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NAVIGATING CHANGE:
GEOSCIENCES SHAPING
A SUSTAINABLE TRANSITION

HOSTED BY TotalEnergies

PARTNERS aramco bp TGS VIRIDIEN

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Derisking source rock potential through geochemical analysis of seabed samples

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ANCAP

AMPLIFIED GEOCHEMICAL IMAGING LLC

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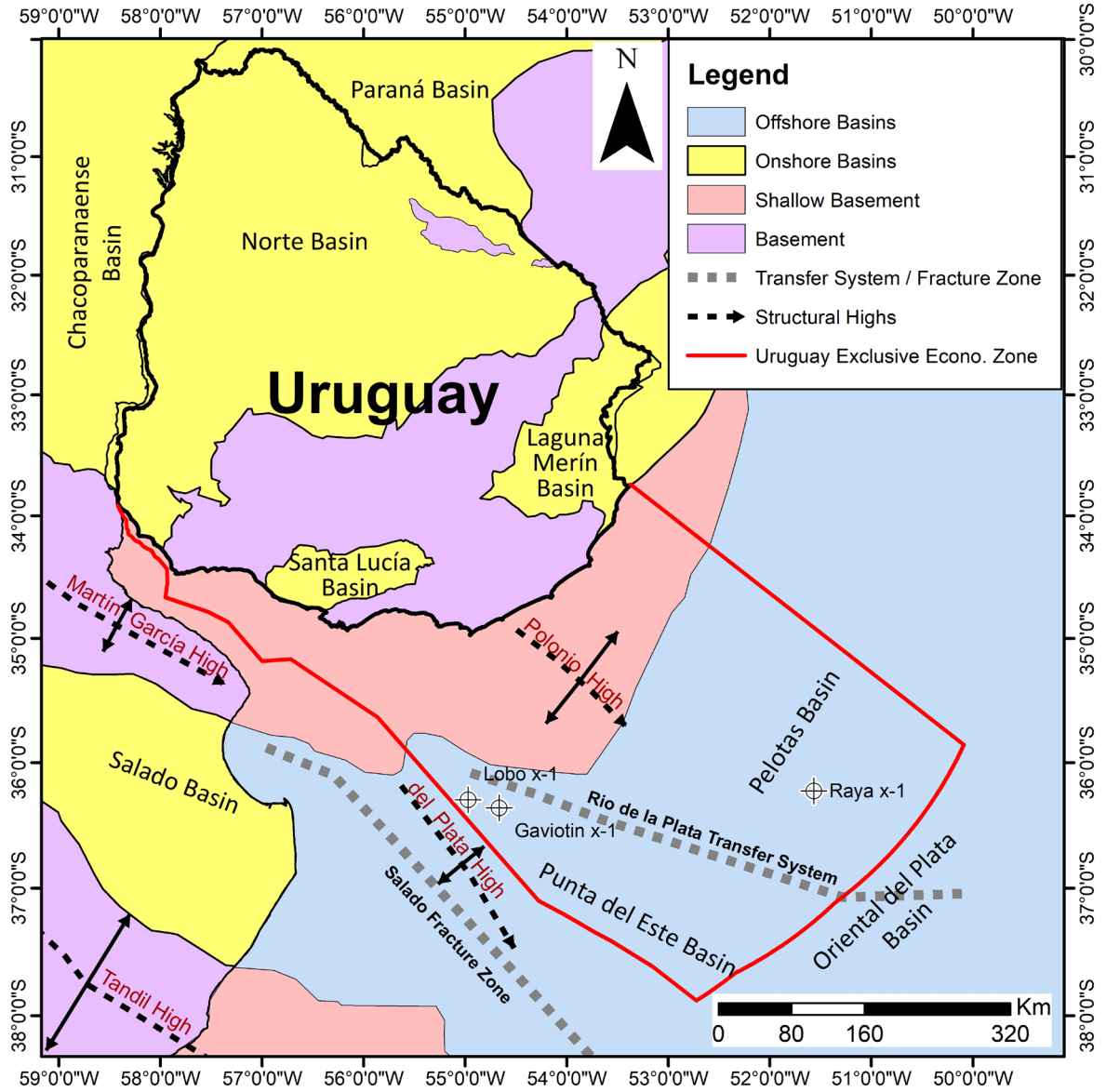
NAVIGATING CHANGE: GEOSCIENCES SHAPING A SUSTAINABLE TRANSITION

Outline

- Introduction (Uruguay and its offshore geology)
- Offshore Uruguay Source Rocks
- Microseeps
  - Methodology
  - Original Study (2016)
  - Extended Study (2024)
- Results
- Conclusions

