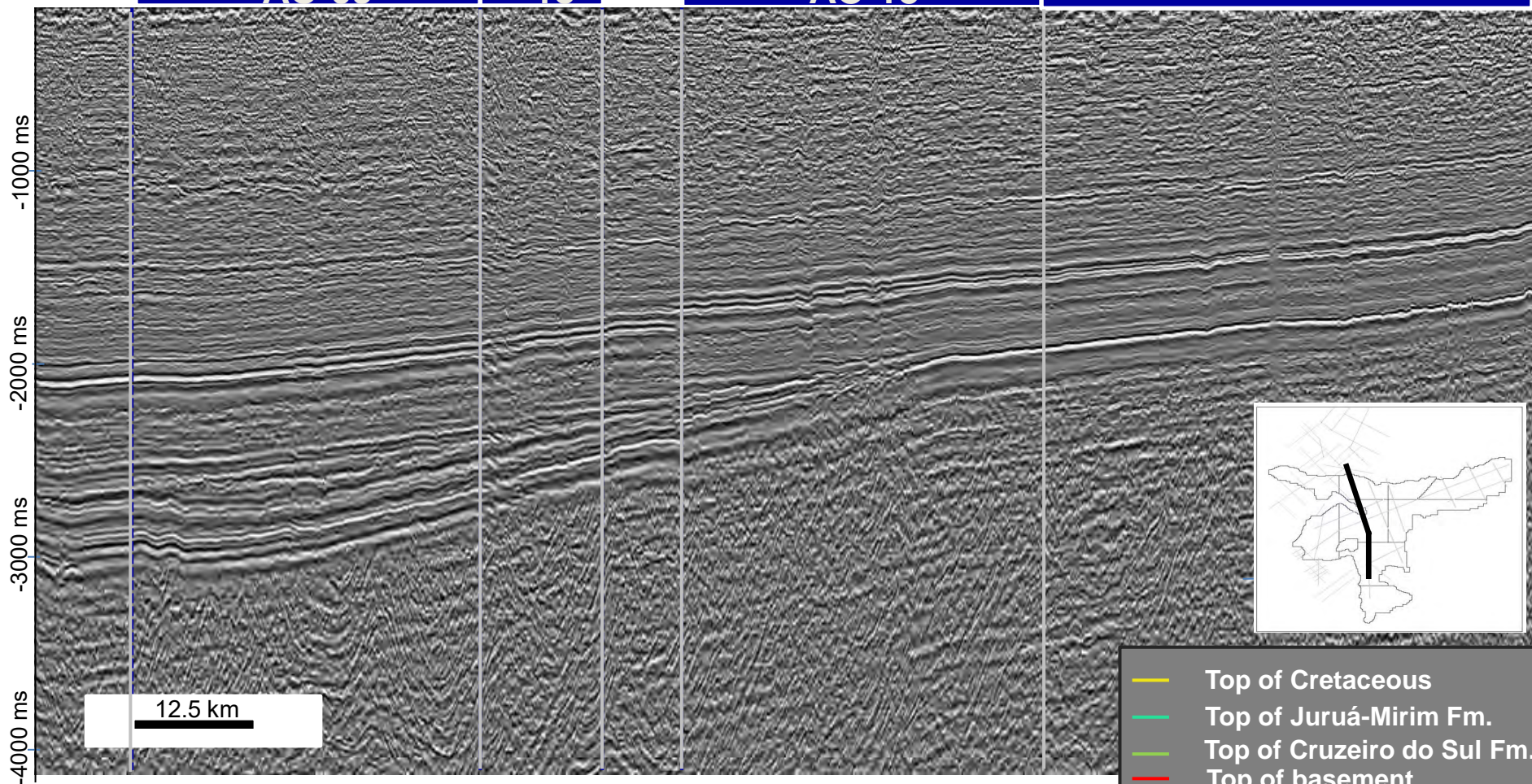
0301\_2D\_BACIA\_DO\_ACRE

AC-09

15

AC-15

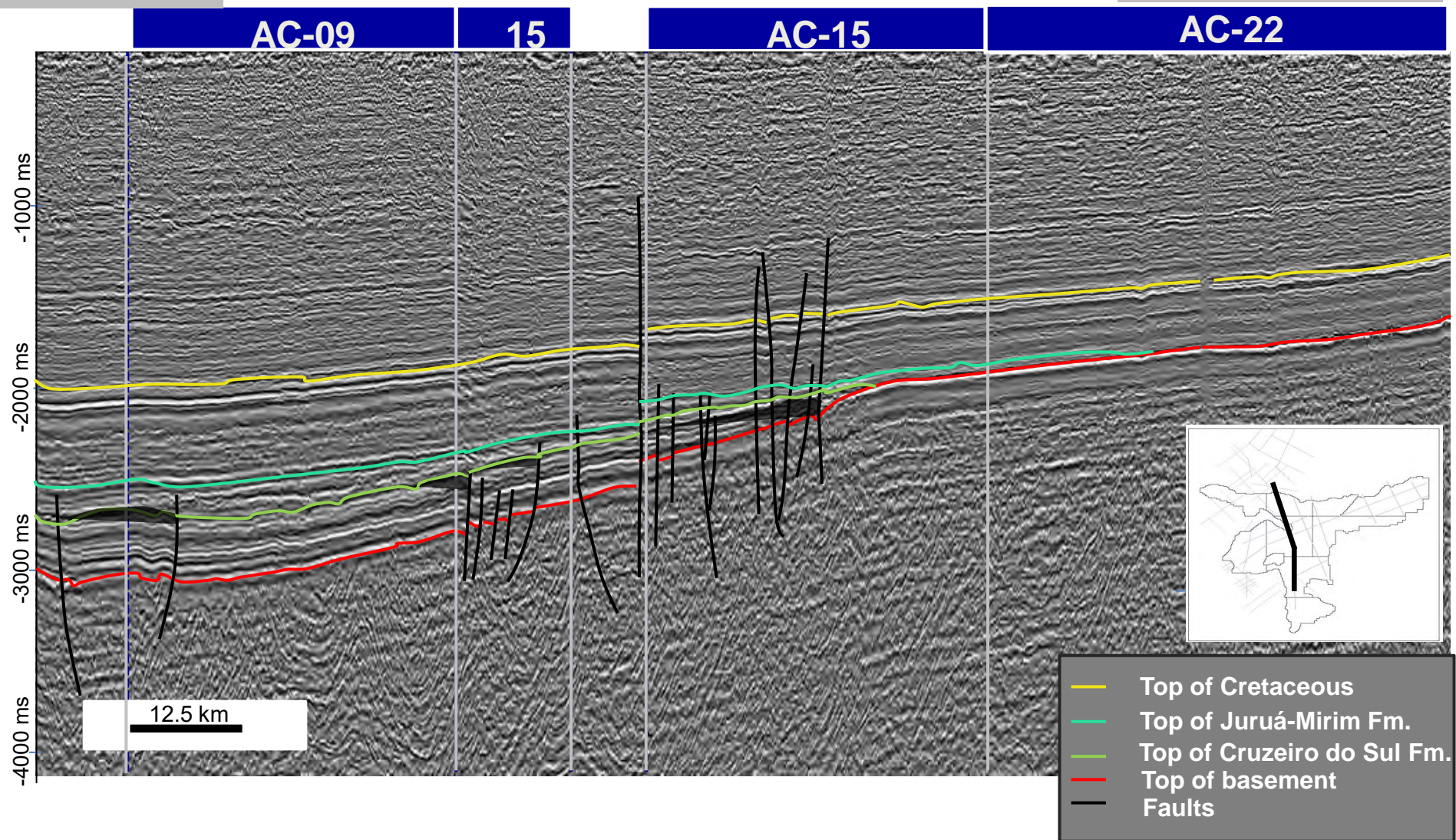
AC-22



- Top of Cretaceous
- Top of Juruá-Mirim Fm.
- Top of Cruzeiro do Sul Fm.
- Top of basement
- Faults

