

COLOMBIA ROUND 2021

COLOMBIA ROUND 2021: CHOCÓ EXPLORATORY OPPORTUNITIES: RÍO ATRATO AND SAN JUAN SUB-BASINS

30/04/2021

Location

History of Exploration

Database

Infrastructure

Geological Framework

Well Summary

Seismic Interpretation

Prospectivity

Conclusions

INTRODUCTION

LOCATION

- **Block Areas**

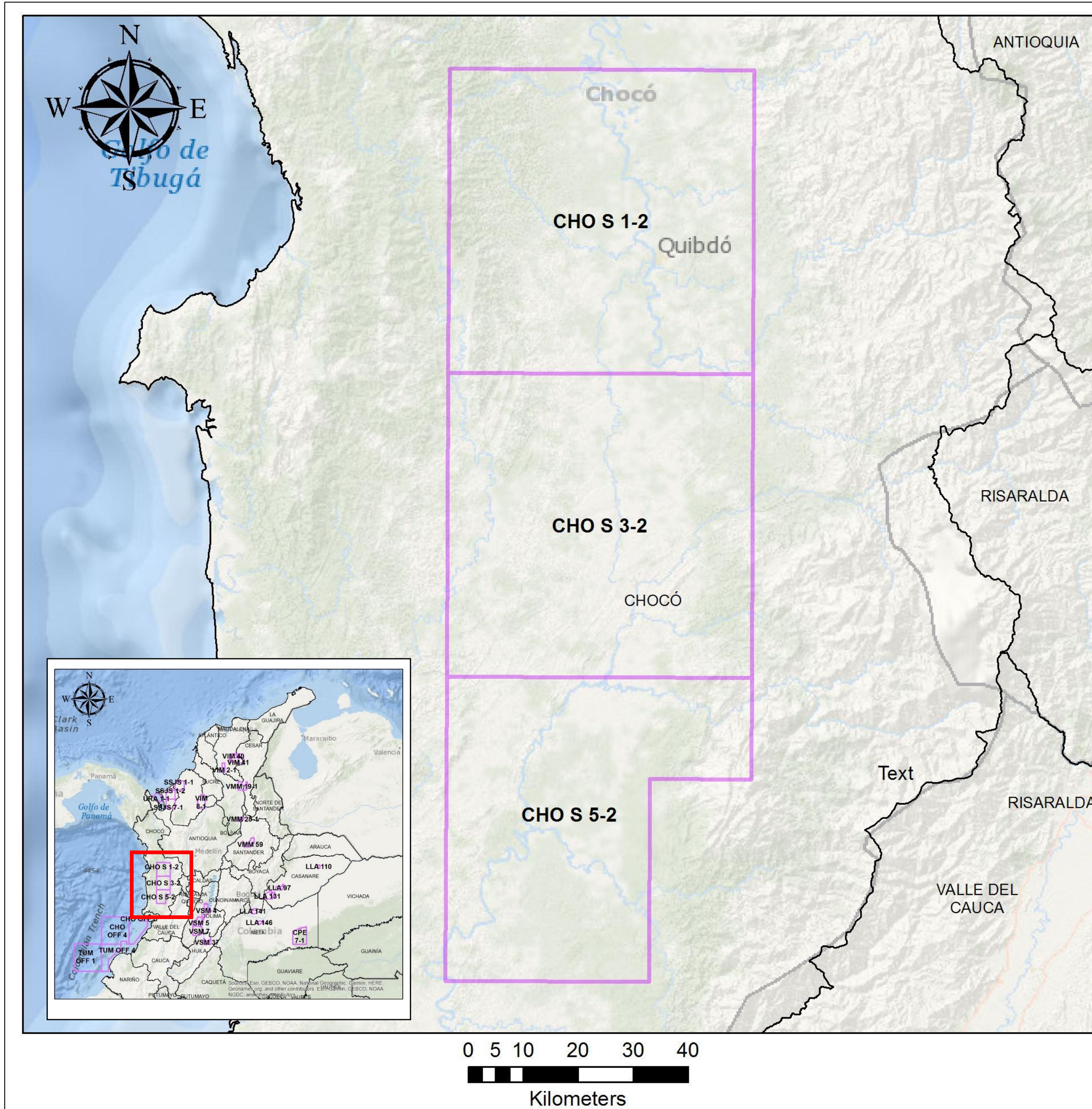
- CHO S 1-2 (306,885 Ha)

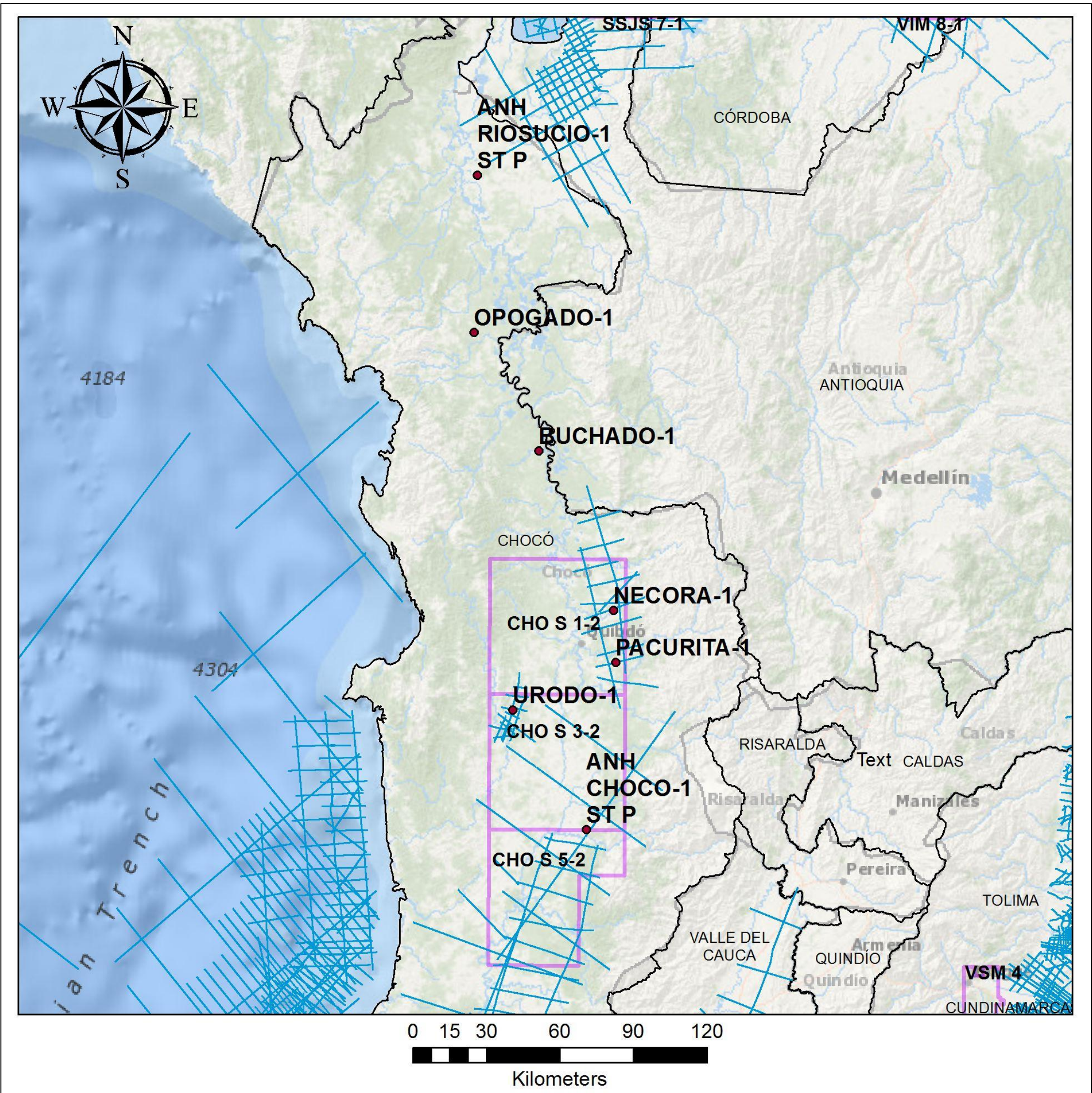
- CHO S 3-2 (307,137 Ha)

- CHO S 5-2 (239,079 Ha)