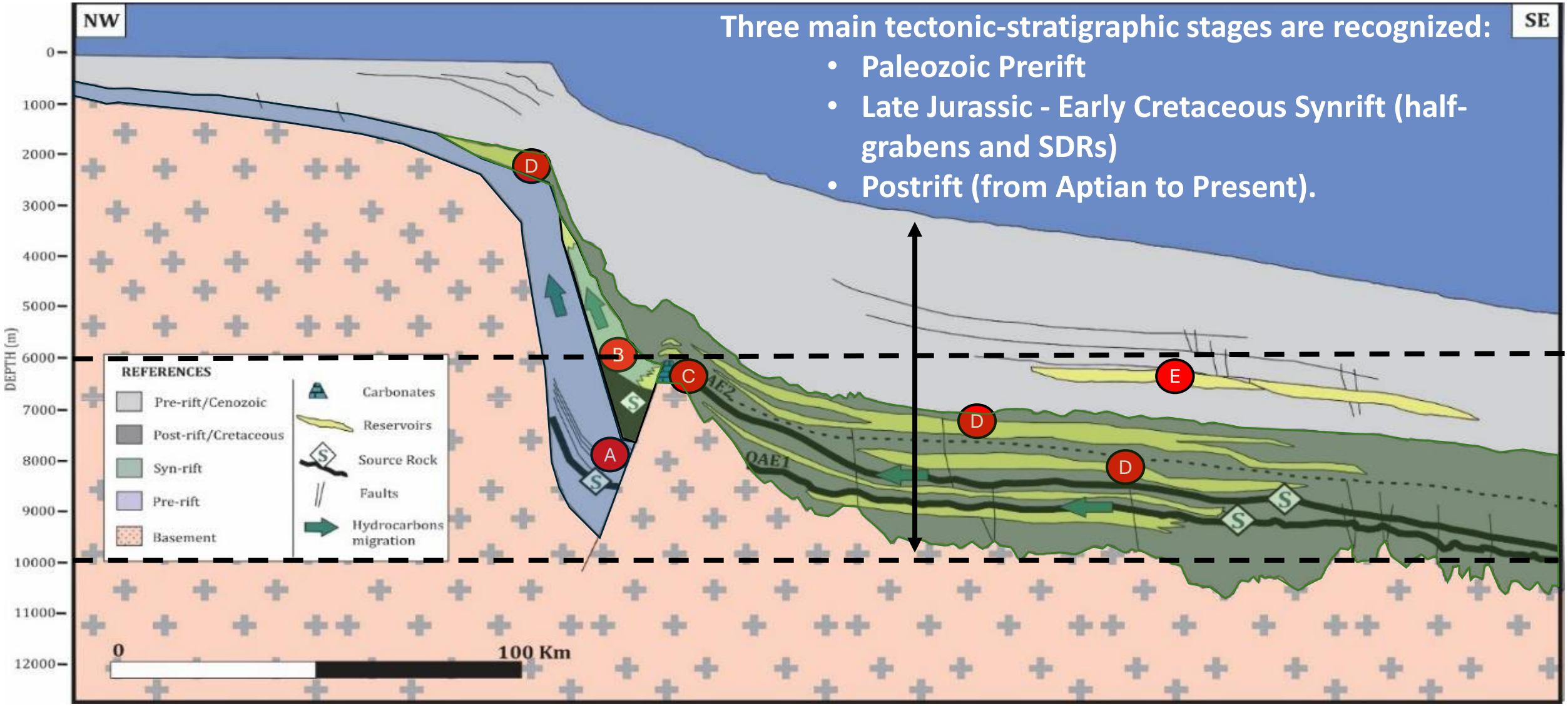
Introduction to Offshore Uruguay Geology

Source: thetruesize.com



- Two basins: Punta del Este and Pelotas.
- Punta del Este: important presence of halfgrabens.
- Only 3 wells.

Introduction to Offshore Uruguay Geology



Offshore Uruguay Source Rocks

Seismic evidences

- ✓ Seismic Correlation:
  - Aptian SR correlation with offshore Namibia
  - Cenomanian-Turonian SR correlation from offshore Namibia and Brazil
- ✓ Seismic Response
  - Regional high amplitude soft kick events
  - AVO Type IV anomalies (dimming in the far offsets)
  - Velocities: inversion in FWI derived velocities
- ✓ DHIs: Anomalous seismic responses at Reservoir levels that support SR
- ✓ Fluid escape features: pockmarks and gas chimneys
- ✓ Bottom Simulating Reflector (BSR)

Non seismic evidences:

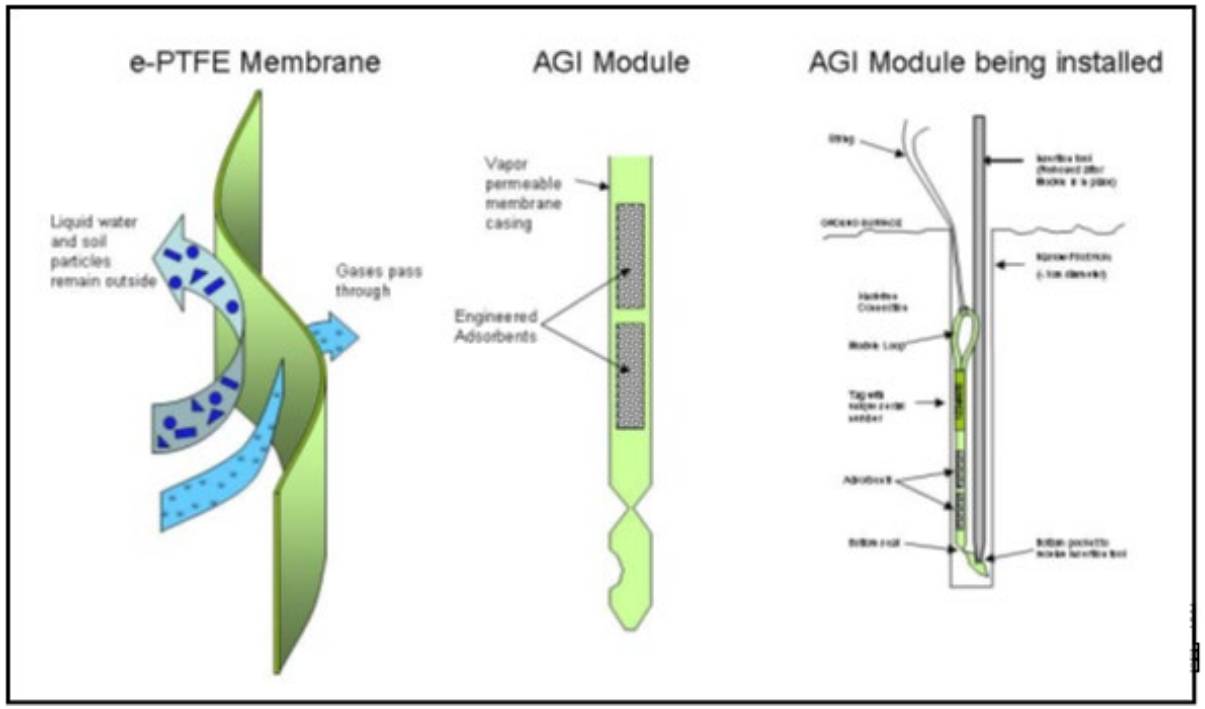
- ✓ Fluid inclusions in wells (only geochemical study published up to now)
- ✓ Oil Slicks from Synthetic Aperture Radar (SAR) imagery
- ✓ CSEM: resistivity anomalies derived from the inversion of CSEM data
- ✓ Hydrocarbon Microseeps identified in seabed samples (this study)

Microseeps - Methodology

- The geochemical technology applied enables the **detection of hydrocarbons at parts per billion (ppb) levels**.
- Traditional methods, which often face challenges in identifying compounds within the C6–C12 range, this technology offers a more comprehensive analysis of lighter petroleum systems (**C2-C20 range**).