0301-0013

0301\_2D\_BACIA\_DO\_ACRE



0301-0013

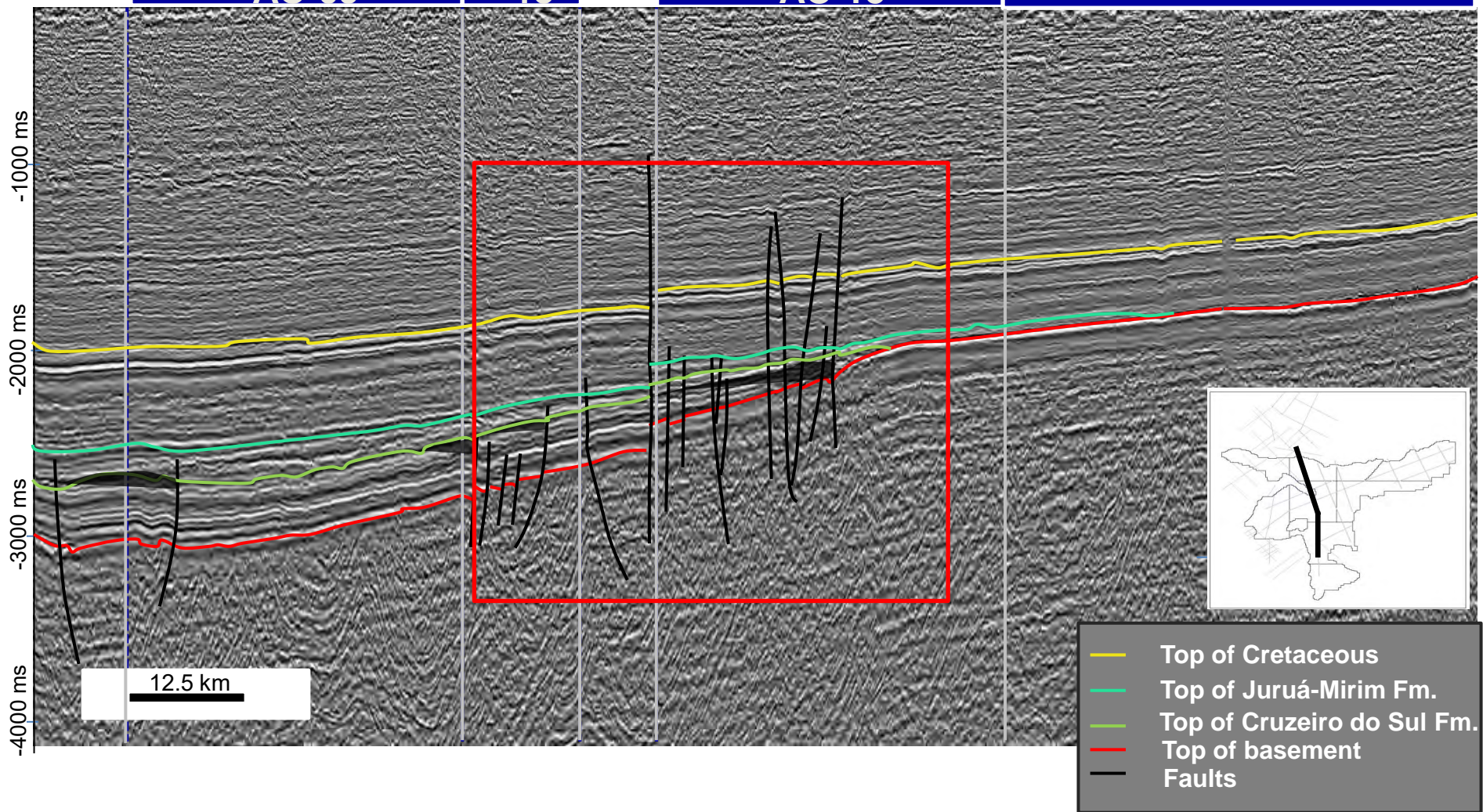
0301\_2D\_BACIA\_DO\_ACRE

AC-09

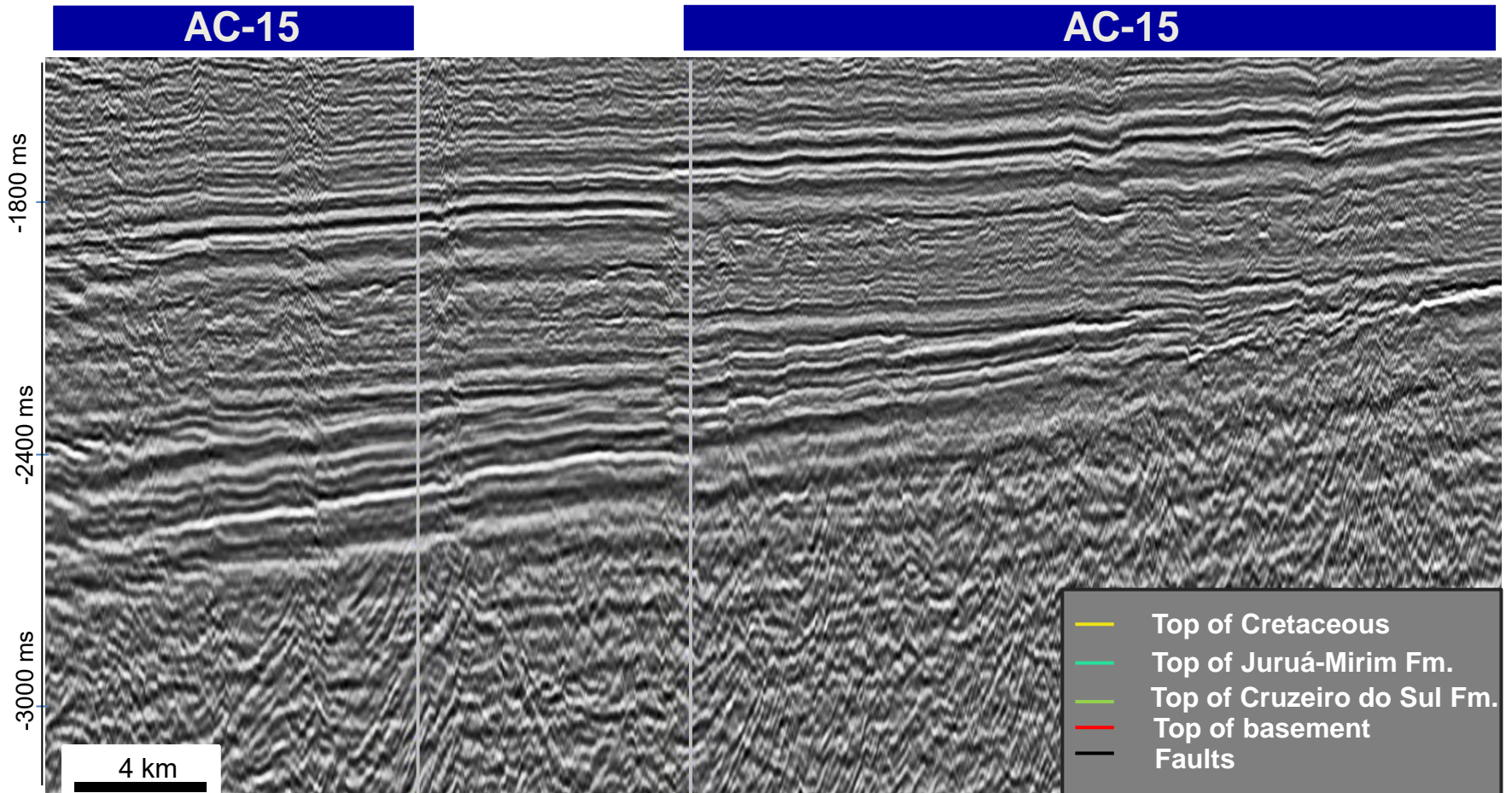
15

AC-15