- **Department**

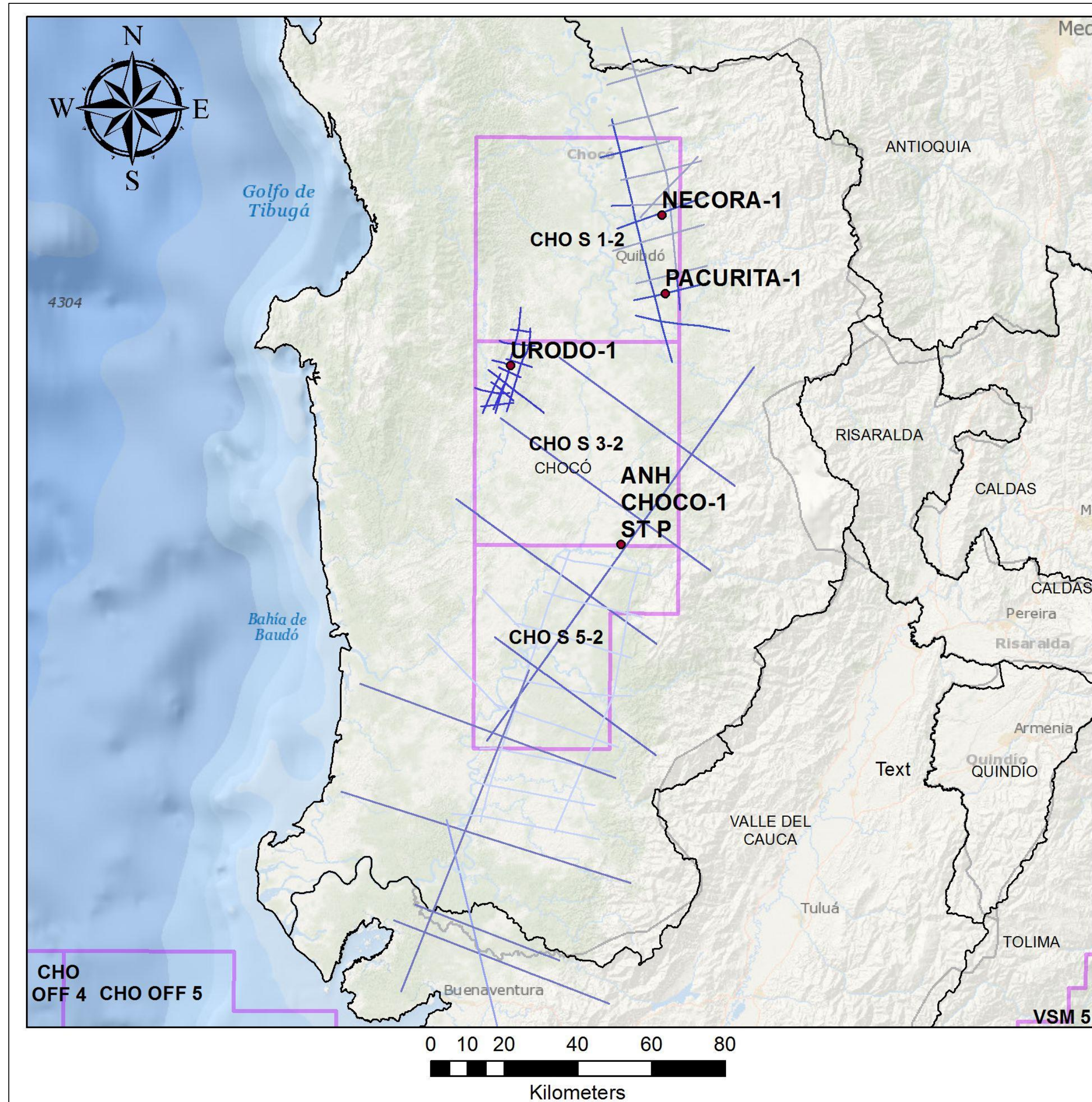
- Chocó



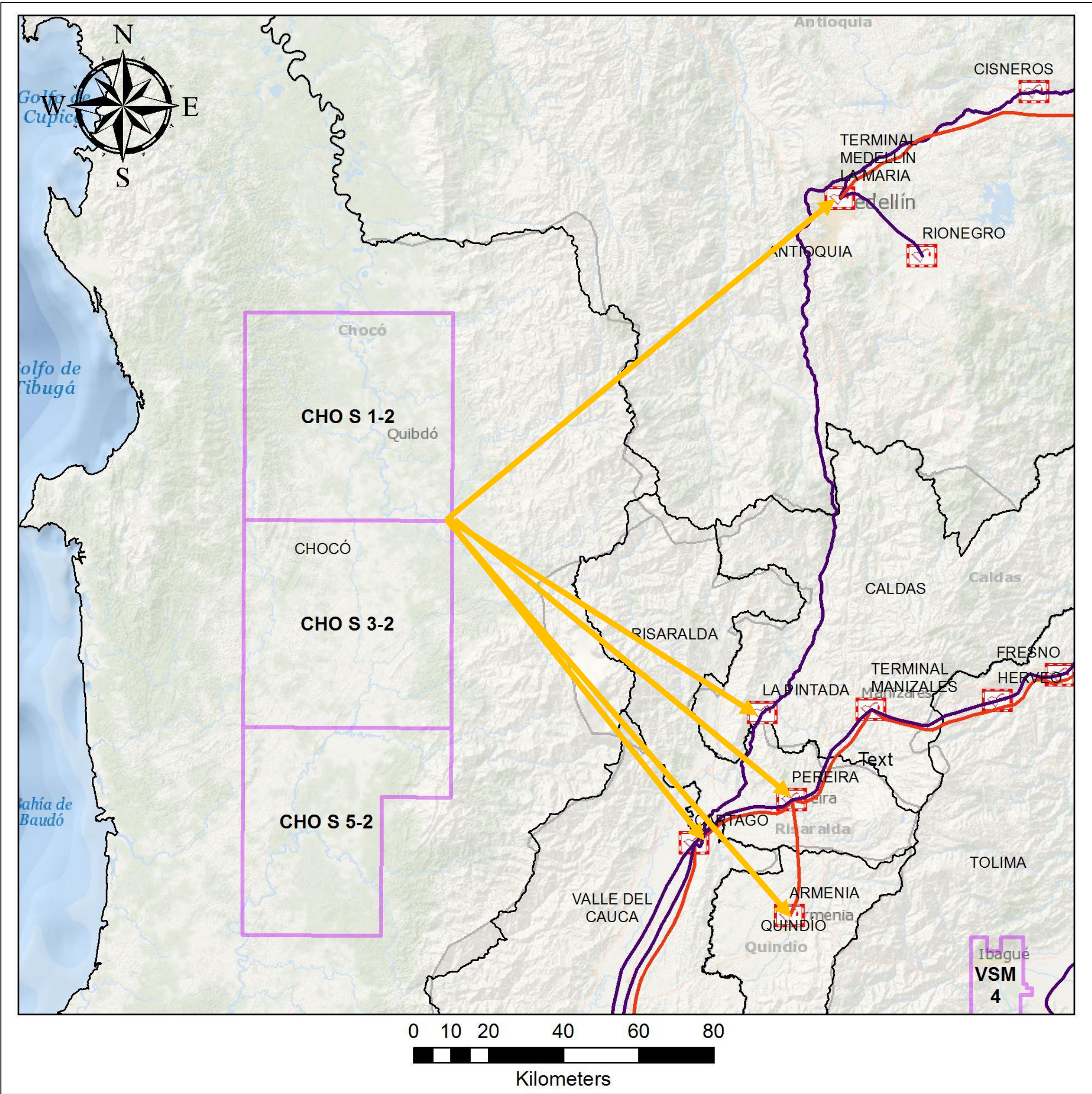


■ WELLS

Well	Data Available	Year	TD (ft)
Necora – 1	Yes	1983	6,503
Pacurita – 1	Yes	1983	9,489
Urodo – 1	Yes	1973	15,000
ANH–Chocó-1ST	Yes	2011	9,988



- **SEISMIC**
- **2D Seismic Surveys (6):**
 - Chocó – Buenaventura 2D – 2006
 - Chocó 2D – 2005
 - Urodó – 72
 - Tutunendo – 81
 - Rio Atrato – 82
 - San Juan 81
- **Total Length (977.67 Km)**



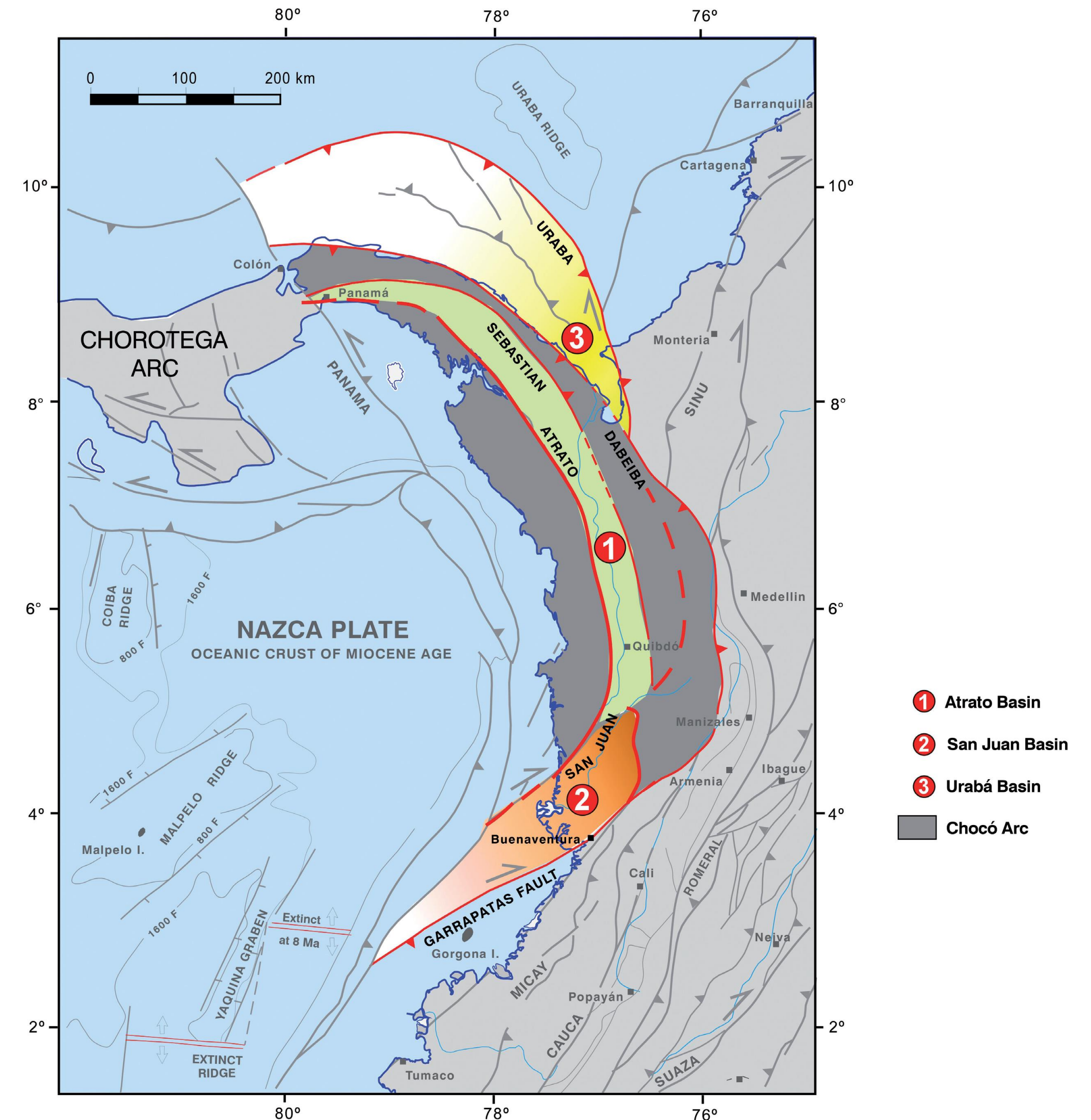
Main Infrastructure nearby

- **Pipeline**
- Terminal Medellín – La María (134 Km)
- La Pintada (97,3 Km)
- **Gas Pipeline**
- Cartago (107,6 Km)
- Pereira (117,3 Km)
- Armenia (138,5 Km)

GEOLOGICAL FRAMEWORK

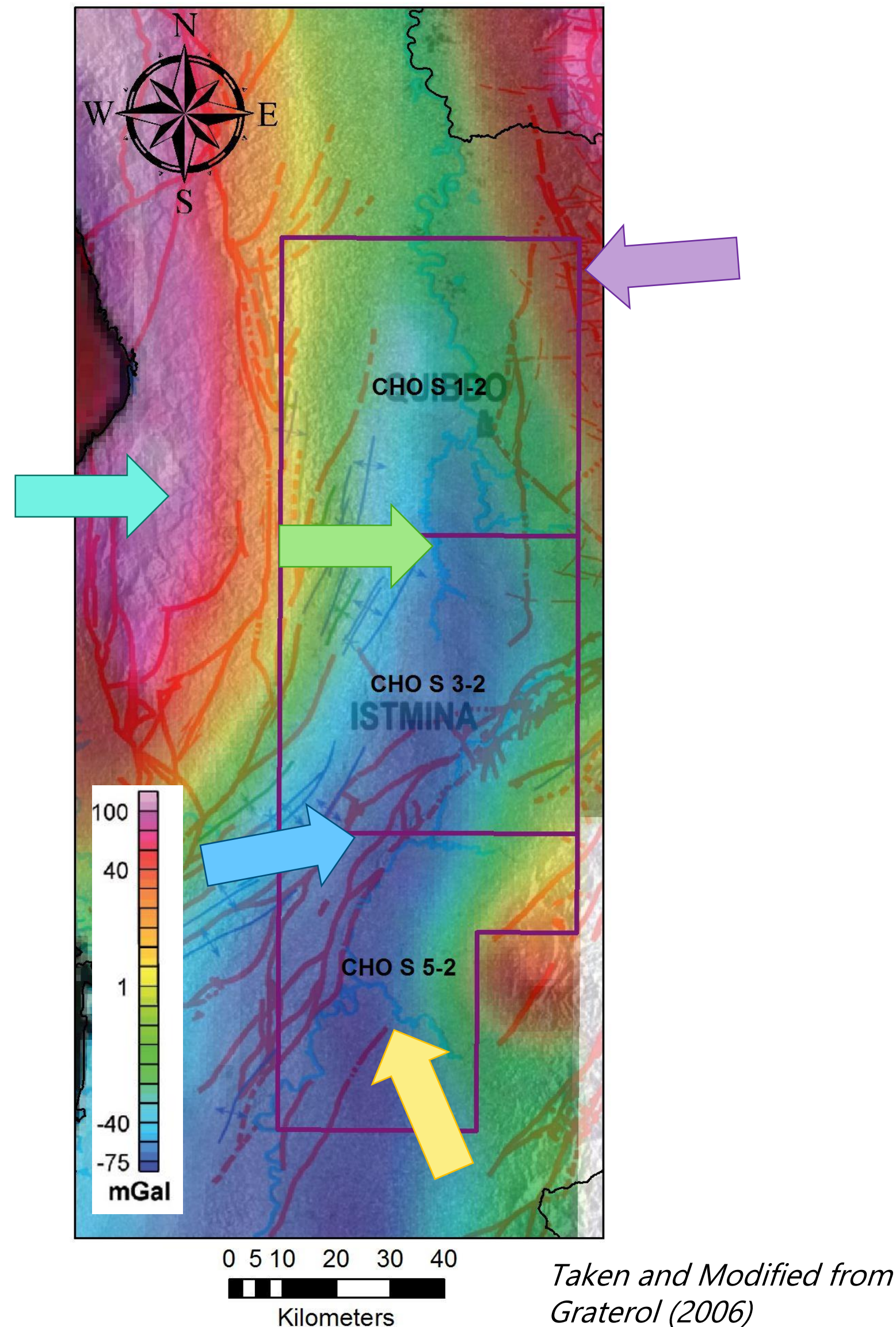
CHOCO BASIN GENERALITIES

- The Choco basin is located at the Western Andes and classified as a fore-arc basin
- Basin extension: 38,582 Km²
- Frontier basin with barely 6 wells drilled.
- The basin has been filled with Cenozoic sediments of marine setting with maximum thicknesses of c.a.10,000 m
- **Divided in two sub-basins**
- North: Atrato Sub-basin
- South: San Juan Sub-basin



Taken from Graterol (2011)