AGI-designed passive sampler:

- Contains oleophilic adsorbent materials with strong oil affinity
- Encased in a microporous membrane
- The membrane pores exclude water and soil particles, allowing hydrocarbon molecules to pass and through and accumulate on the adsorbent

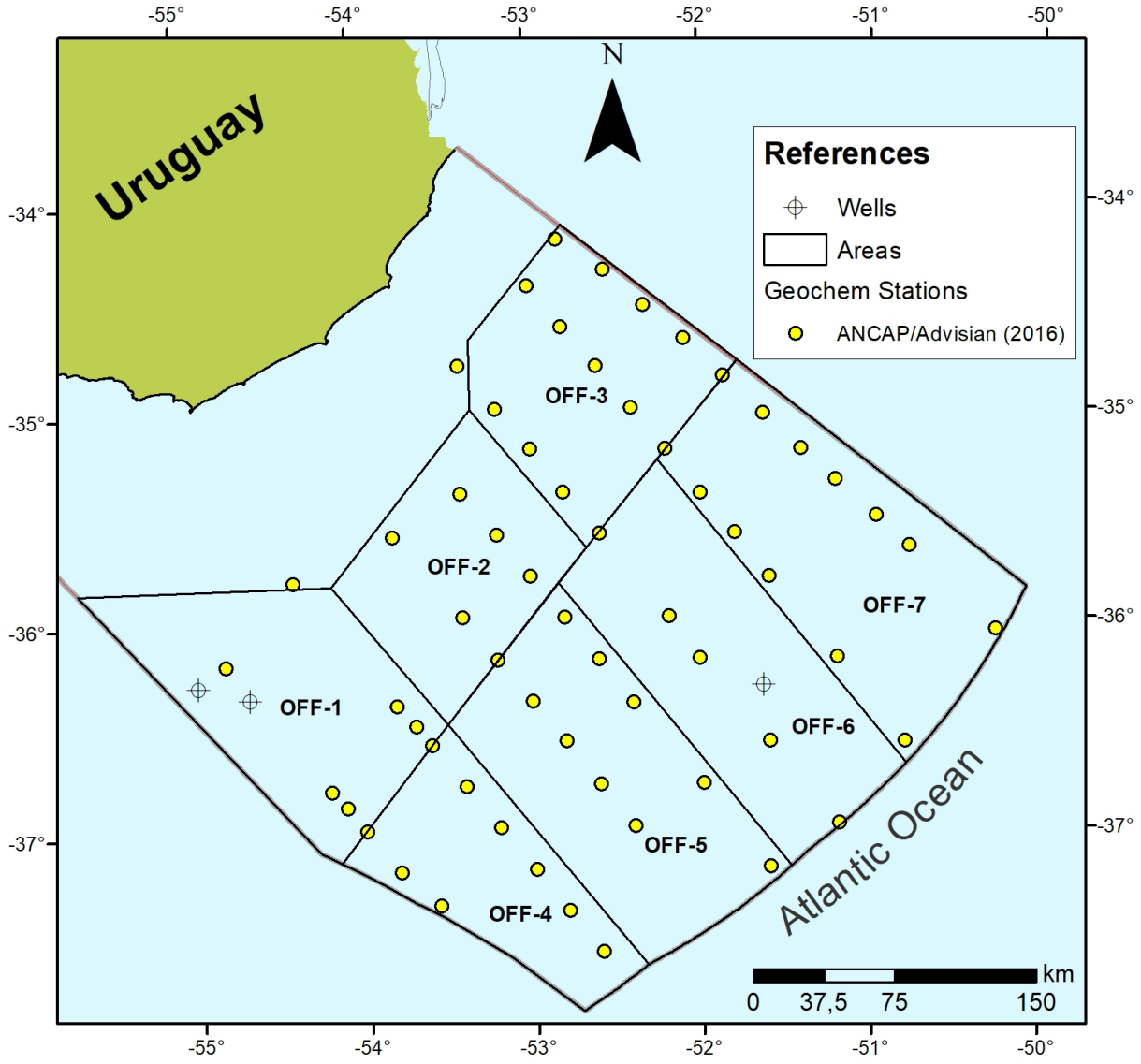


Microseeps - Methodology

A sediment subcrop is taken from the lower portion of a piston core, in a clean work area set up on the back deck of the marine vessel at sea.