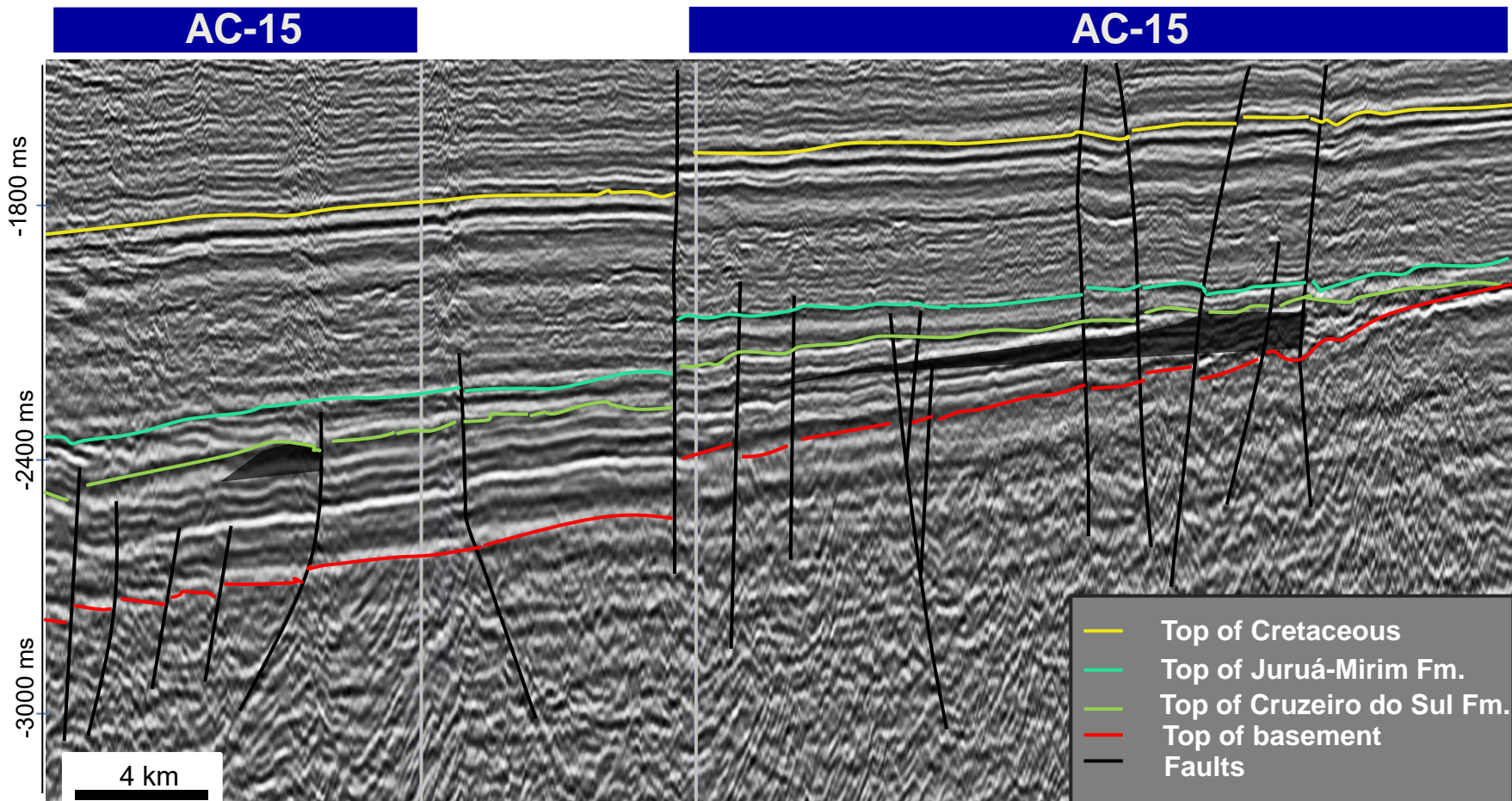
AC-22



## 0301-0013 - Detail

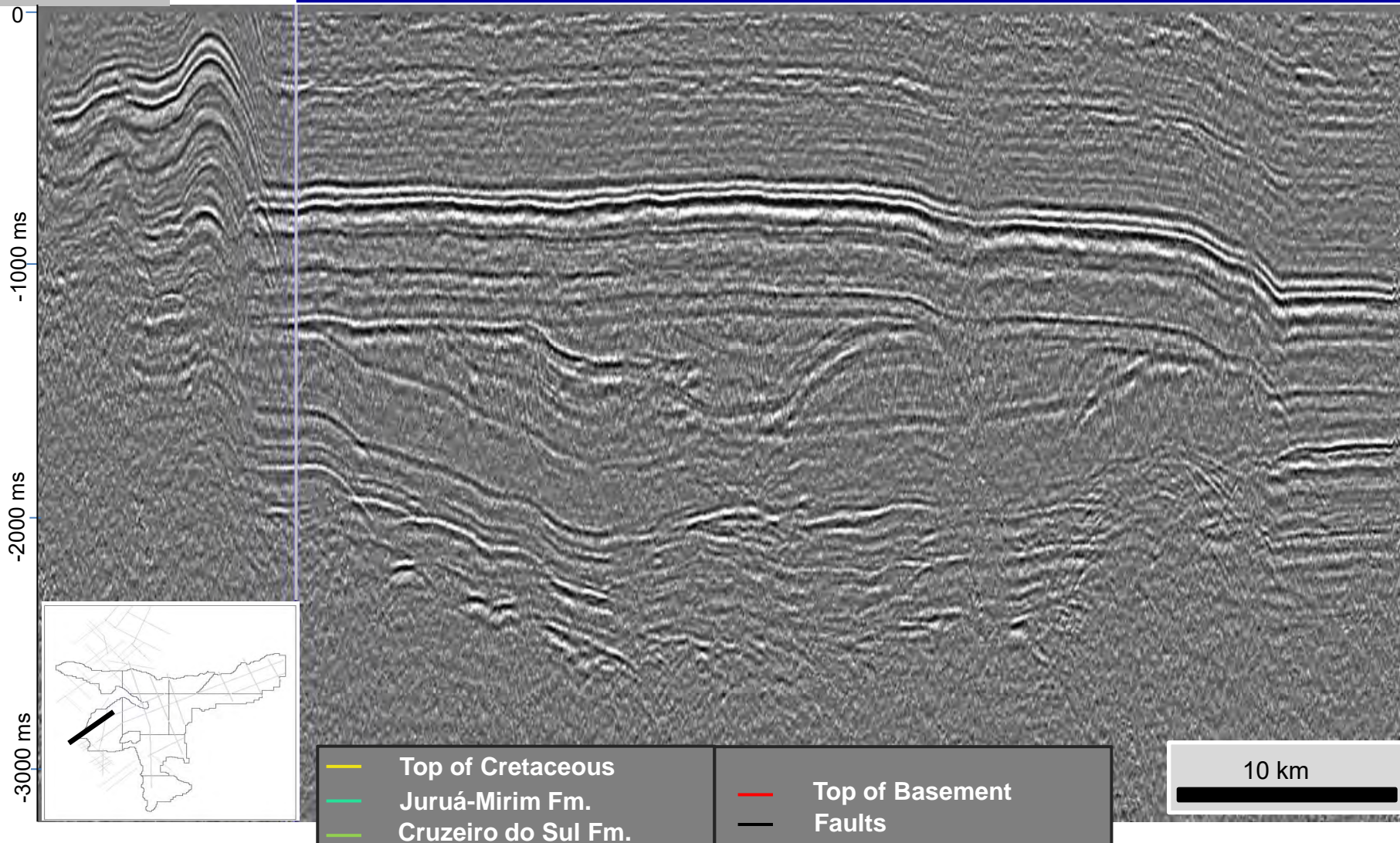


## 0301-0013 - Detail



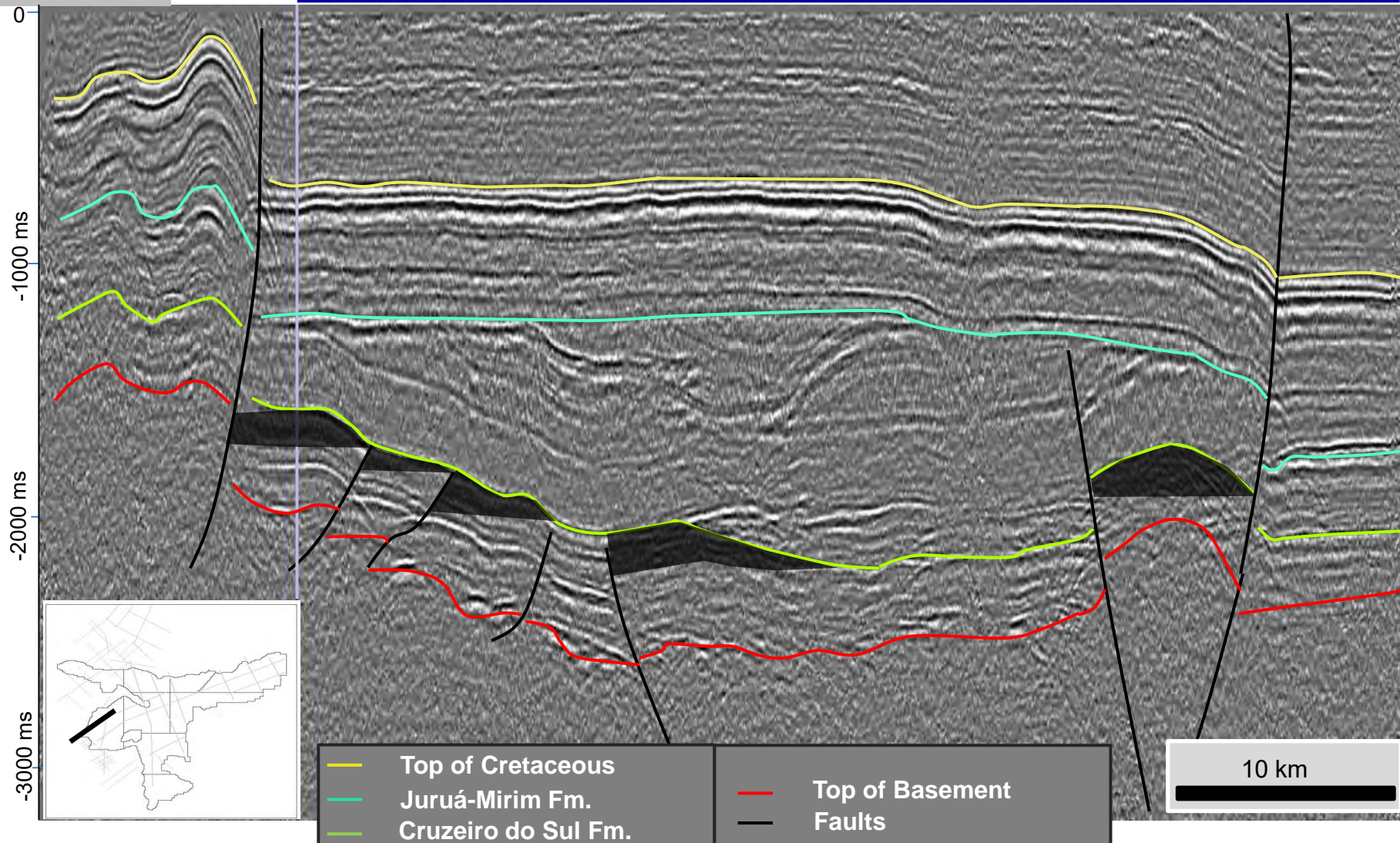