Bouguer Anomaly & General Structural Elements

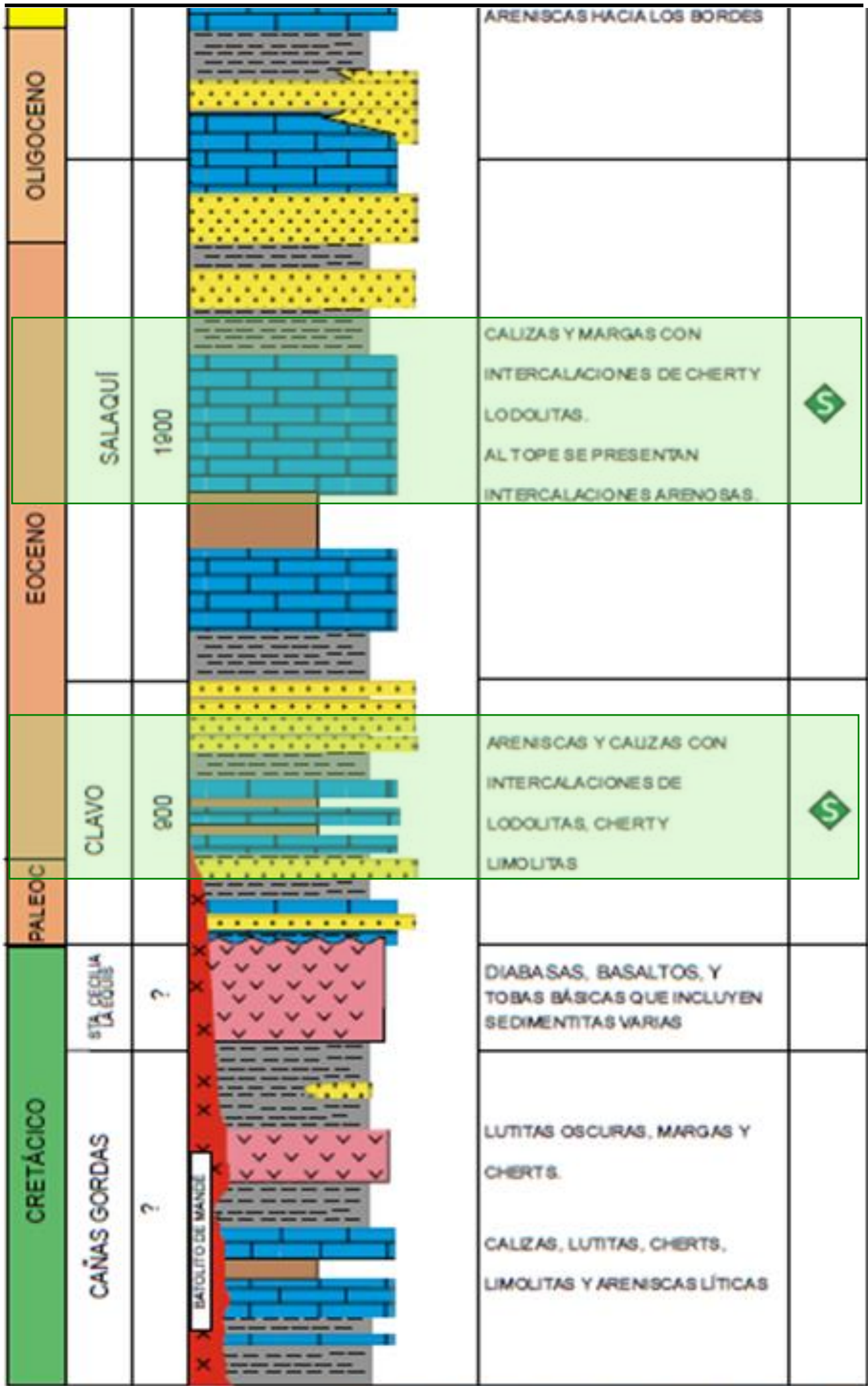
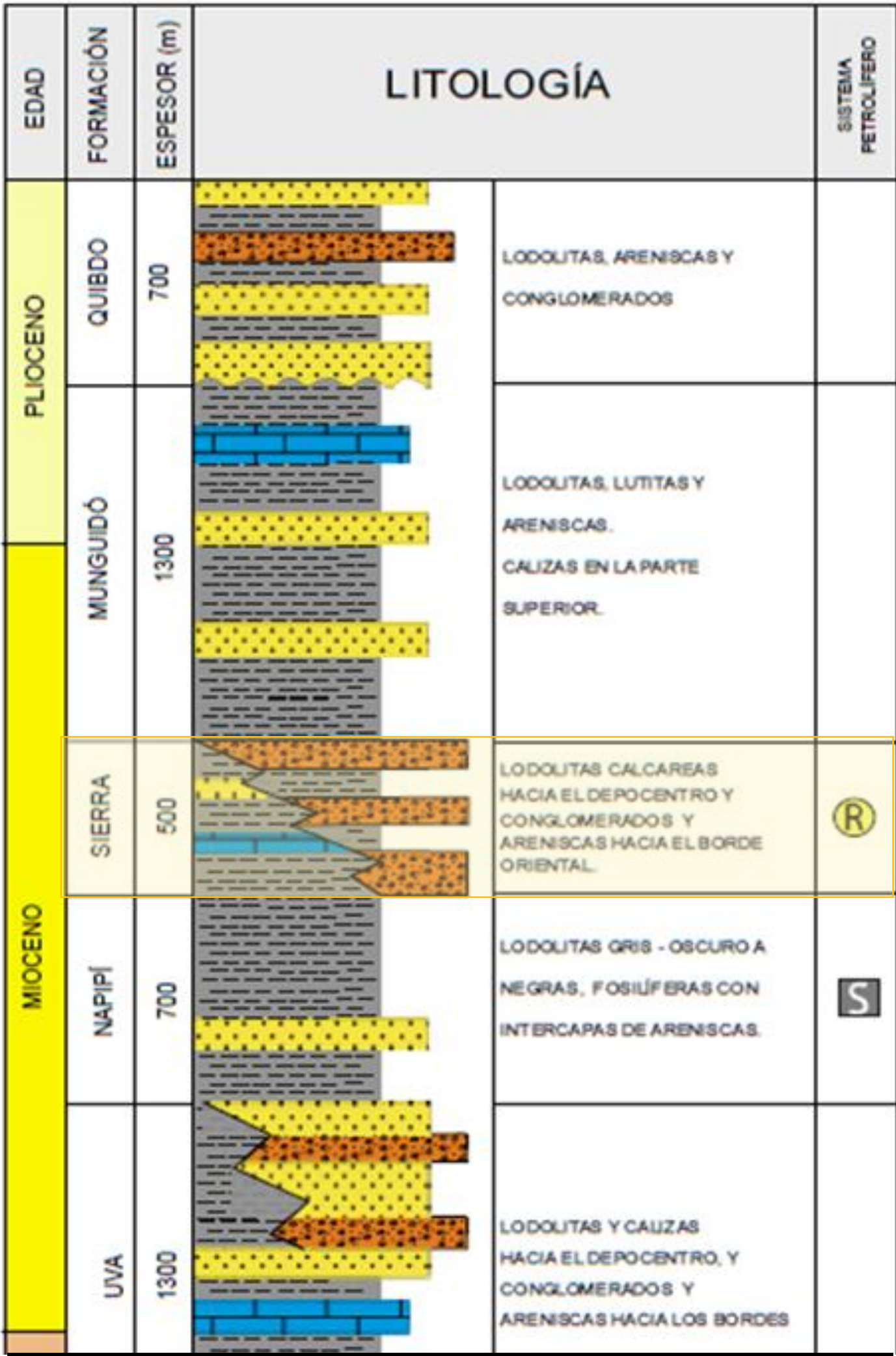


Taken and Modified from
Graterol (2006)

■ Main gravimetric features of the area

- Atrato Sub-basin: Negative anomaly
- San Juan Sub-basin: Negative anomaly
- **Istmina high:** There is no gravity anomaly associated to the Istmina-Condoto high (Mainly sediment is involved into the structure)
- **Abrupt changes from positive to negative anomalies:**
 - At the E: N-S oriented faults put in contact the basin and the Mande Magmatic arc
 - At the W: N-S oriented faults put in contact the basin with the Baudó Complex

STRATIGRAPHIC SETTING: ATRATO SUB-BASIN

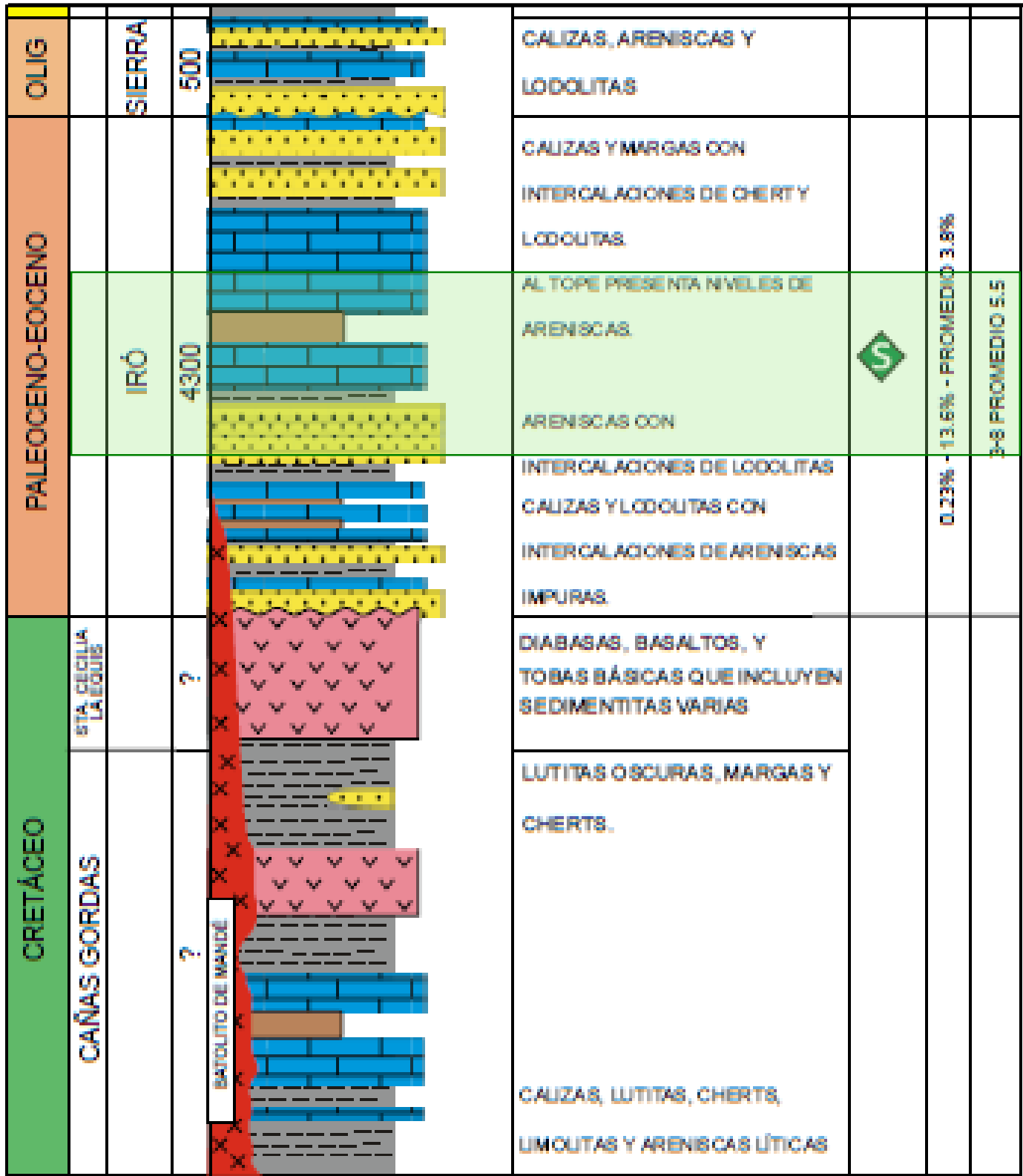


- **Reservoir**
- Fm Sierra: Conglomerates and Sandstones
- **Source**
- Fm Salauquí (Eocene): Limestone, Marls and Shales
- Fm Clavo (Lower Eocene): Calcareous sandstone and shale

Taken and Modified from Suarez (2007)