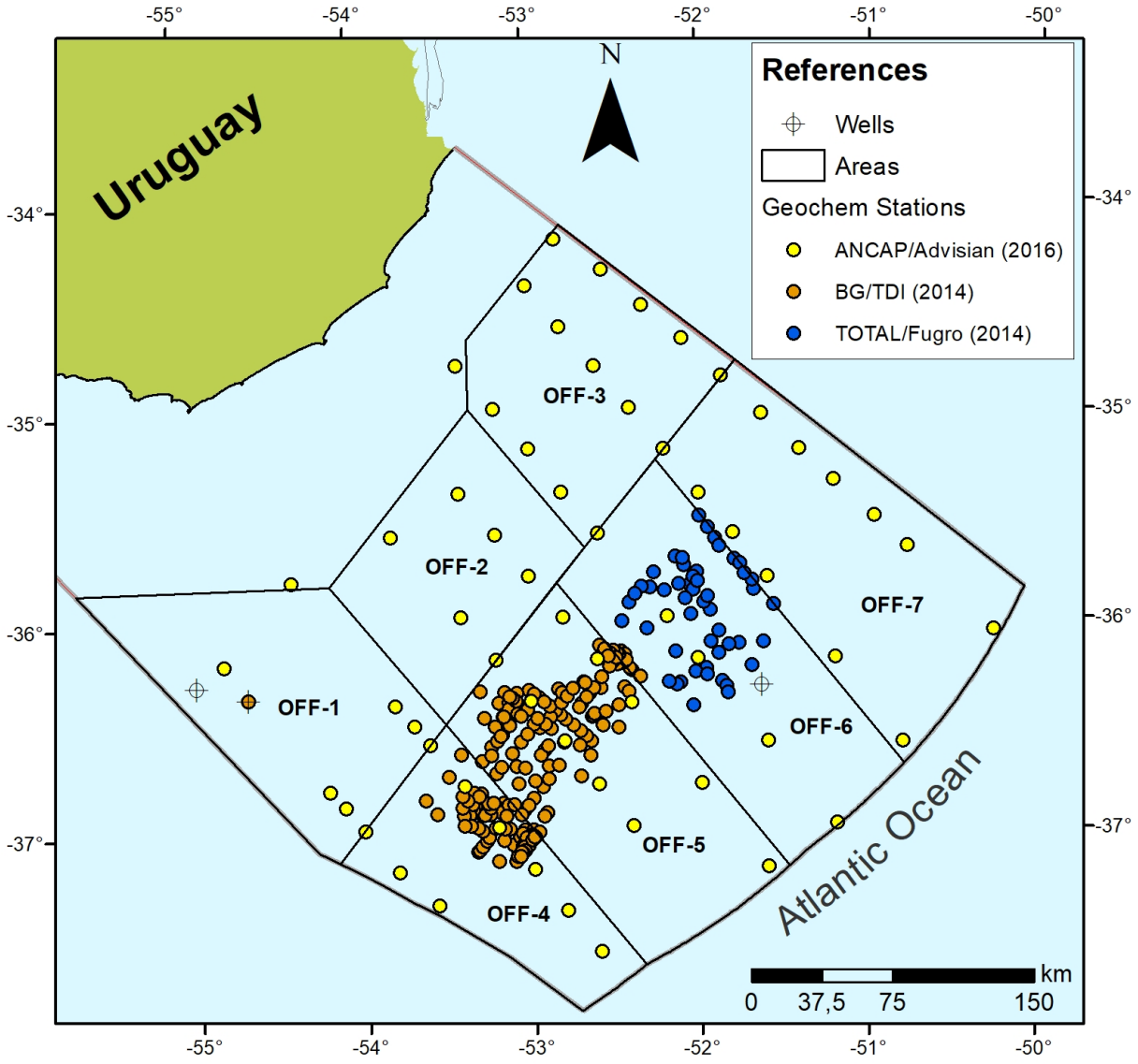
- 100 ml sealed glass container (60-80 ml of sample)
- AGI passive sampler modules: adsorbent-based collectors of volatile and semi-volatile organic compounds from shallow soils or sediments.
- Exposure time ≥ 21 days: heavier molecular weight organic compounds to equilibrate onto the adsorbents inside the module.

Microseeps – Original Study (2016)



- Microseepage analysis on seabed samples during an environmental baseline survey.
- Presence of potential thermogenic hydrocarbon systems?
- 58 box cores and 1 gravity core.
- Detected 2 hydrocarbon signatures, microseepages of:
  - oil
  - oil with gas/gas-condensate

Microseeps – Extended Study (2024)