0031-0191

AC-14



0031-0191

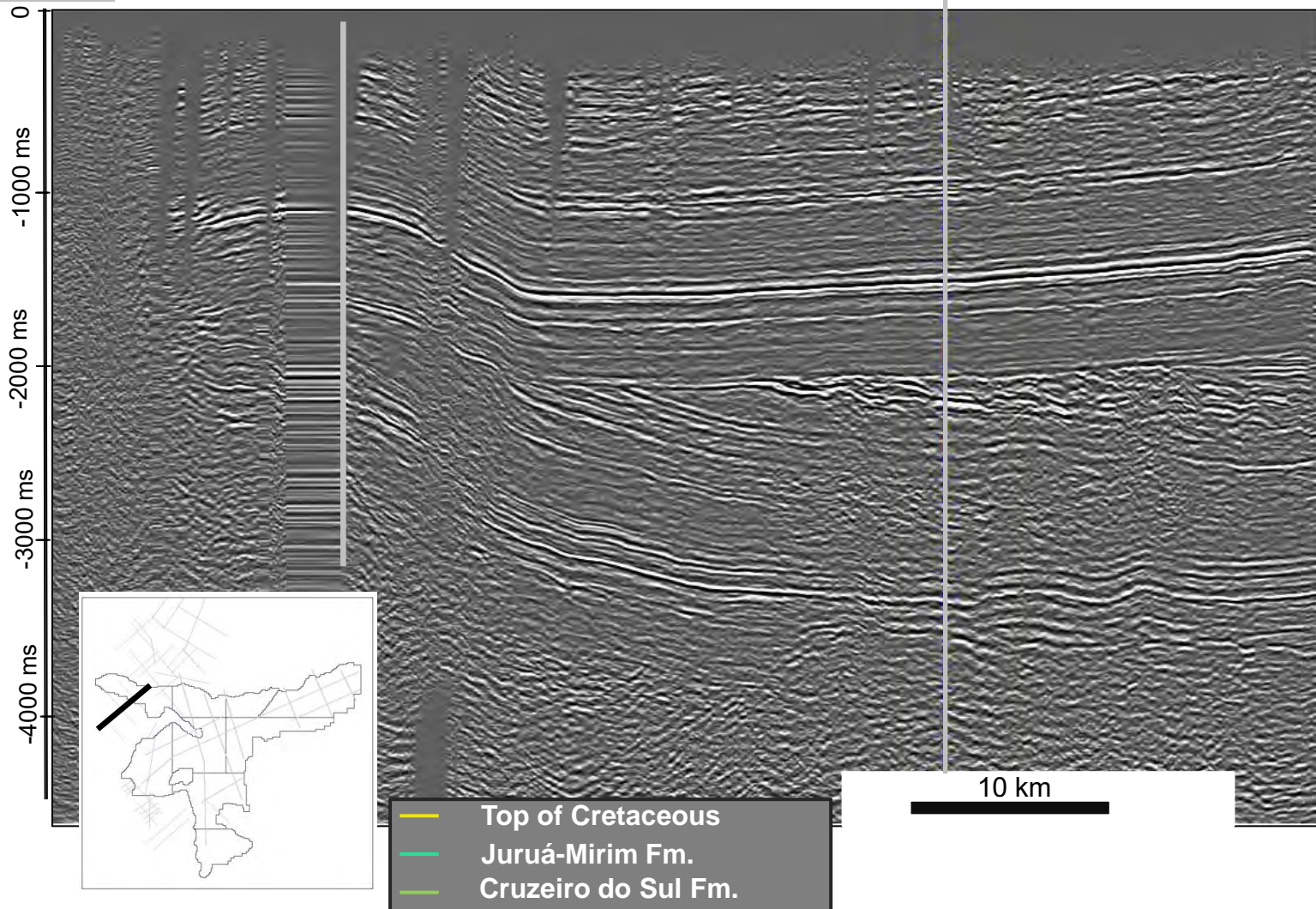
AC-14



# Leads

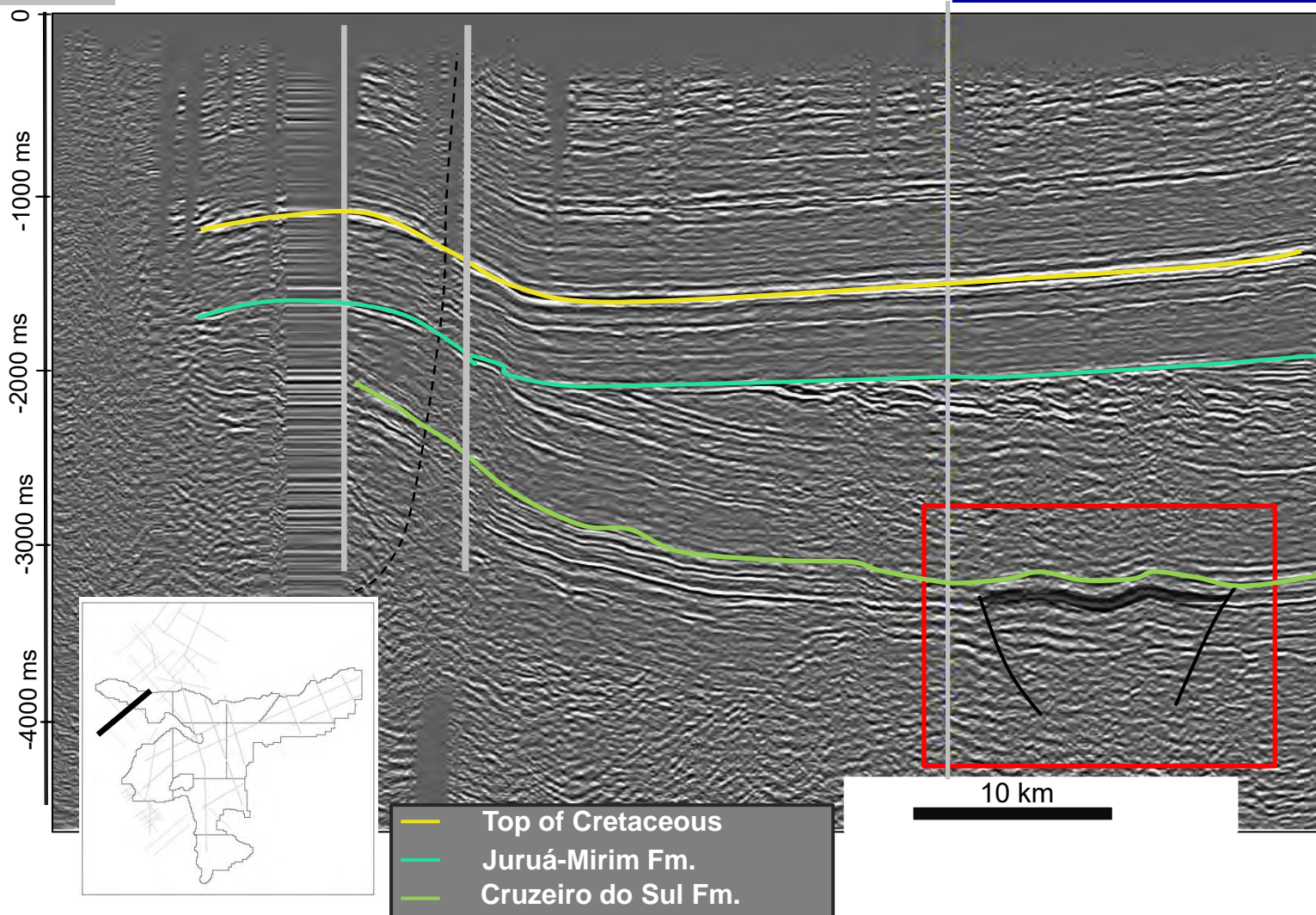
0040-0044

AC-08



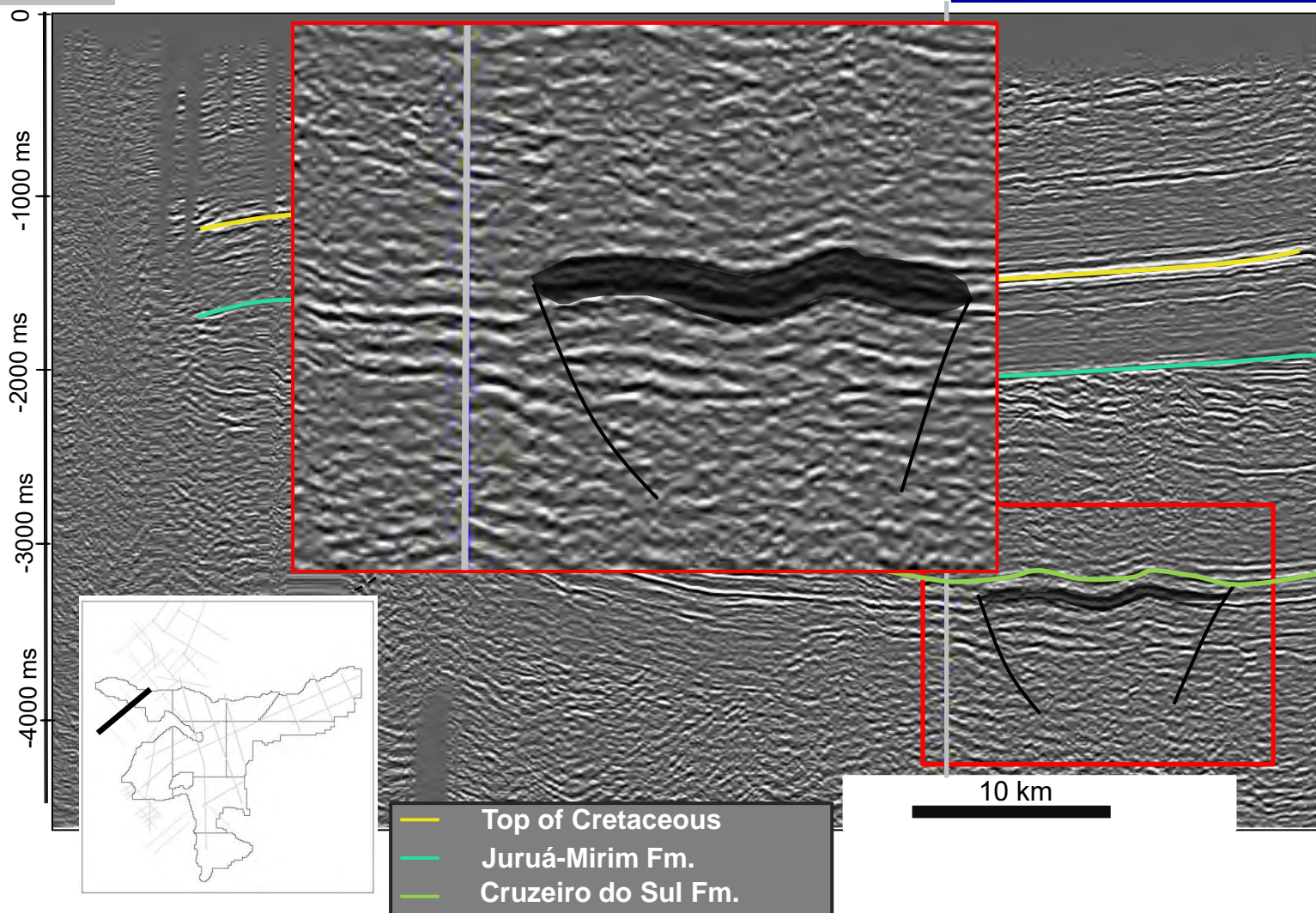