STRATIGRAPHIC SETTING: SAN JUAN SUB-BASIN

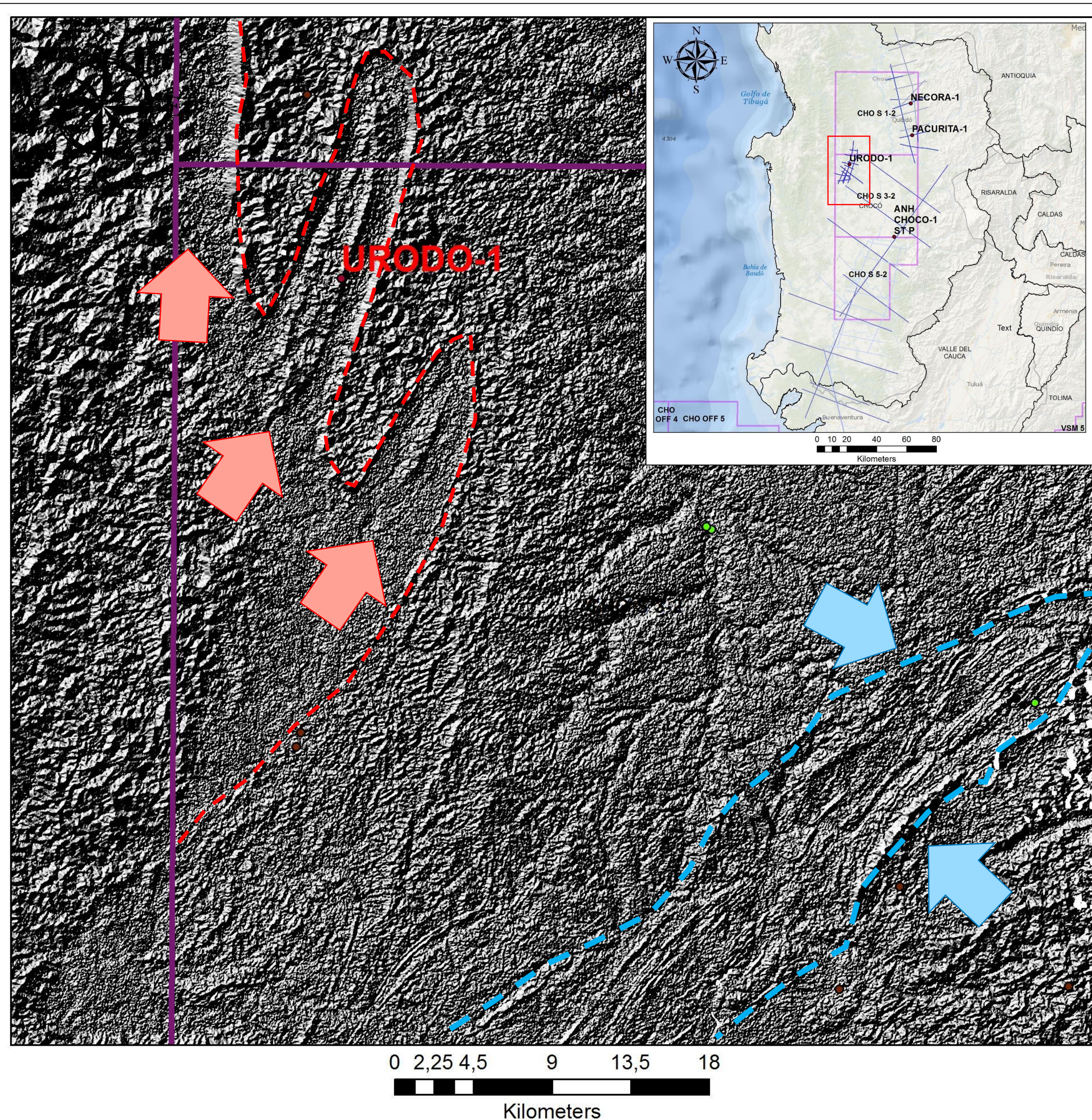
EDAD	GRUPO	FORMACIÓN	ESPESOR (m)	LITOLOGÍA	SISTEMA PETROLIFERO	TOC	SCI
D							
PLIOCENO-PLEISTOCENO		ATRATO	1000	ARENISCAS CONGLOMERADO BASAL, ARENISCAS Y LODOLITAS			
MIOCENO SUPERIOR		MUNGUIDO	2500	ARENISCAS, ARENISCAS CONGLOMERATICAS Y LIMOLITAS	®		
		CONDOTO		ARENISCAS, CONGLOMERADOS, ARCILLOLITAS Y CALIZAS	® S		
MIOCENO INFERIOR	SAN JUAN	CONGL. LA MOJARRA	4500	CONGLOMERADOS	®	0.35% - 0.70% - PROMEDIO 0.57%	
	ISTMINA			LIMOLITAS Y ARCILLOLITAS CON ALGUNOS NIVELES DE CONGLOMERADOS Y ARENISCAS	S	0.35% - 0.70% - PROMEDIO 0.57%	2.5 - 5 PROMEDIO 3.75



Taken and Modified from Suarez (2007)

- **Reservoir**
- Fm Condoto: Shoreface Sandstone
- Fm Munguido: Sandstones and Conglomerates
- Fm Iró (Paleoceno): Limestones and Sandstones
- **Source**
- Fm Iró (Paleoceno – Eoceno): Limestones and Sandstones

EXISTENCE OF MUD DIAPIRISM AS TRAPS

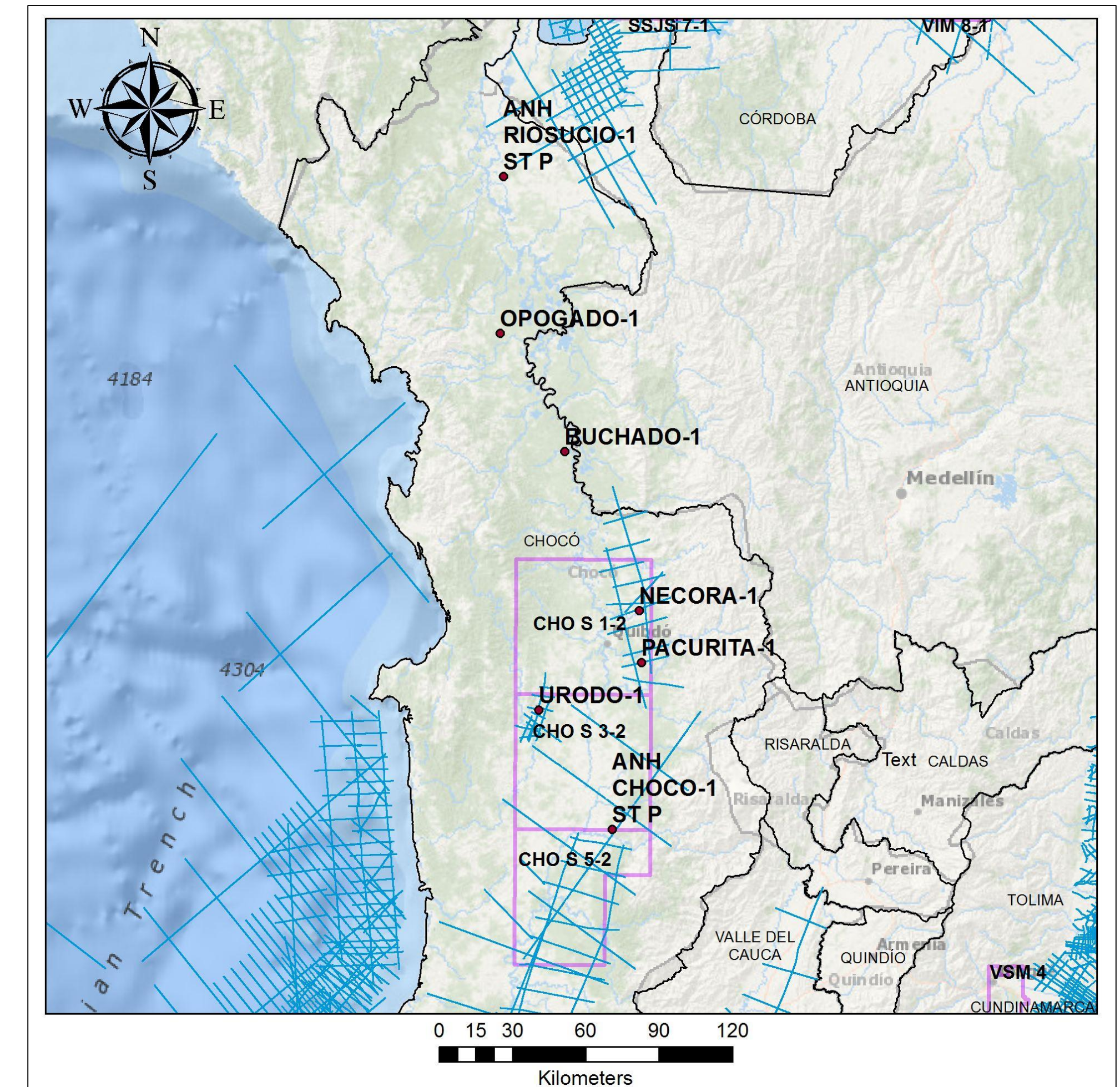


- Anticlines with their axis orientated NE-SW
- **Elongated elliptic geometries** similar to the ones found in the Sinú Basin
- Structures probably related to mud diapirs with possible structures and traps at their flanks
- **Urodó well** drilled in a structural high **finding a mud diapir**
- Surface expression of the **Istmina-Condoto high** that divides the Chocó basin into the Atrato and San Juan sub-basins.

WELL HISTORY

Wells History

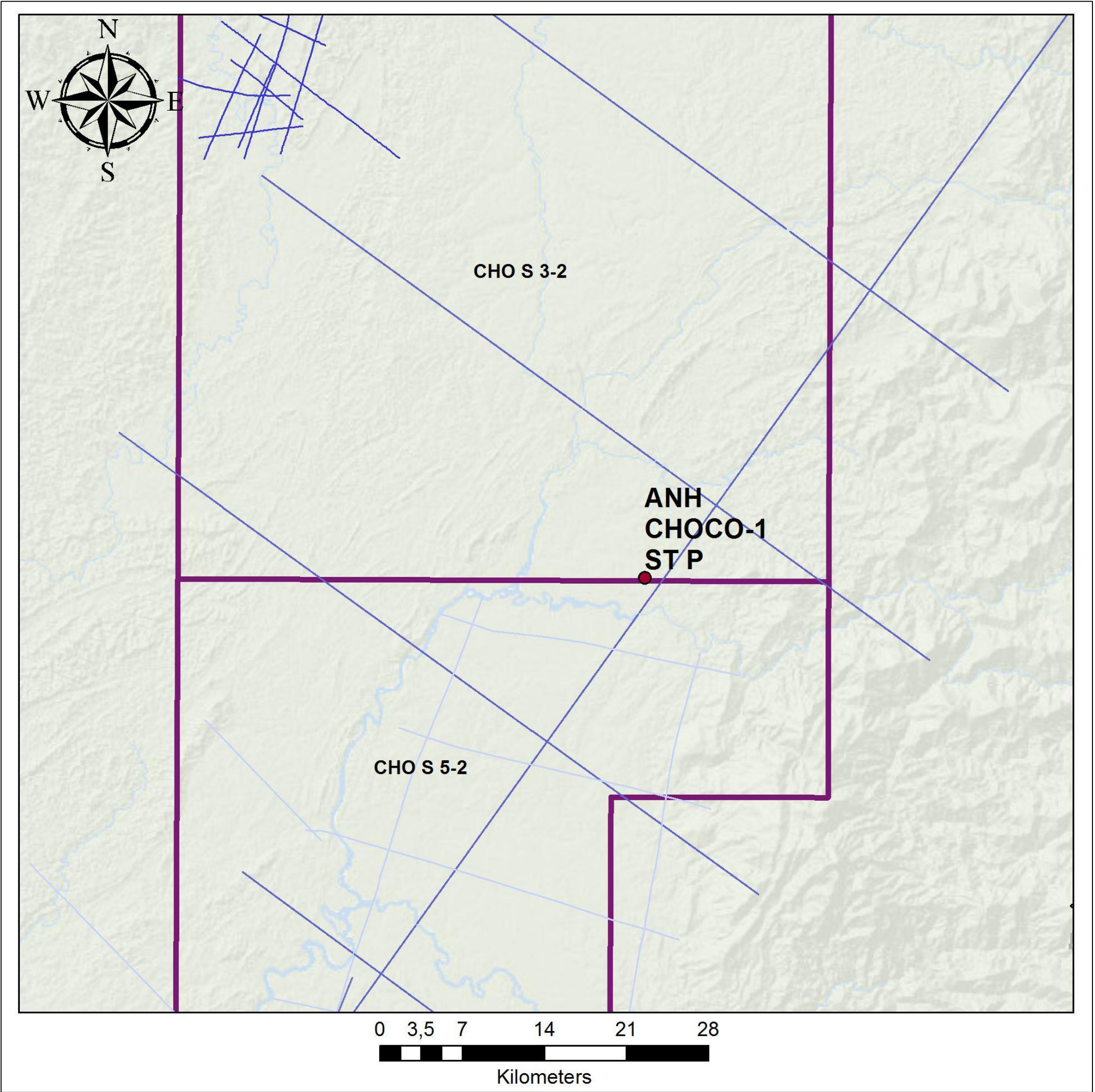
- **Buchadó-1 (1953) (TD 15,539')**
- Drilled by Richmond. Reached Upper Eocene, equivalent to Iró Fm. Well out of trap with gas shows at 5,800' and oil shows at 11,500'.
- **Opogadó-1 (1973) (TD 11,372')**
- Drilled by Continental. Seemed that well was drilled at a mud diapir.
- **Urodó-1 (1973) (TD 15,000')**
- Drilled by Superior. Structural high at a mud diapir
- **Pacurita-1 (1981) (TD 9,489')**
- Drilled by Asamera. Ended up in the Oligocene sequence but did not reached the target
- **Necora-1**
- Drilled by Asamera. Ended up in the Oilgocene sequence but did not reached the target