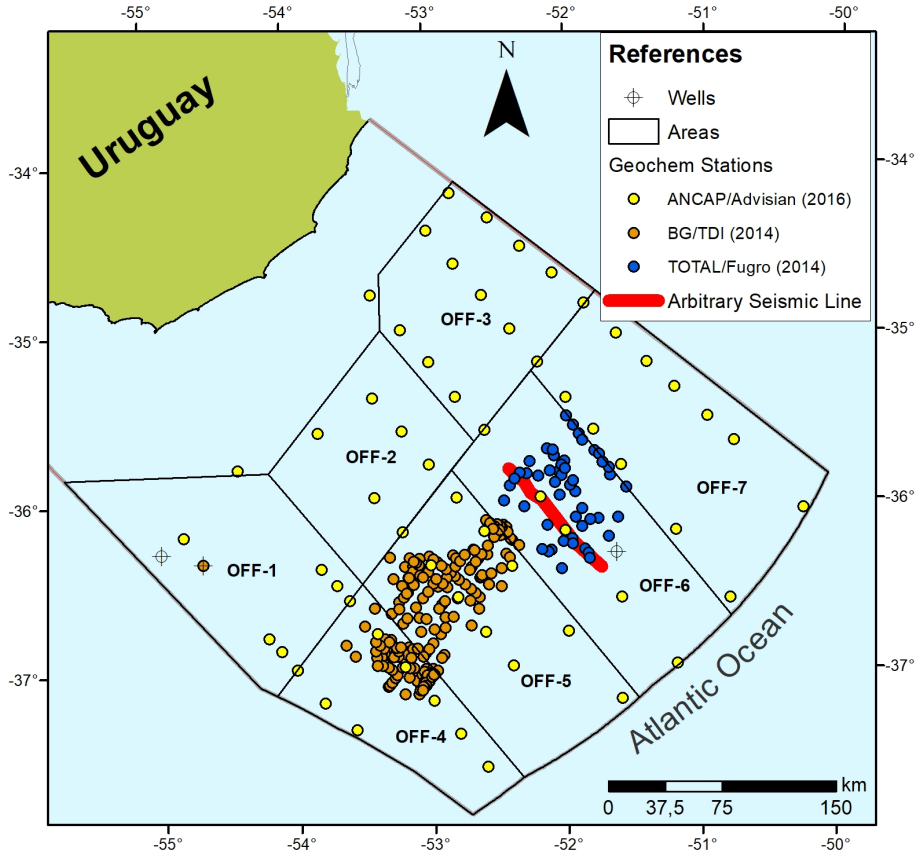


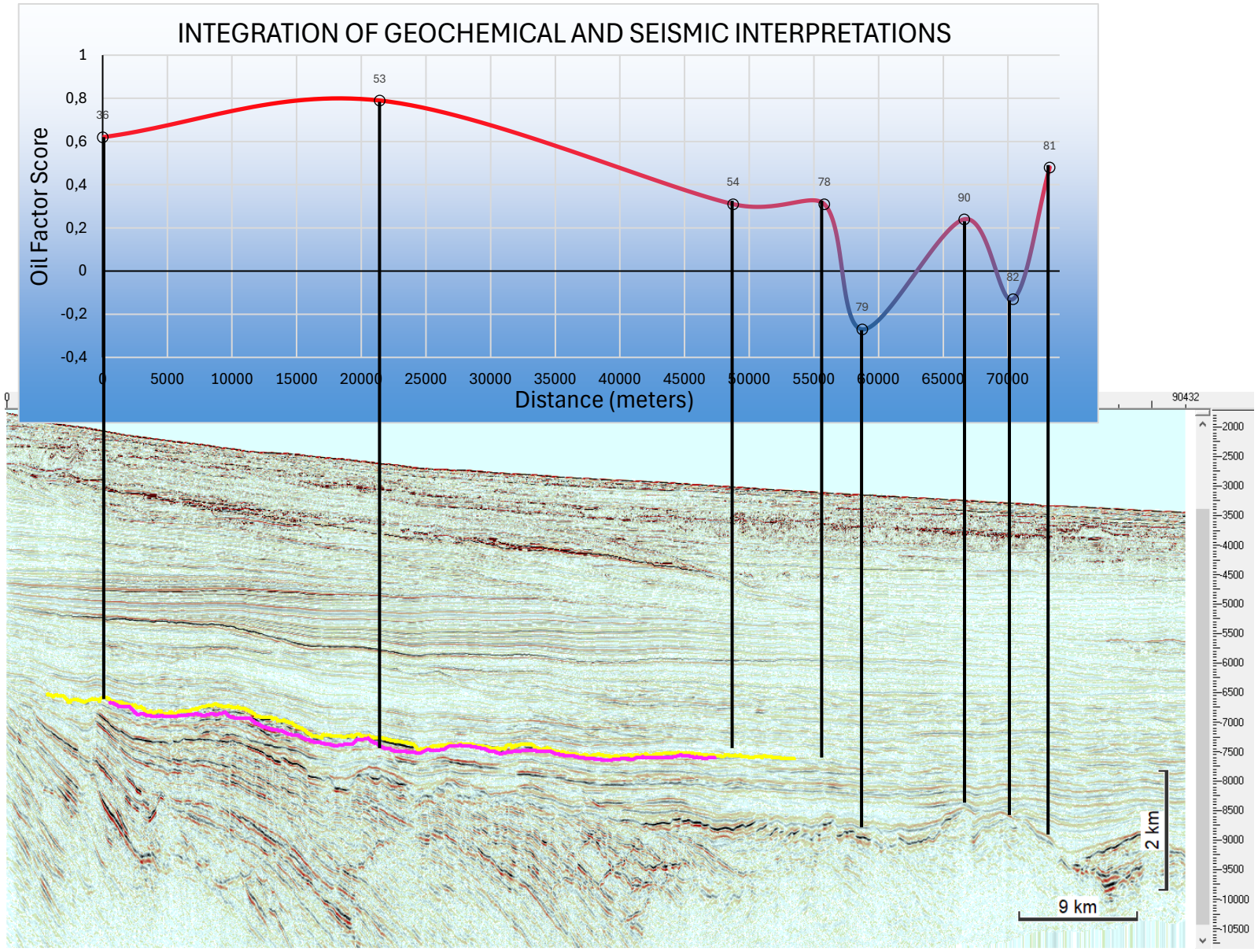
Addition of 348 piston core seabed samples taken in 2014:

- 199 by BG/TDI collected on an unbiased semi-regular grid (orange dots)
- 149 by TOTAL/Fugro collected near seabed and fluid scape features identified with multibeam bathymetry and 3D seismic data (blue dots)

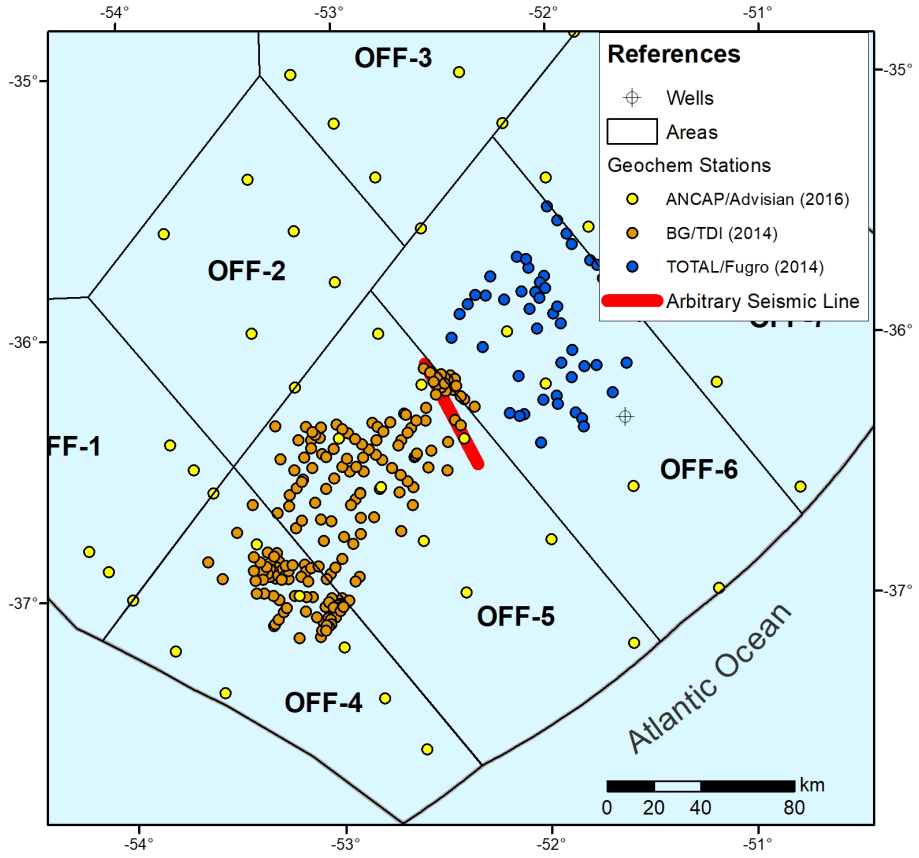
  - Allowed for the normalization and integration of all geochemical data into a comprehensive dataset of 409 samples

Results


Uruguay
N
References
Wells
Areas
Geochem Stations
ANCAP/Advisian (2016)
BG/TDI (2014)
TOTAL/Fugro (2014)
Arbitrary Seismic Line
OFF-1
OFF-2
OFF-3
OFF-4
OFF-5
OFF-6
OFF-7
Atlantic Ocean
km
0 37,5 75 150
-55°
-54°
-53°
-52°
-51°
-50°
-34°
-35°
-36°
-37°