0040-0044

AC-08



0040-0044

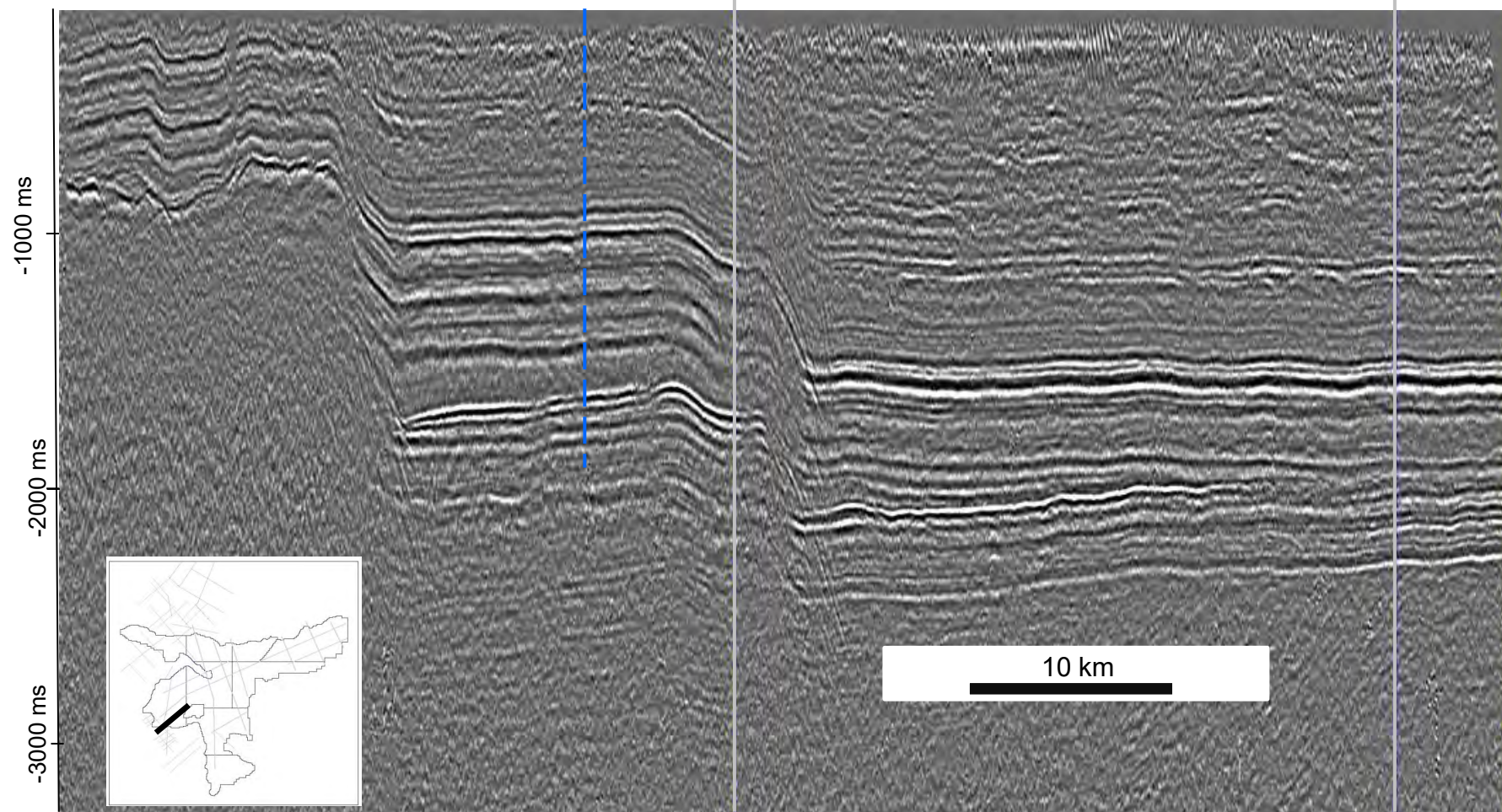
AC-08



0031-0180A

2 JMST 1 AC

AC-14

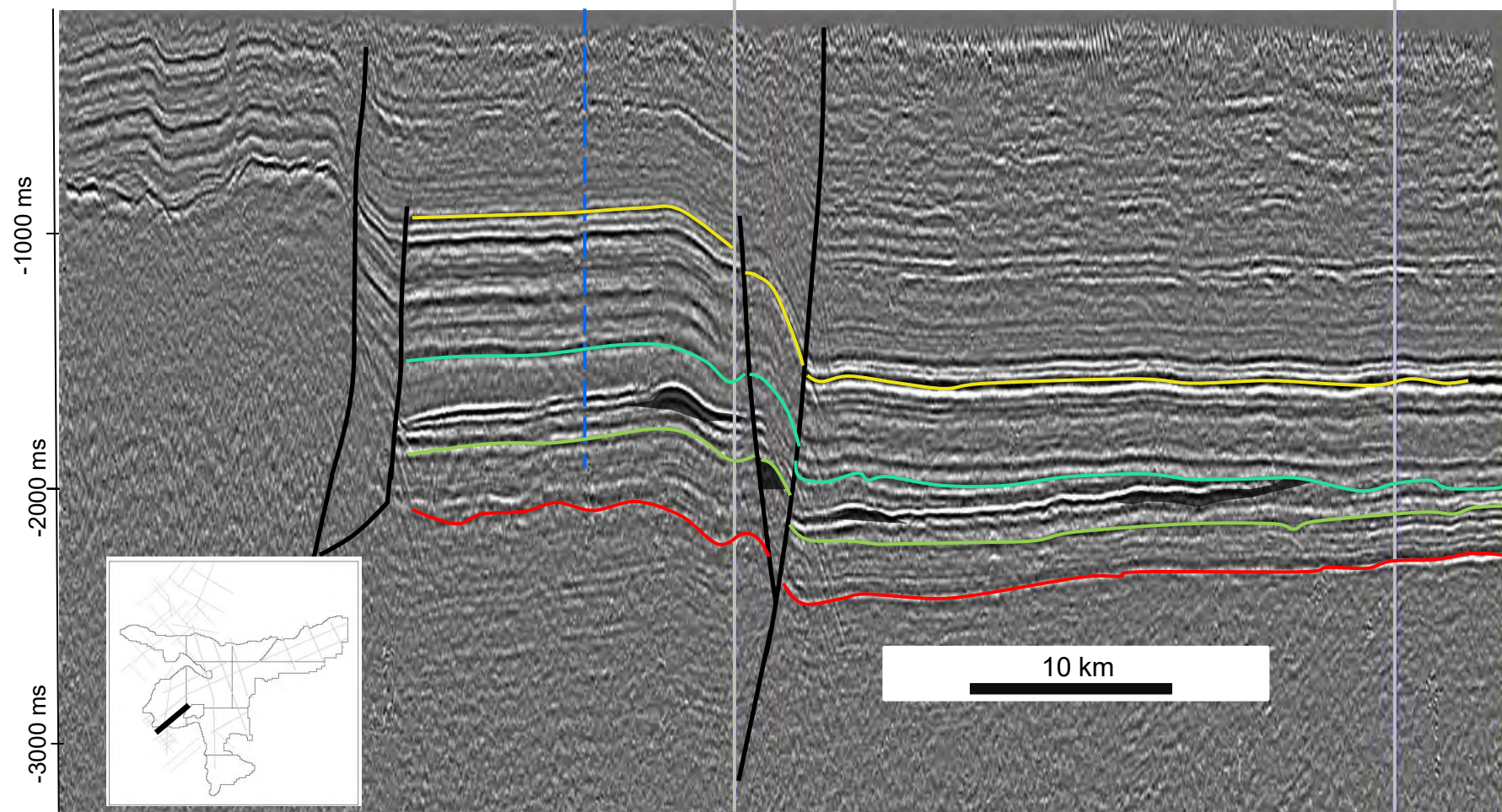