Wells History: ANH-CHOCÓ-1ST

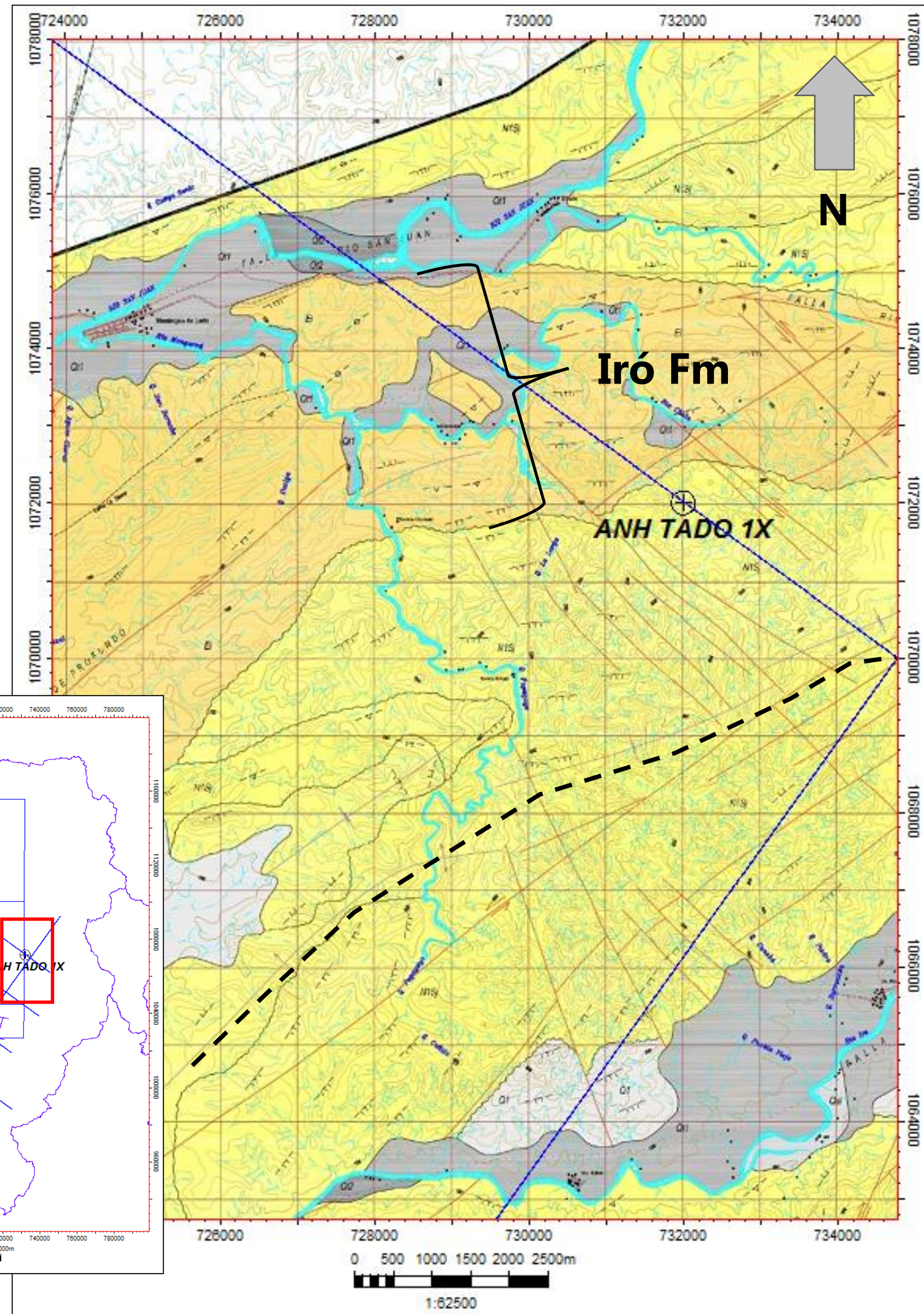
- **Stratigraphic well drilled by ANH from 2009 to 2010**
- The well reached a total depth of 10,000'
- Despite of not reaching its target the Iró Fm. It has a good set of logs and lithological description of the reservoir unit **Condoto Fm.**

Unit	Top (ft)	Bottom (ft)	Thickness (ft)
Quaternary	Surface	150	6,503
Mayorquin/Raposo	-	-	-
Condoto	150	9,500	9,350
Mojarra Conglomerates	9,500	10,000	500
Istmina	-	-	-
Iró	-	-	-
Basement	-	-	-



ANH EFFORTS

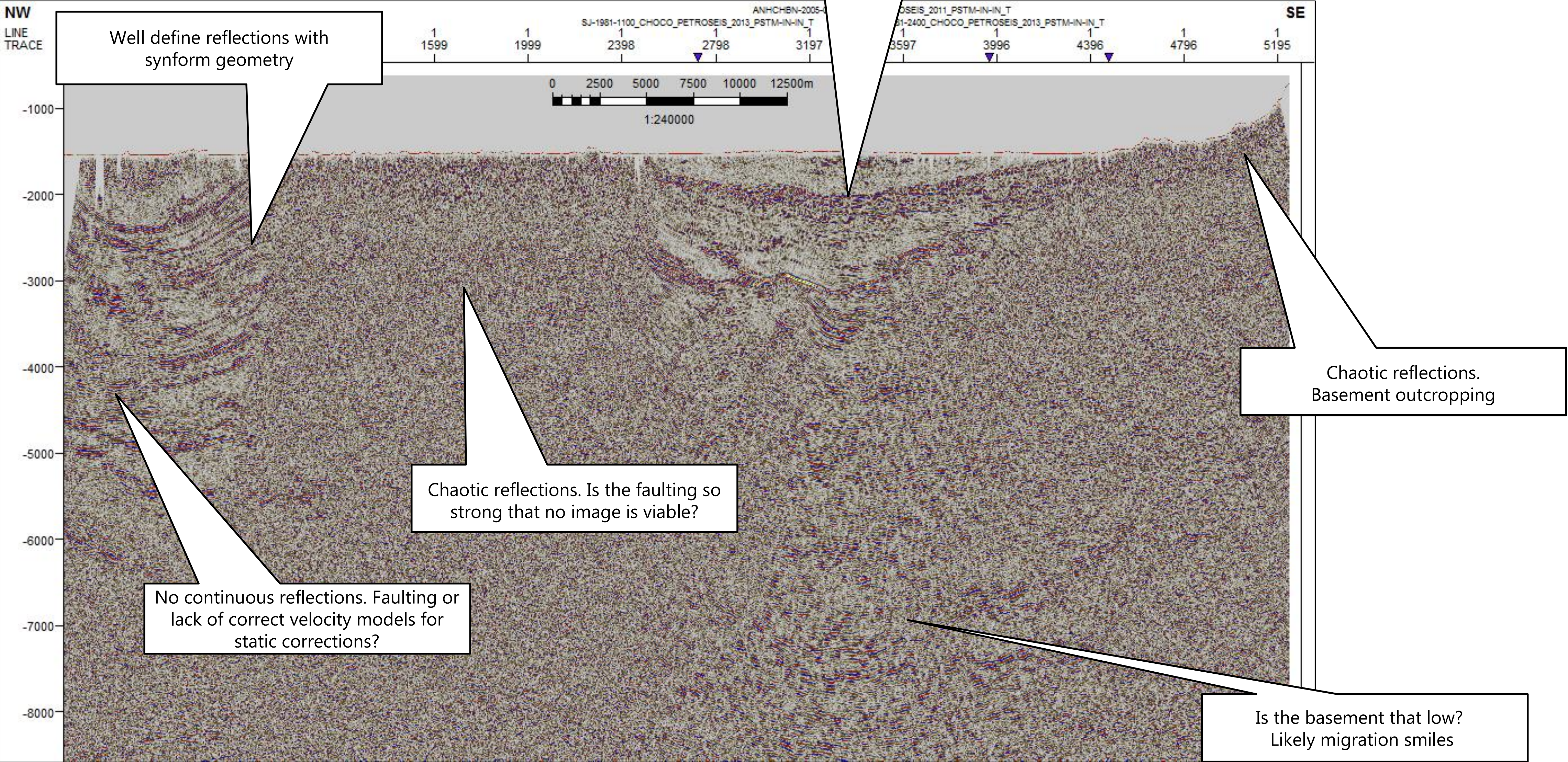
ANH-TADO-1X



- The **ANH** will drill a **stratigraphic well** with an **expected TD of 4,000'**
- Based on the geology made by Dunia in 2009 (the surface geology will be reconfirmed) and seismic data, the well will drill **the northwestern flank of the Tado syncline** limited by the Mojarras and Tadocito faults
- It is expected to **fully drill and sample with cores** the **Iro Formation** in order to understand its **geochemical** and **petrophysical** properties.
- Based on the **quality of the Iró Formation** as a **source rock**, the prospectivity of the basin could increase significantly
- Eocene units never have been reached in the basin by a well

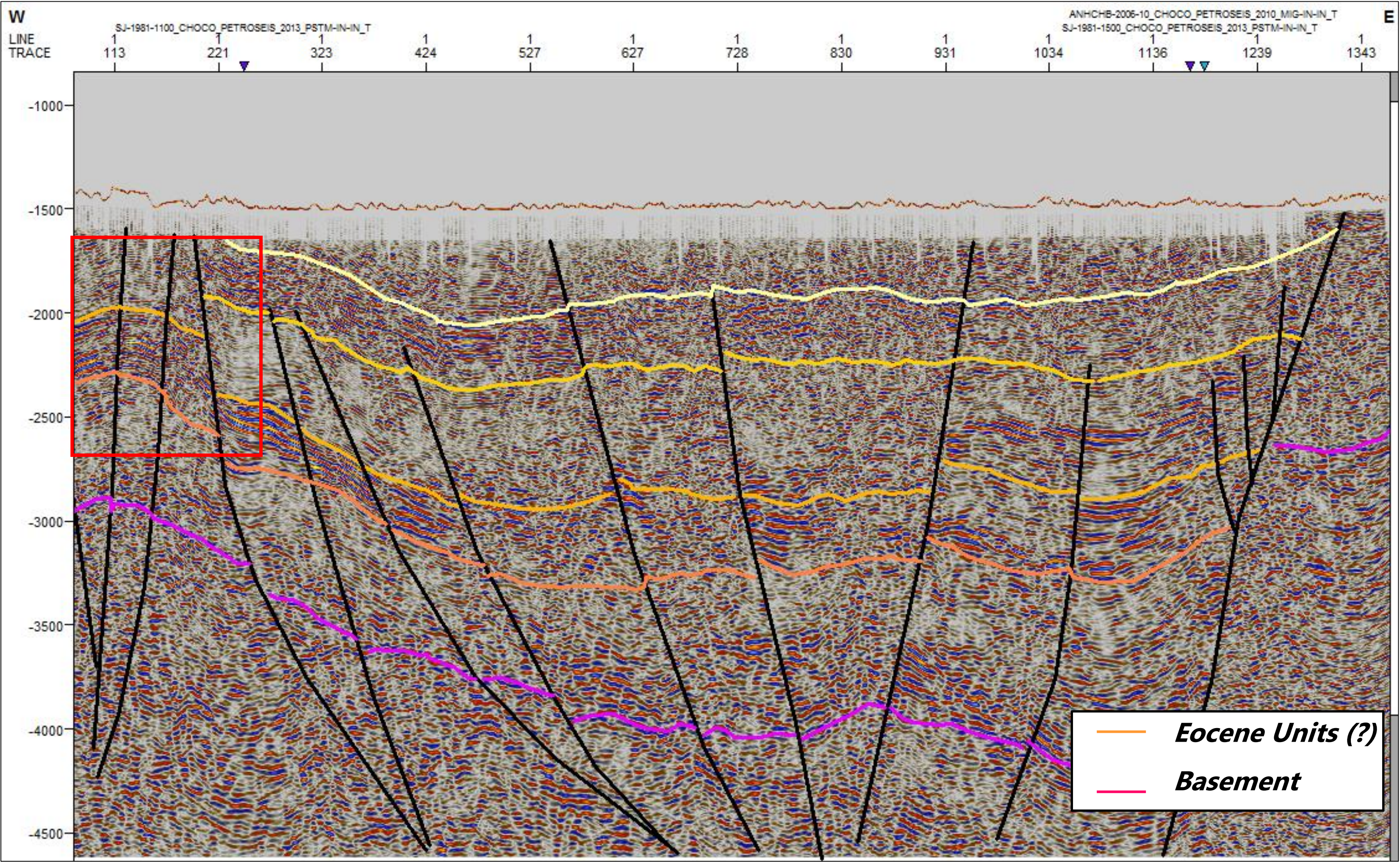
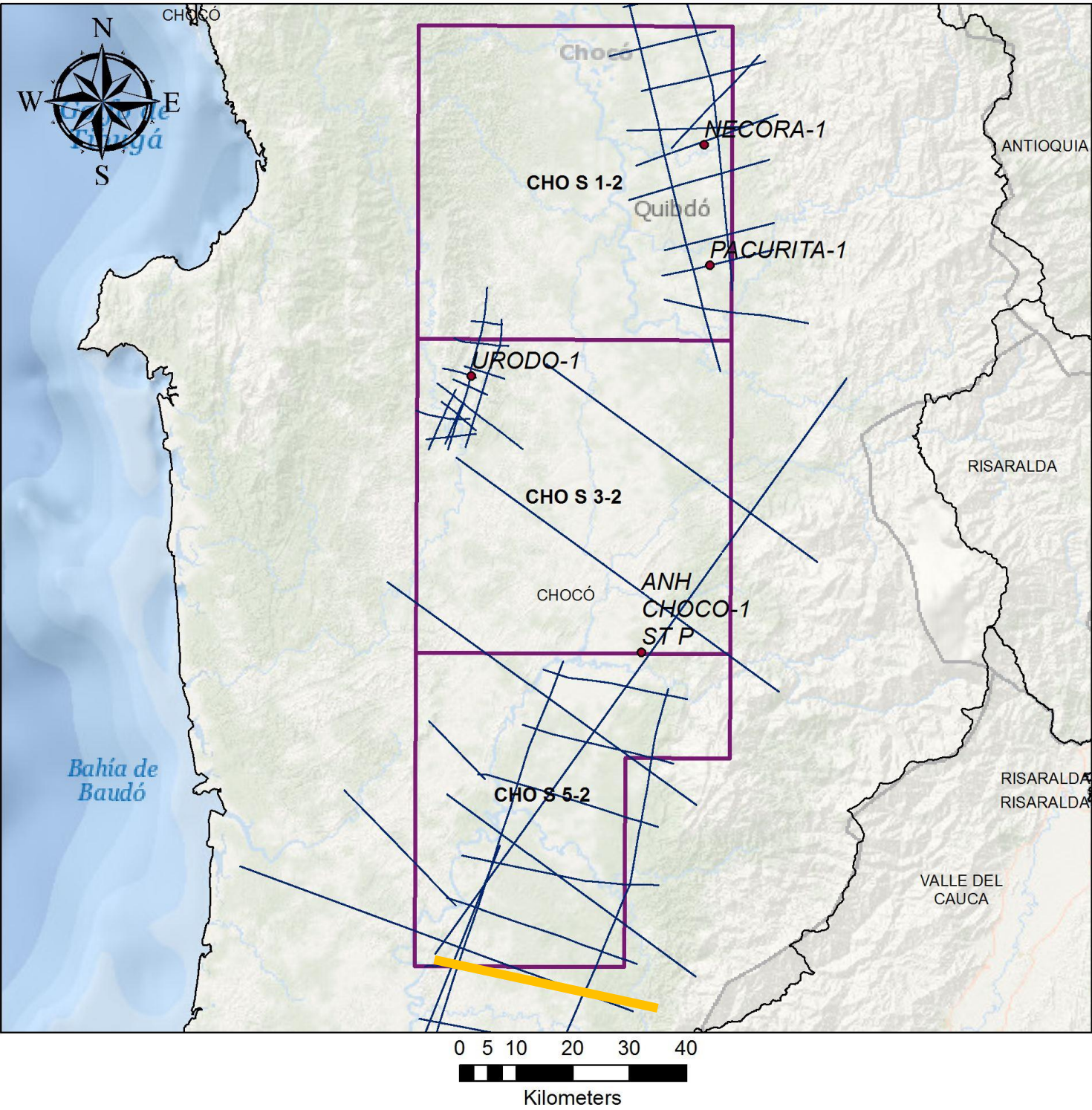
SEISMIC QUALITY