INTEGRATION OF GEOCHEMICAL AND SEISMIC INTERPRETATIONS
Oil Factor Score
1
0,8
0,6
0,4
0,2
0
-0,2
-0,4
36
53
54
78
79
90
82
81
0
5000
10000
15000
20000
25000
30000
35000
40000
45000
50000
55000
60000
65000
70000
Distance (meters)
90432
2000
2500
3000
3500
4000
4500
5000
5500
6000
6500
7000
7500
8000
8500
9000
9500
10000
10500
2 km
9 km

Results


-54°
-53°
-52°
-51°
-35°
-36°
-37°
OFF-3
OFF-2
OFF-1
OFF-6
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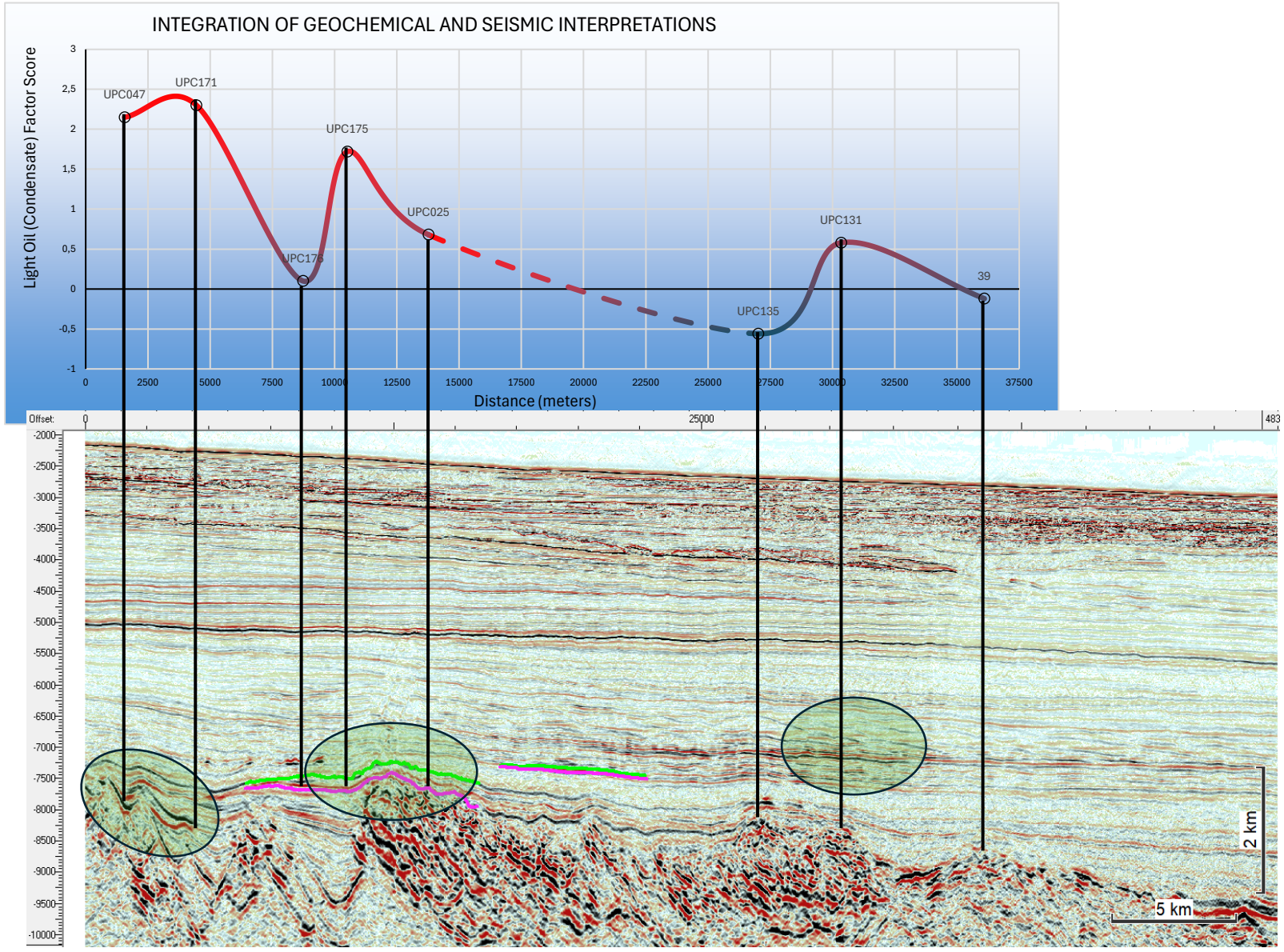
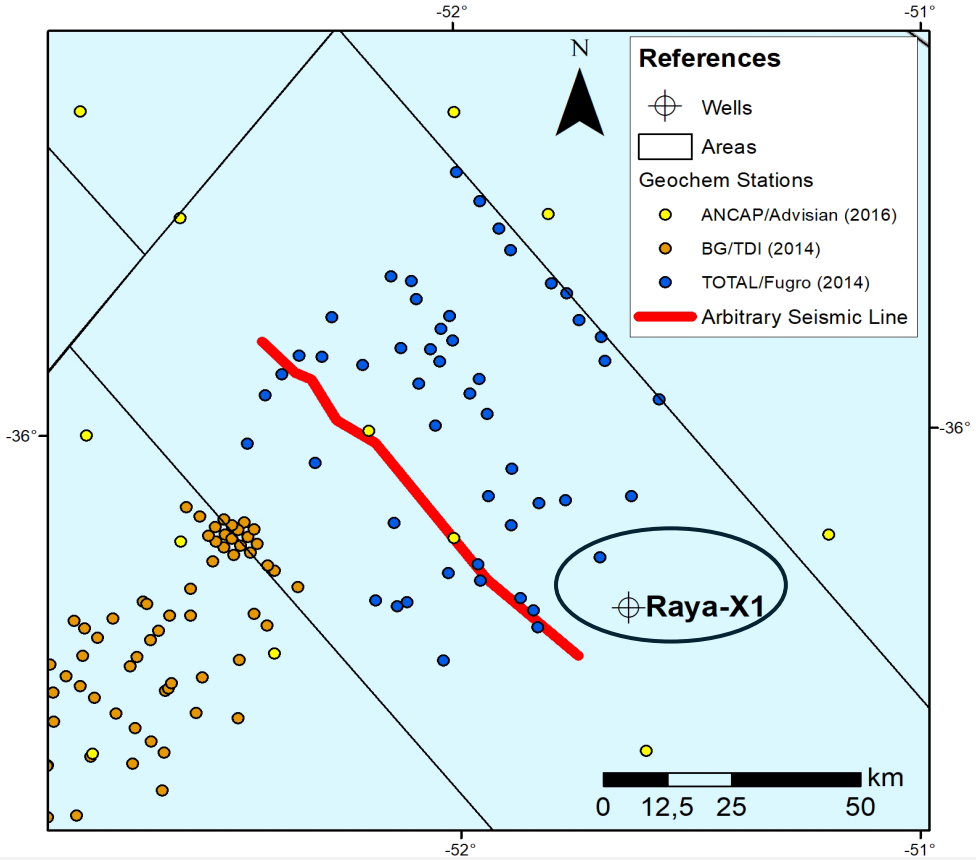
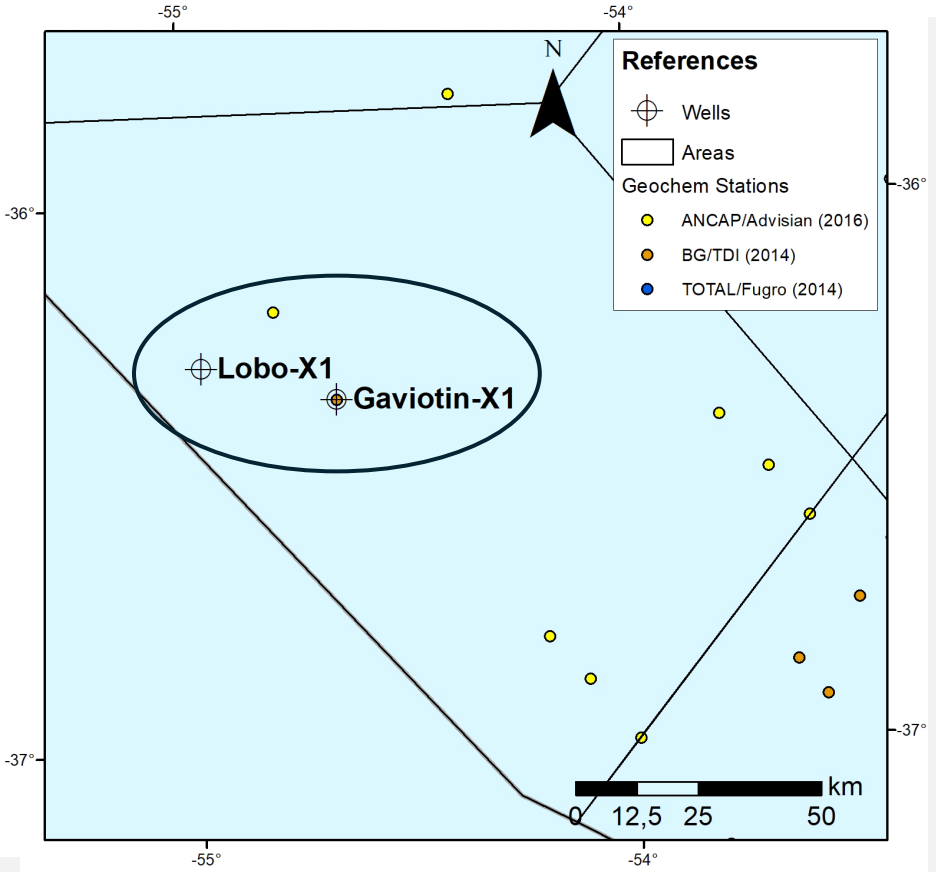
Arbitrary Seismic Line
km
0 20 40 80