	Top of Cretaceous		Cruzeiro do Sul Fm.		Basement
	Juruá-Mirim Fm.				Faults

0031-0180A

2 JMST 1 AC

AC-14

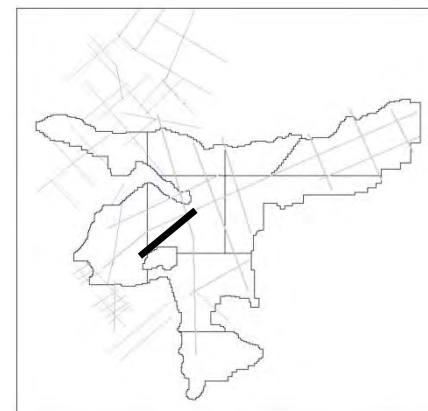
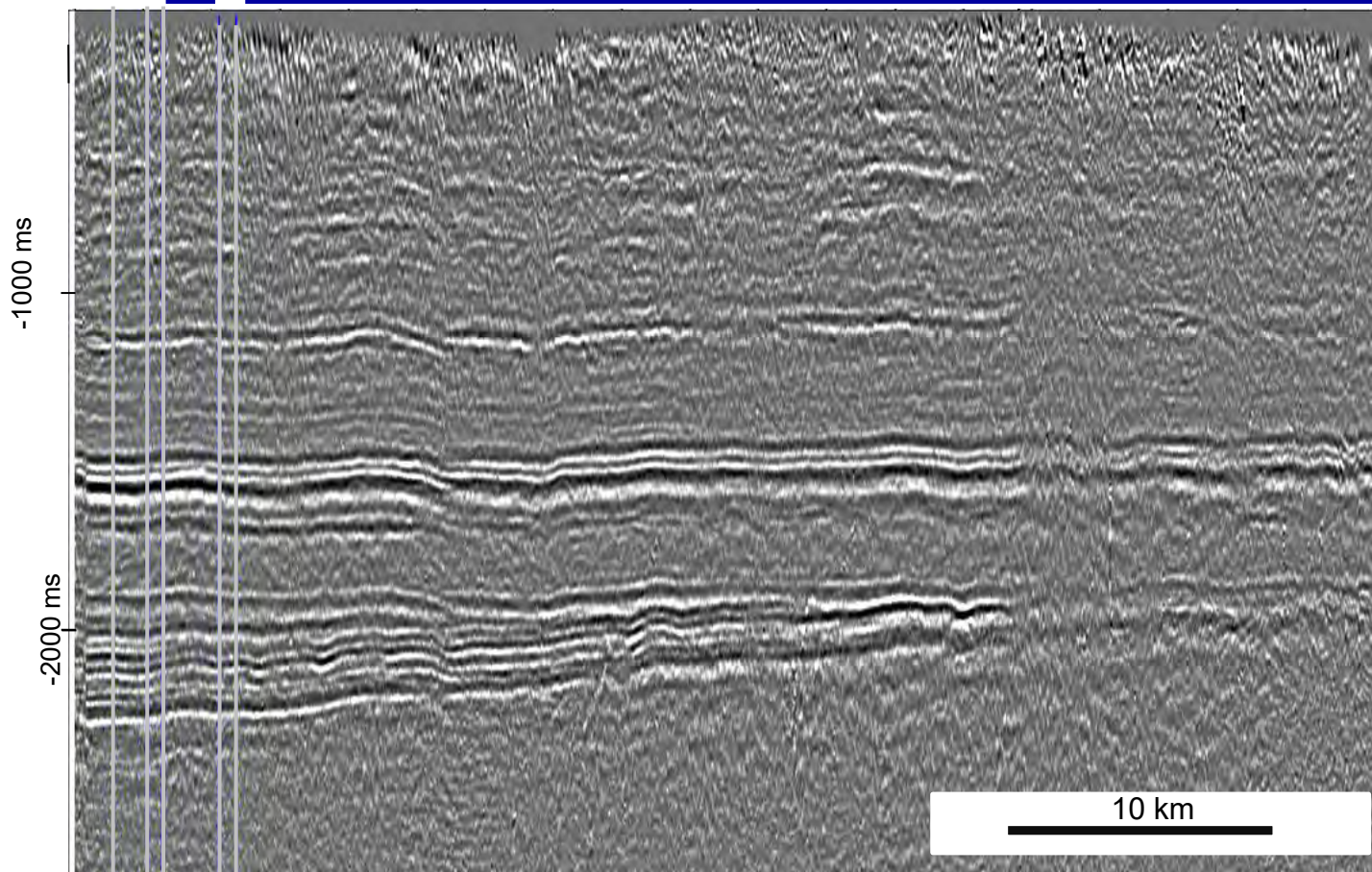