SEISMIC QUALITY: REPROCESSING IS NECESSARY

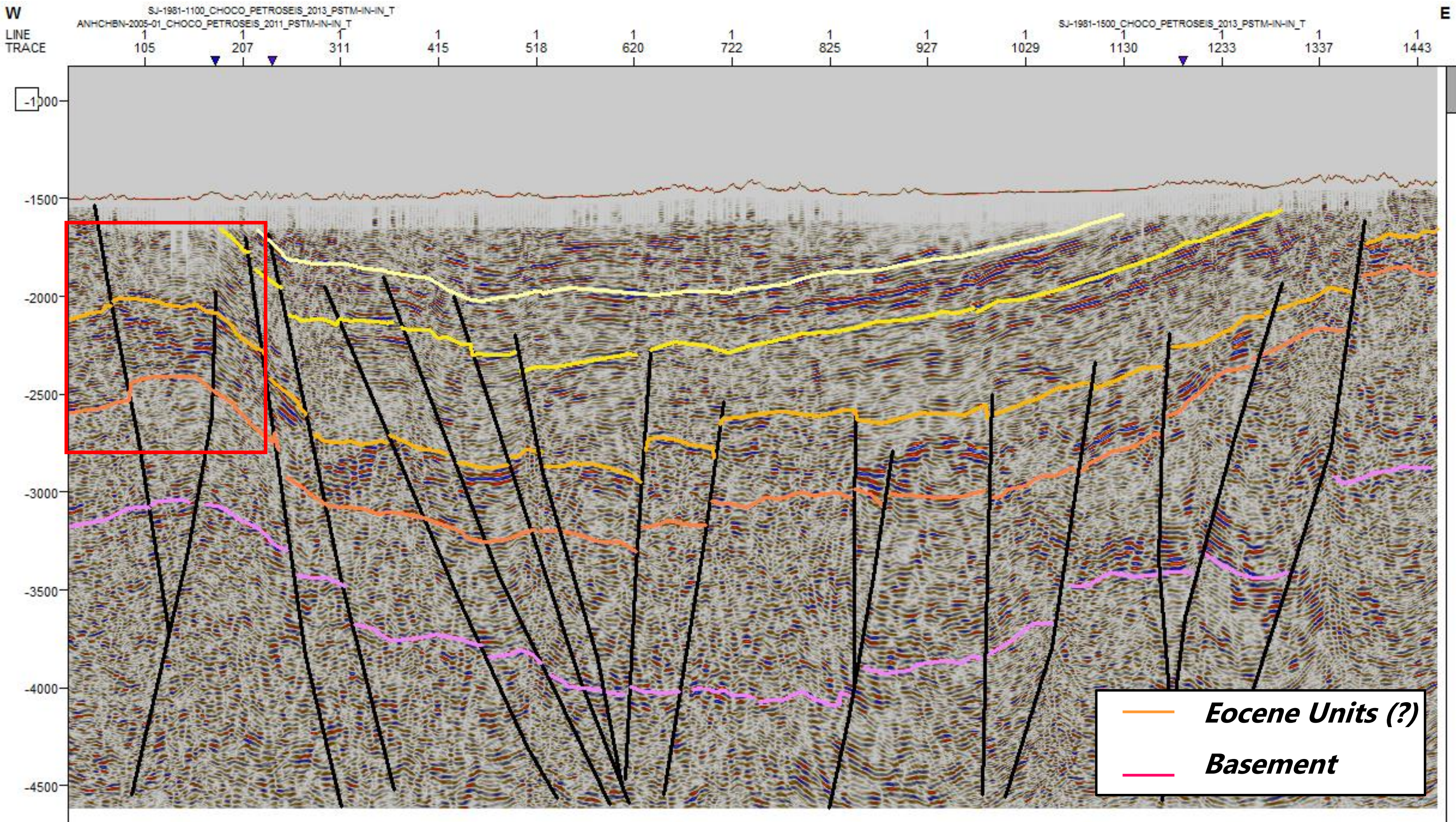
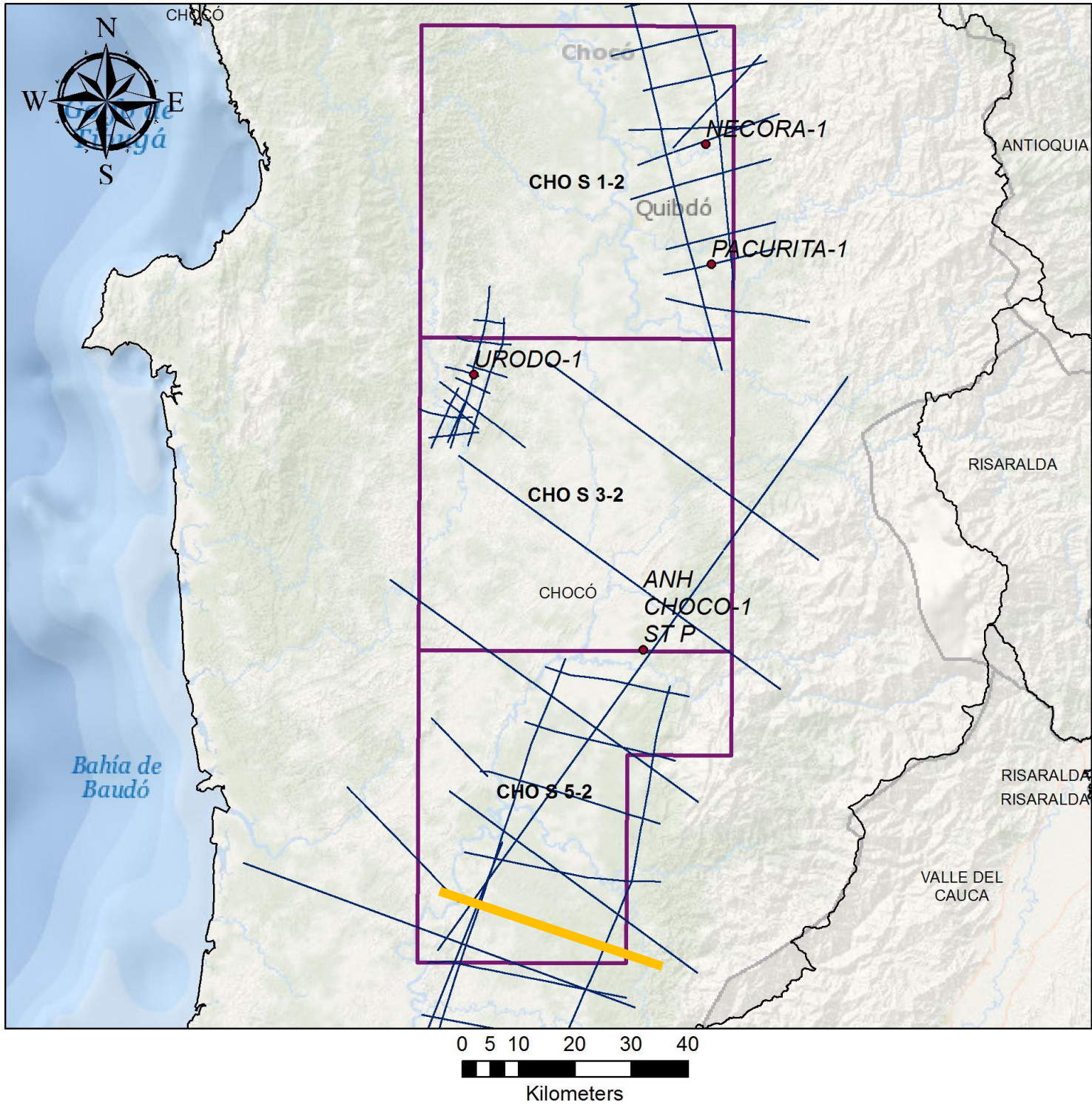