INTEGRATION OF GEOCHEMICAL AND SEISMIC INTERPRETATIONS
Light Oil (Condensate) Factor Score
Distance (meters)
UPC047
UPC171
UPC175
UPC176
UPC025
UPC135
UPC131
39
Offset:
2 km
5 km

Results - Wells





Raya-X1 dry well:

- the nearest core sample, approx. 12 km away, exhibits a **negative** geochemical signature.

Lobo-X1 dry well

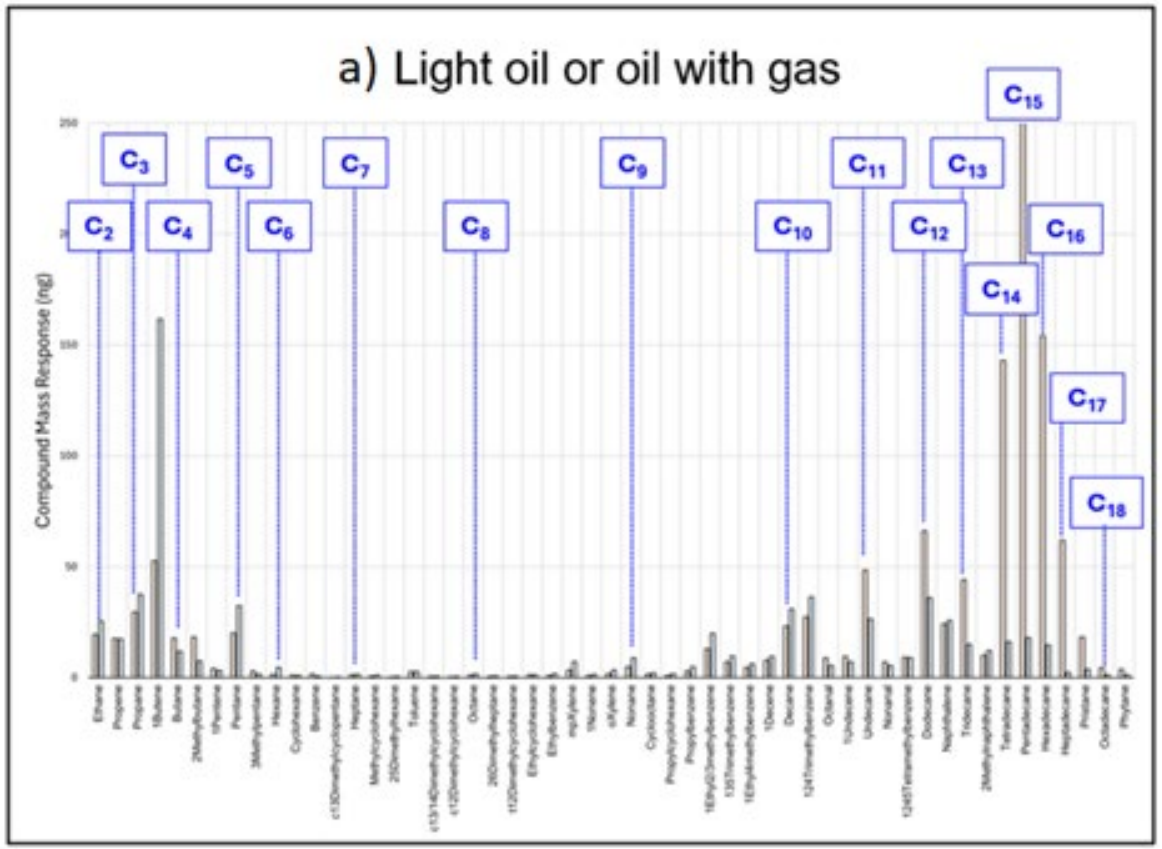
- 2 nearby samples show **negative** geochemical signatures.