— Top of Cretaceous	— Cruzeiro do Sul Fm.	— Basement
— Juruá-Mirim Fm.		— Faults

0031-0180

15

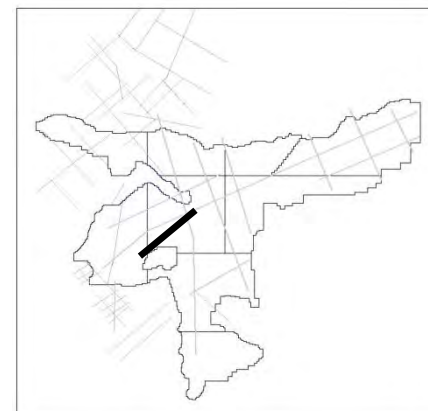
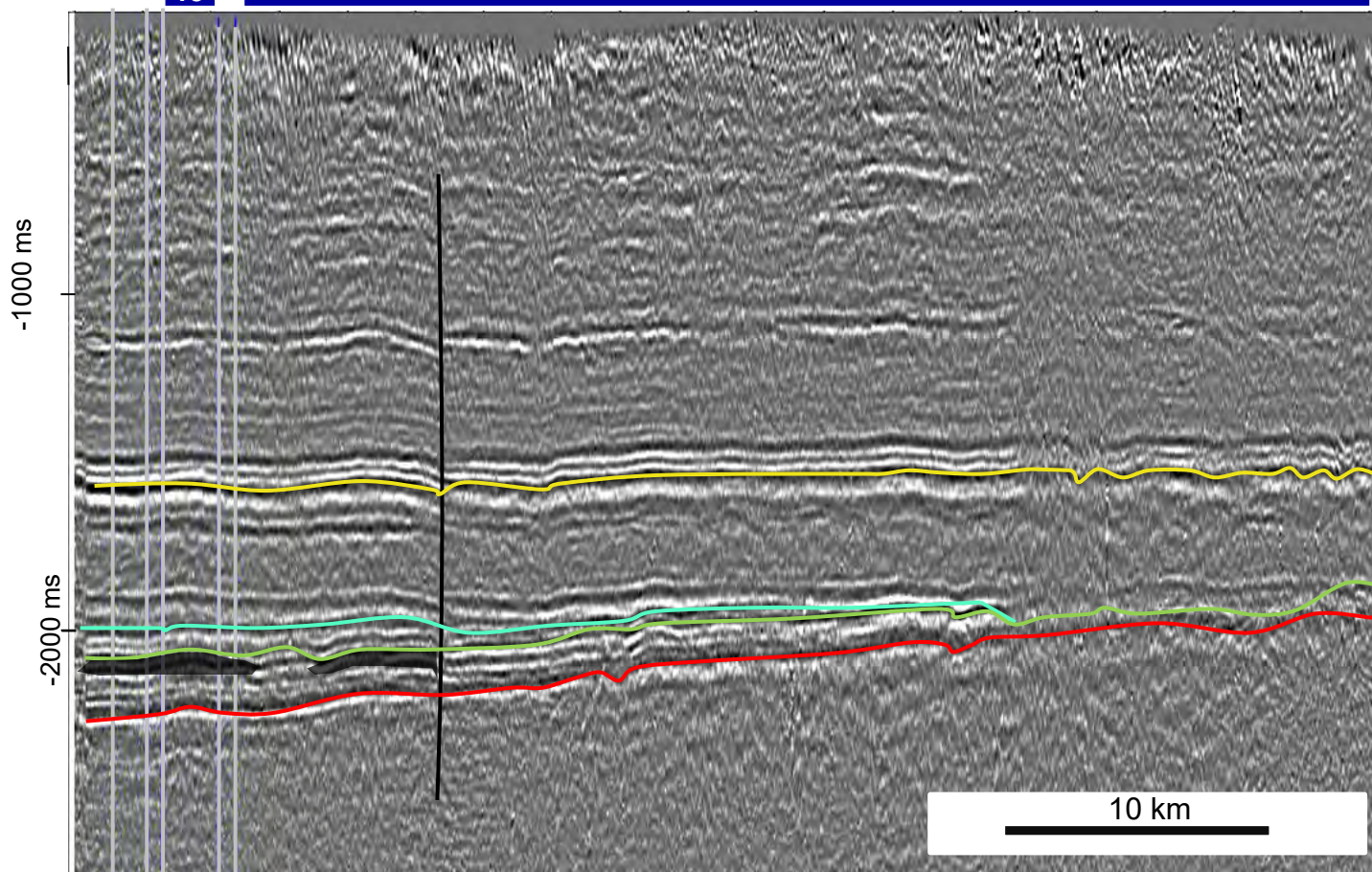
AC-15