SEISMIC INTERPRETATION

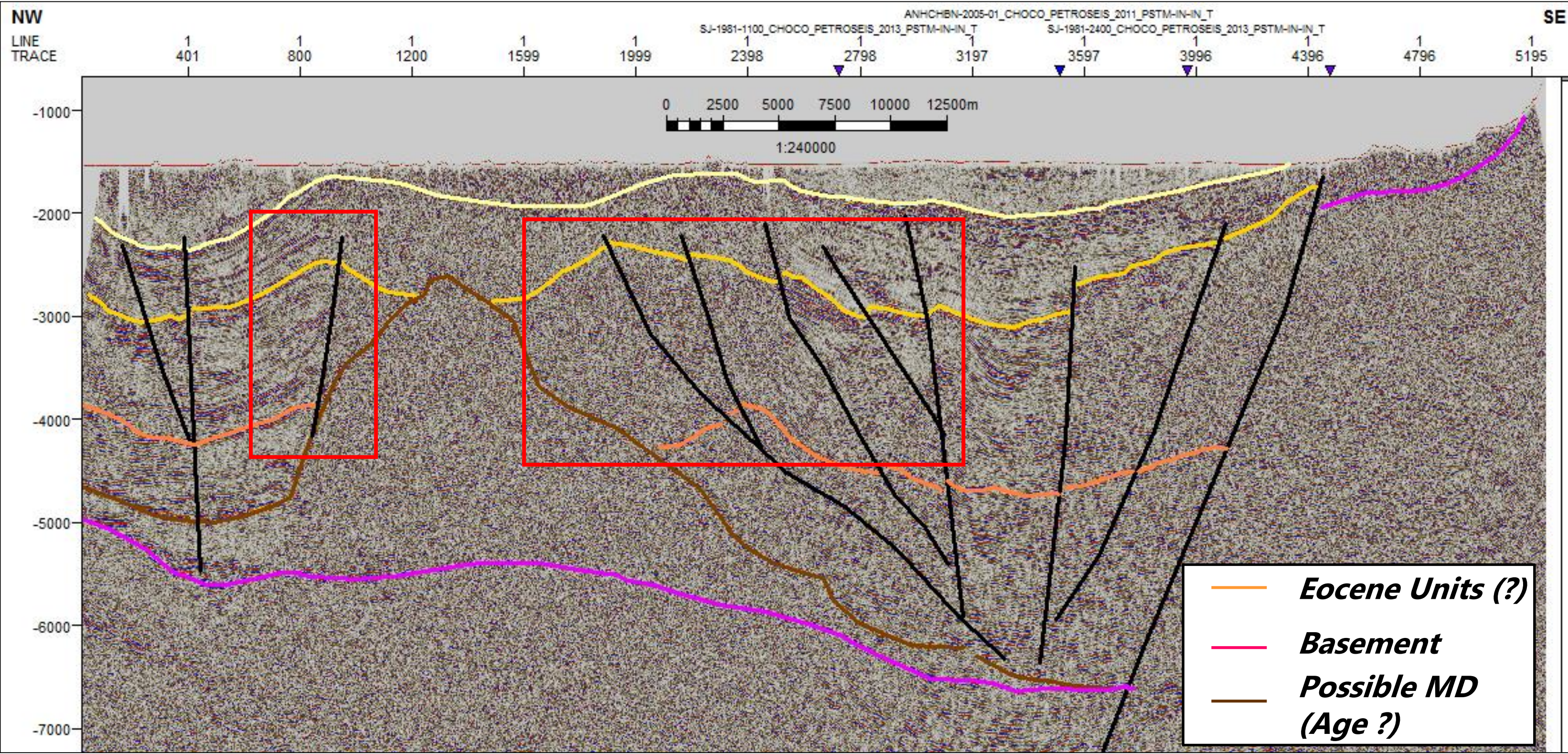
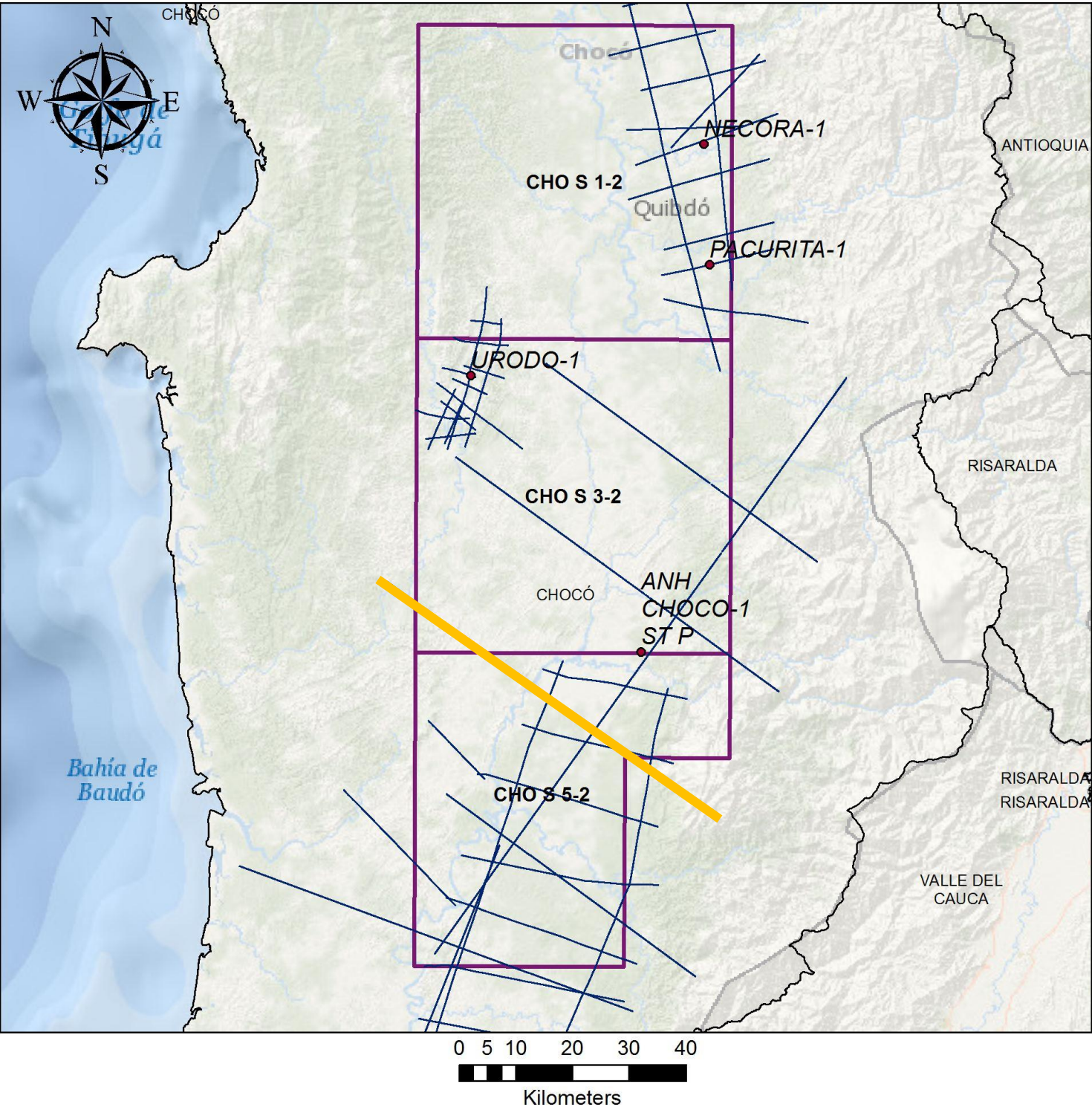
SEISMIC INTERPRETATION SOUTH: CHO S 5-2



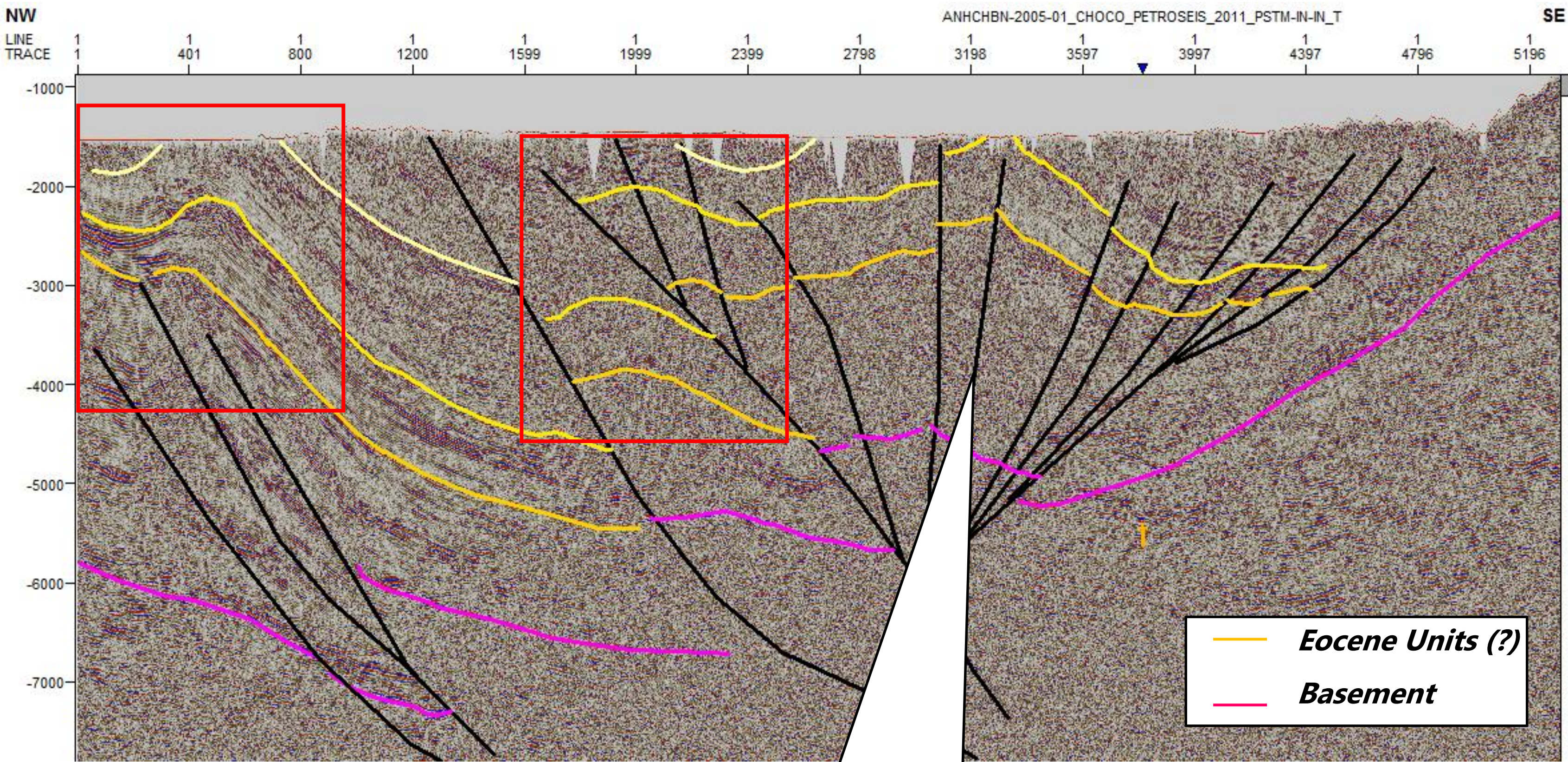
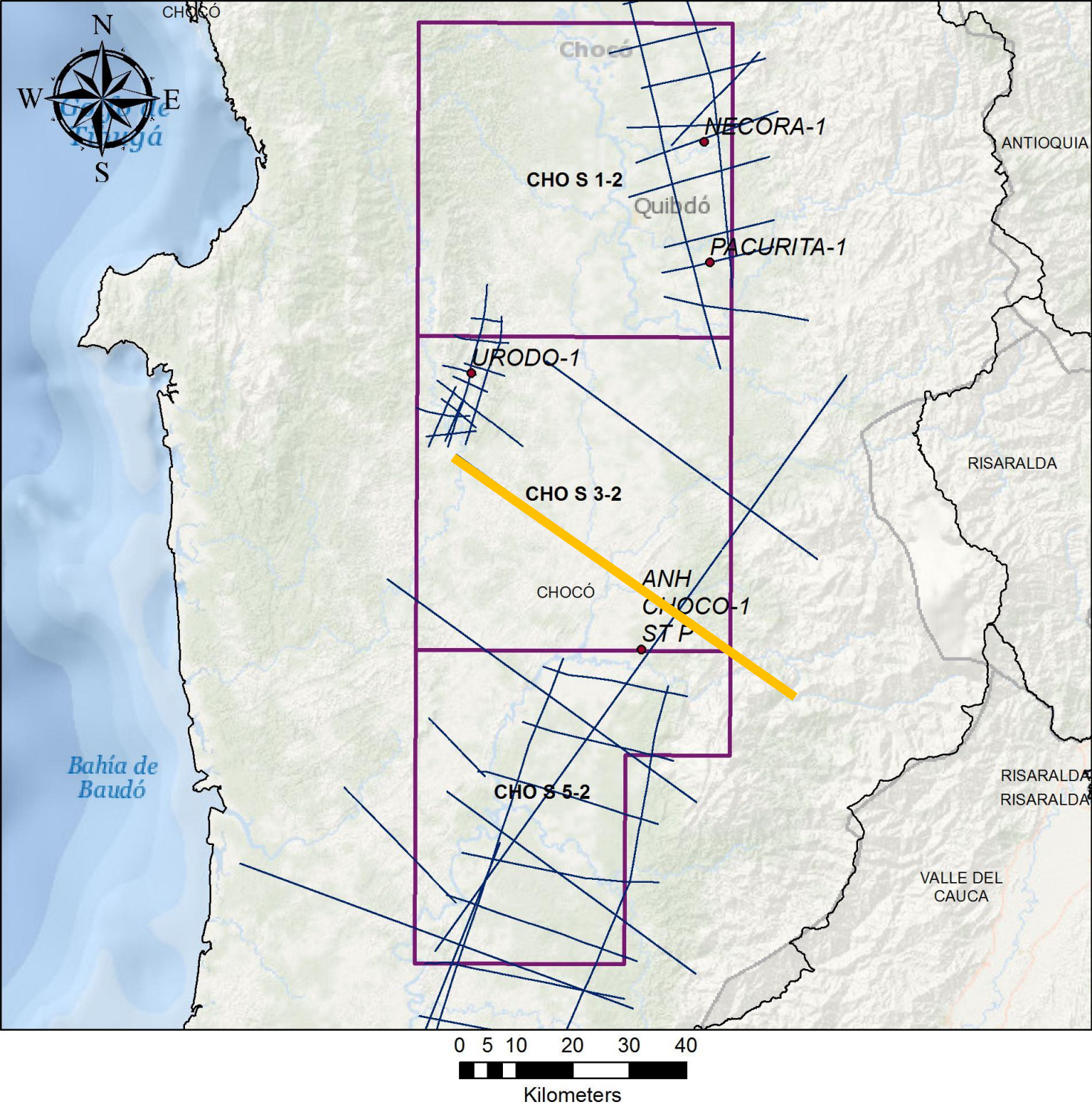
SEISMIC INTERPRETATION SOUTH: CHO S 5-2