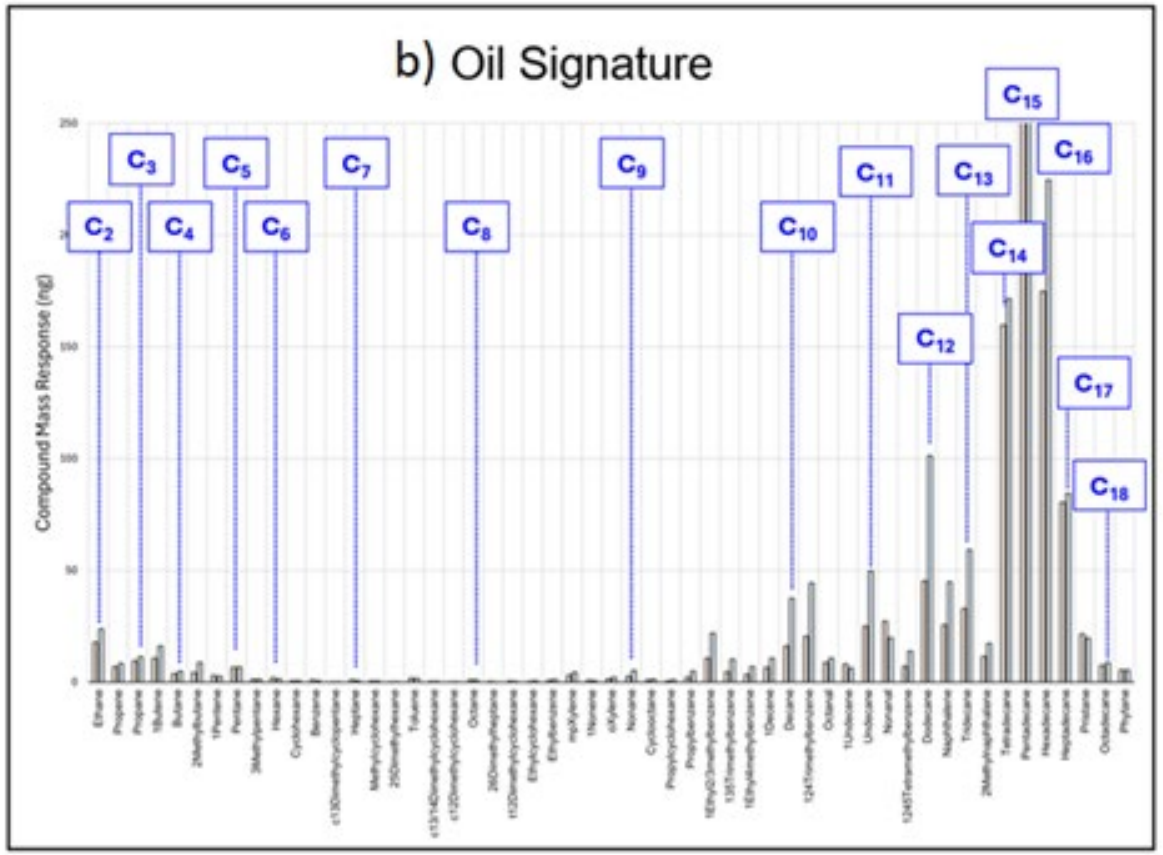
Gaviotin-X1 dry well:

- a core sample, approx. 100 m away, exhibits a **negative** geochemical signature.

Results

- This study reveals the presence of **both light oil/gas condensate and liquid petroleum systems** across multiple blocks.
- Hydrocarbon phase results are **consistent with those produced offshore Namibia**.





Summary of Results

- This study delivers significantly **enhanced geochemical resolution in deep to ultra-deep waters**. It also provides a more precise hydrocarbon interpretation across the entire offshore region.
- Thermogenic **hydrocarbon anomalies** are aligned mostly with **Cretaceous prospects** identified within seismic data.
- **Hydrocarbon phase results align with those observed offshore Namibia**, highlighting geological continuity between the regions
- Hydrocarbon trends appear to align with the deposition of sediments into deeper water facies, based on the inferred trend of anomalous core locations oriented perpendicular to the shelf break.

Conclusions

- This study provides clear evidence of **active petroleum systems in offshore Uruguay**.
- Several **hydrocarbon anomalies** correlate with **prospects identified within available seismic data**, emphasizing the importance of integrating geochemical and seismic analyses.
- **Enhanced geochemical resolution in areas with dense sampling**, along with improved hydrocarbon interpretations across the entire offshore region, **reduces exploration uncertainty**.
- **Key takeaways:**
  - **Infill coring**, with increased sampled density in key areas, to **reduce risks.**
  - **Cretaceous it the most prospective sequence for hydrocarbon exploration.**

Thank you!

Q&A

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