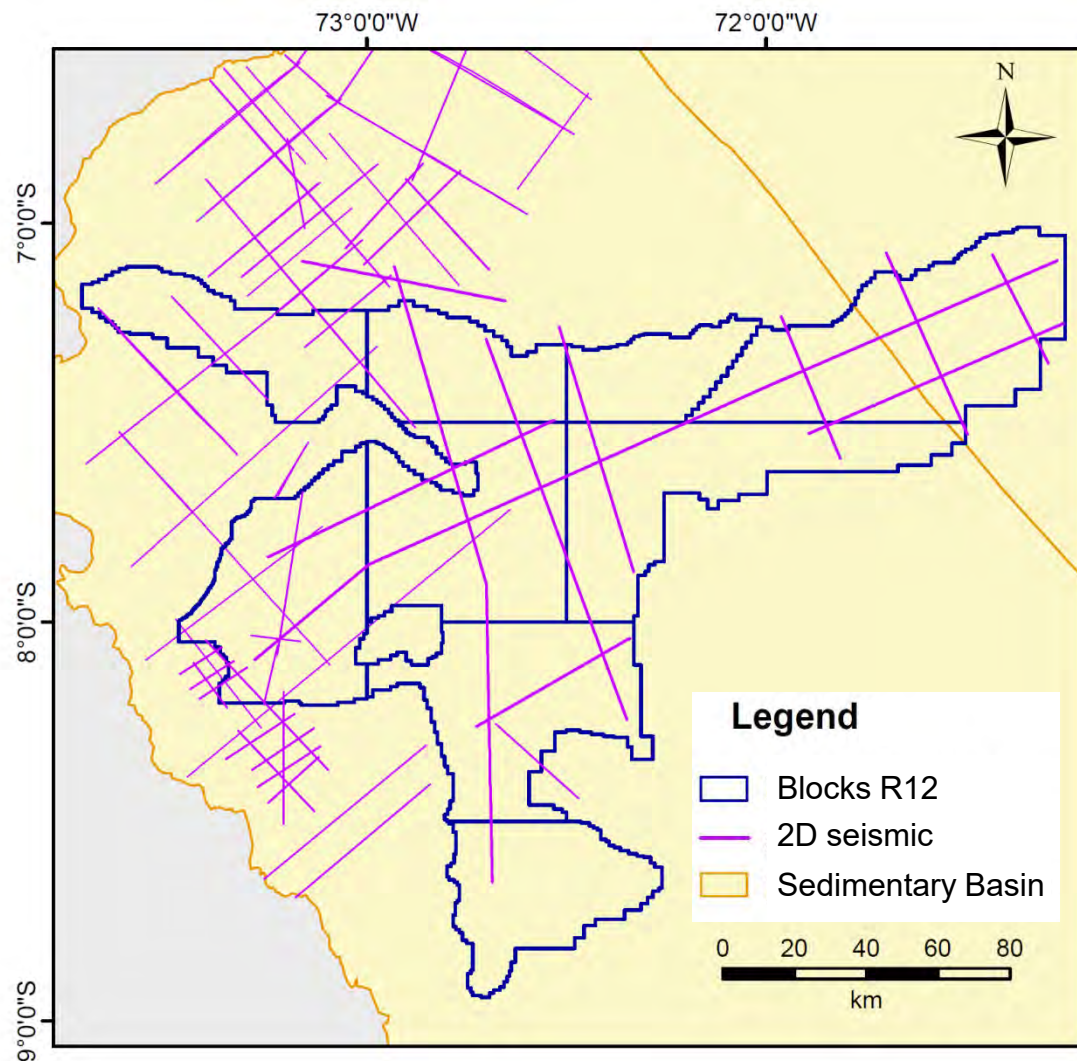
0031-0180

15

AC-15



# Speculative Resources

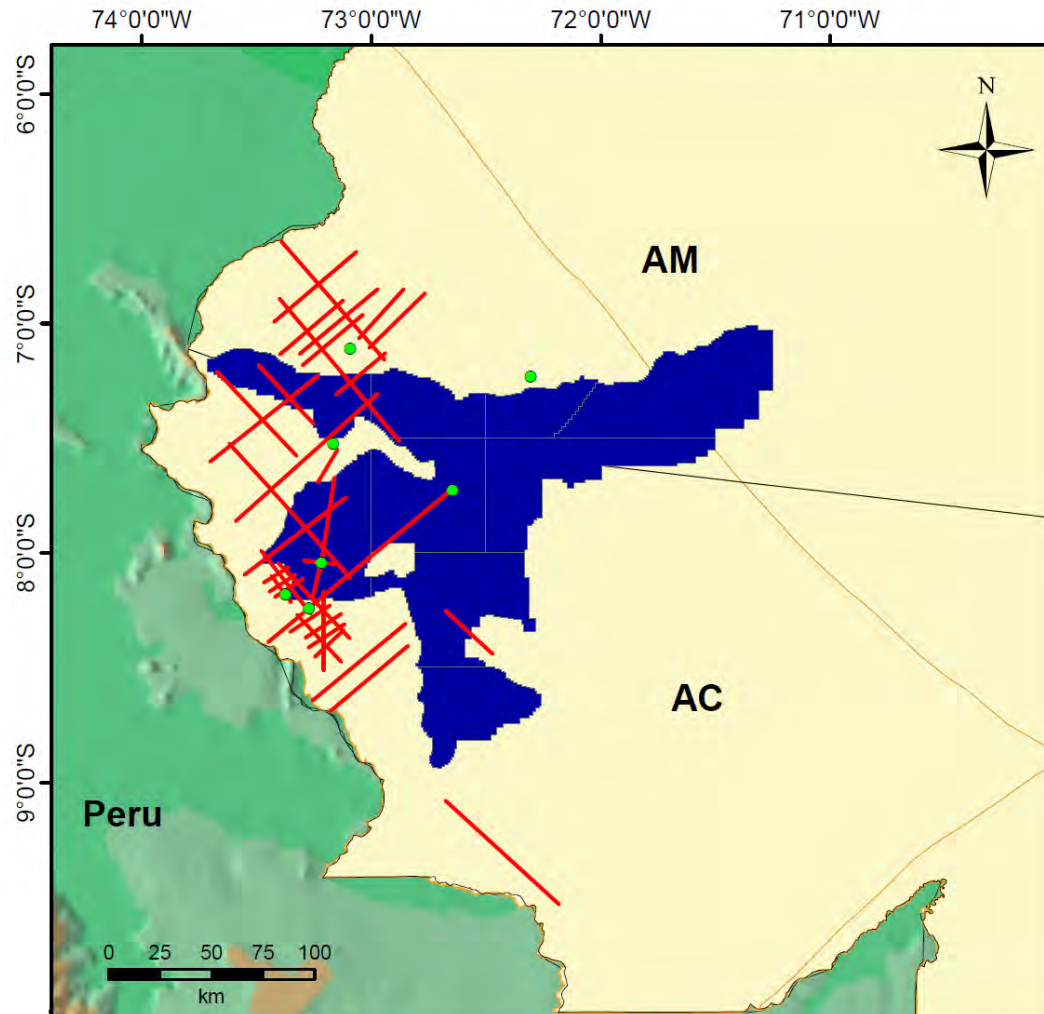


## Seismic Surveys:

0301\_2D\_BACIA\_DO\_ACRE  
0031\_ACRE\_75  
0040\_ACRE\_75  
0054\_ACRE\_75  
0069\_ACRE\_75

**Preliminary in situ  
Volume of Gas:  
2.2 TCF**

# Data Package



7 wells  
1,562 km 2D seismic  
Geochemical data  
Potential methods



## Legend

-  Wells
-  2D Seismic
-  Blocks
-  Sedimentary Basin
-  States

# Contractual Aspects

SECTOR	SAC
Exploration Model	Frontier Basin
Number of Blocks	9
Area on Offer	19,719 km <sup>2</sup>
Exploration Phase	8 years
Exploration Period	5 + 3 years
Technical Qualification of the Operator	B
Minimum Bonus	R\$ 86,104.77 to 668,920.77
Minimum Depth (Main Objective)	Cruzeiro do Sul Formation (Permo-carboniferous)

Location

Infrastructure and Operational Conditions

Exploration Overview

Tectonostratigraphic Evolution

Petroleum Systems

Plays

Analogous Exploration Successes

Area on Offer

**Final Remarks**

# Final Remarks

- **Still underexplored Frontier Basin, but promising due to the occurrence of several hydrocarbon shows;**
- **Gas prone basin, however oil stains were found in two wells;**
- **Discoveries in Peru and Bolivia basins support the petroleum potential of the Acre Basin;**
- **Technical studies promoted by ANP identified several leads in the area on offer, with preliminary in place volumes ~ 2.2 TCF.**

## **National Agency of Petroleum, Natural Gas and Biofuels**

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