SEISMIC INTERPRETATION SOUTH: CHO S 5-2 MUD DIAPIR



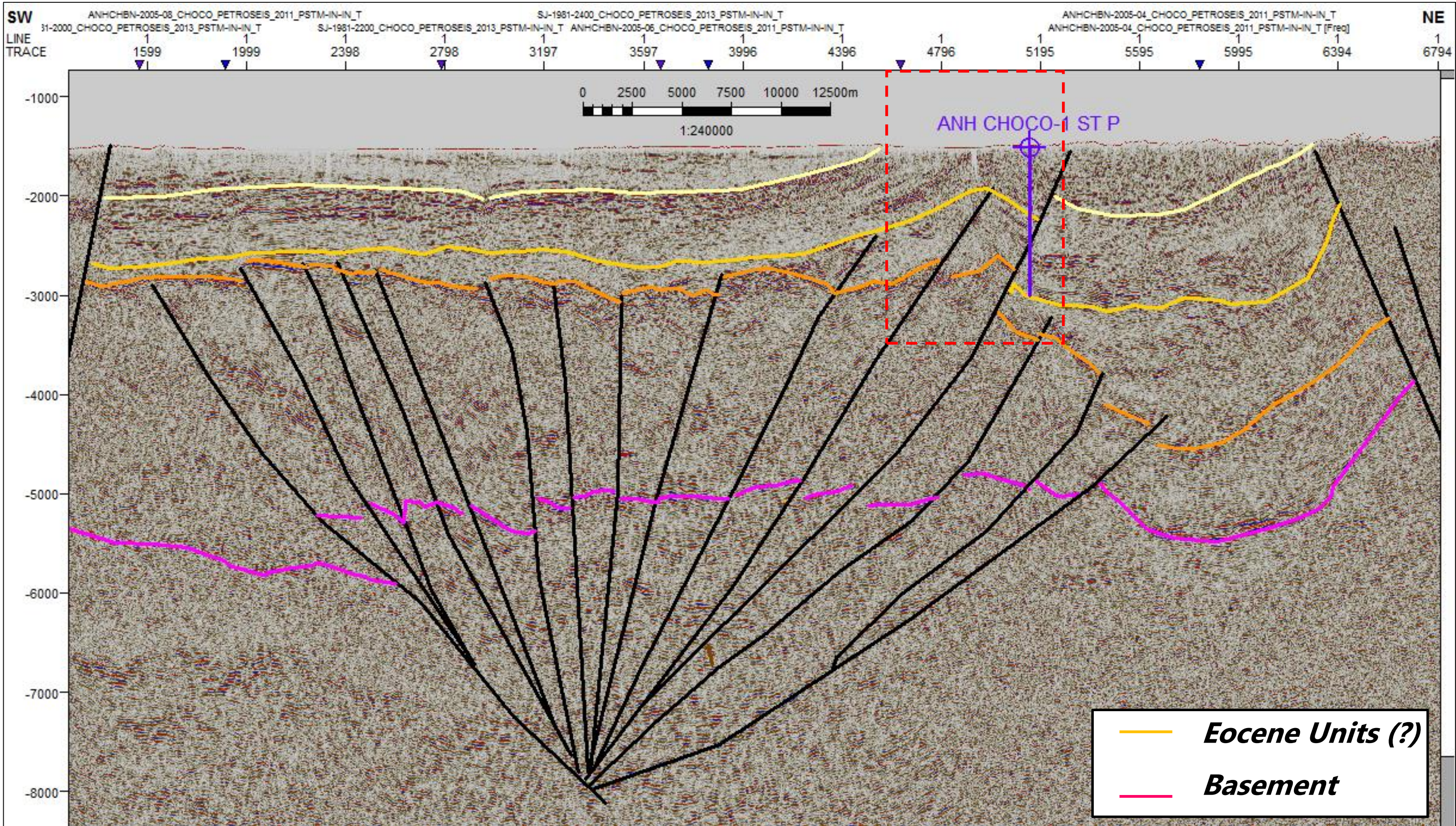
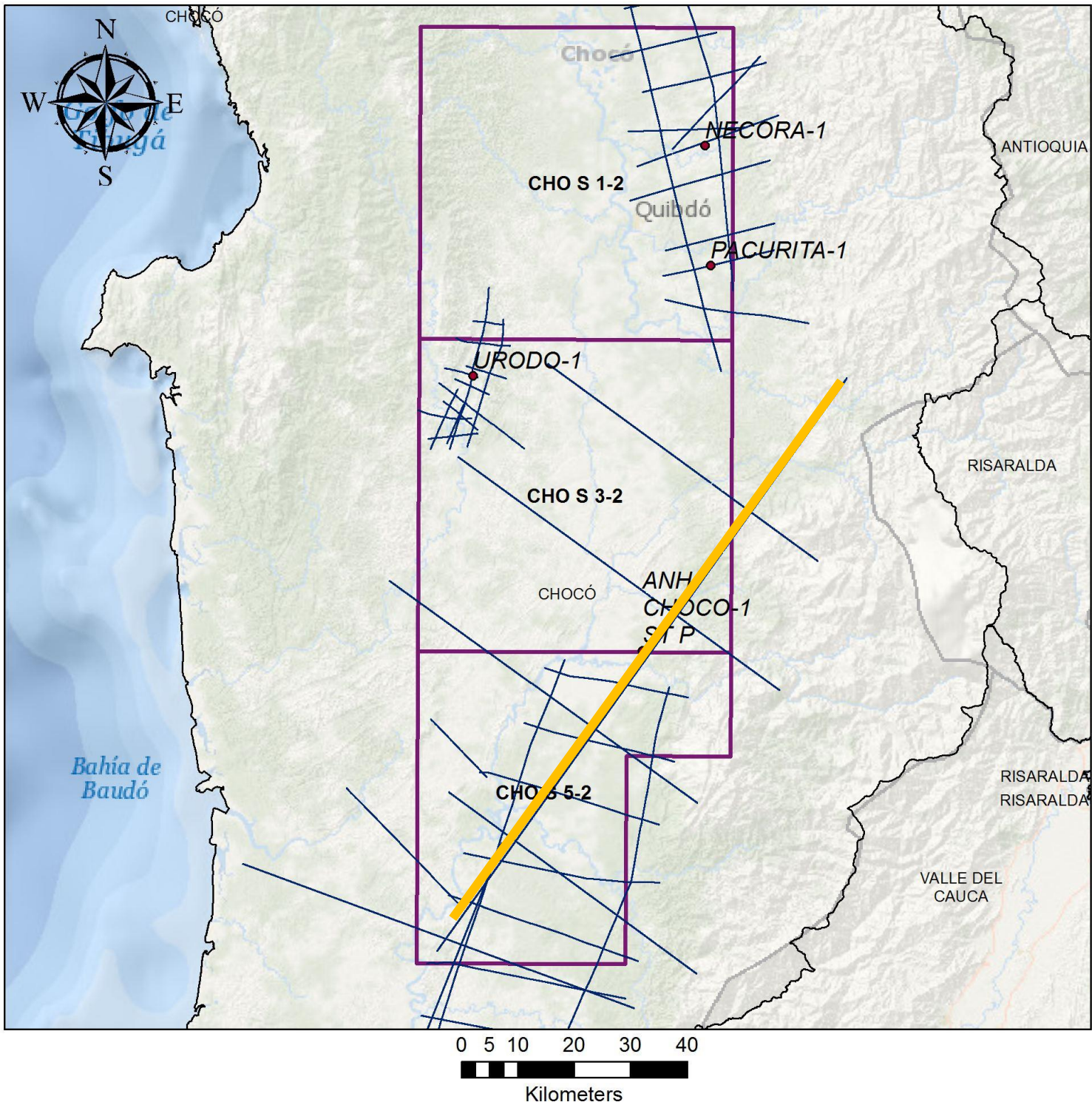
SEISMIC INTERPRETATION SOUTH: CHO S 5-2 POSITIVE FLOWER STRUCTURE



This positive flower structure could have involved mud diapirs as the previous line or not exist at al

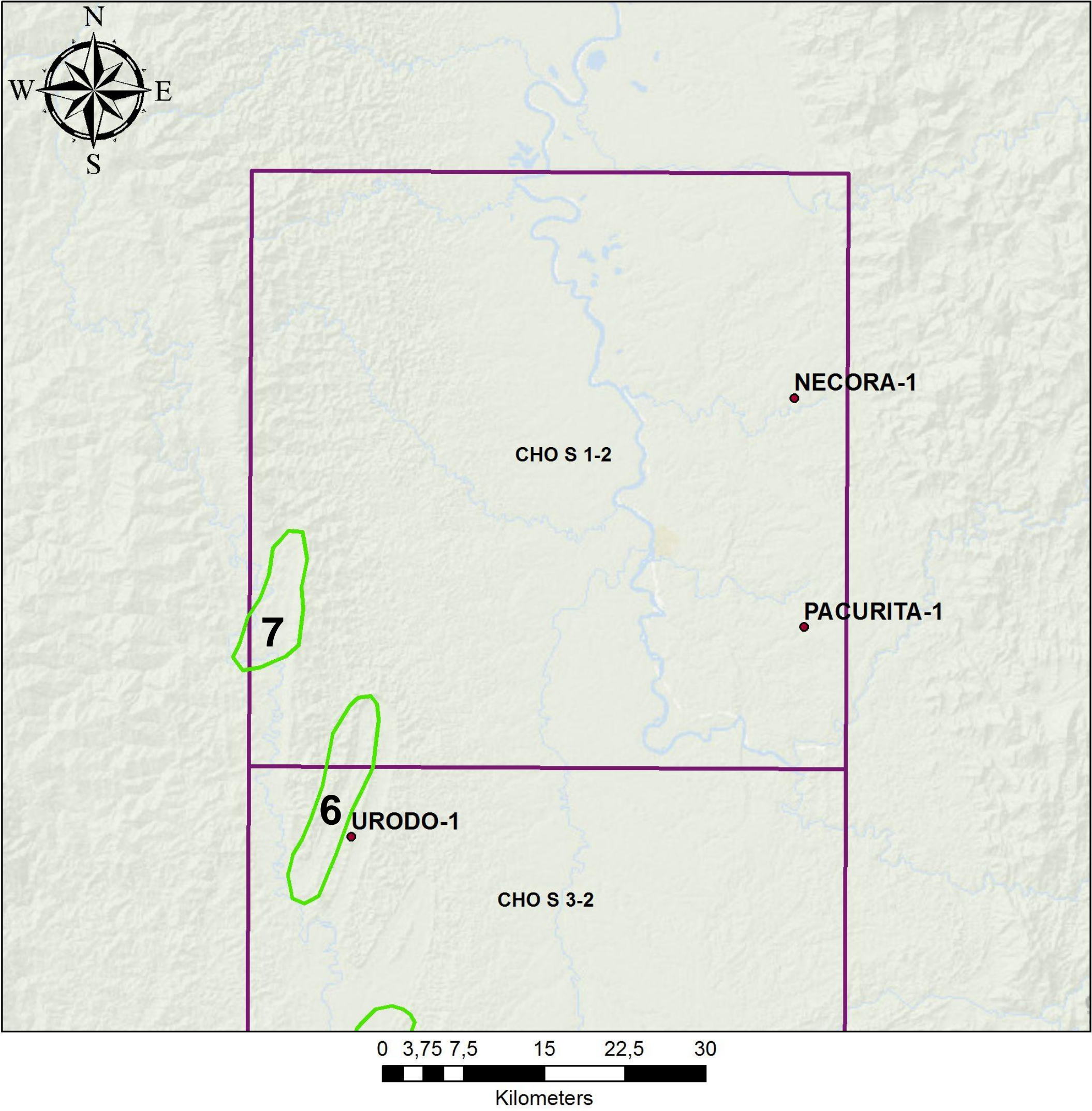
¡Seismic image need to be improved!

SEISMIC INTERPRETATION STRIKE LINE: FLOWER STRUCTURE



PROSPECTIVITY & RECOVERABLE PROSPECTIVE RESOURCES

VOLUMETRICS CHO S 1-2:



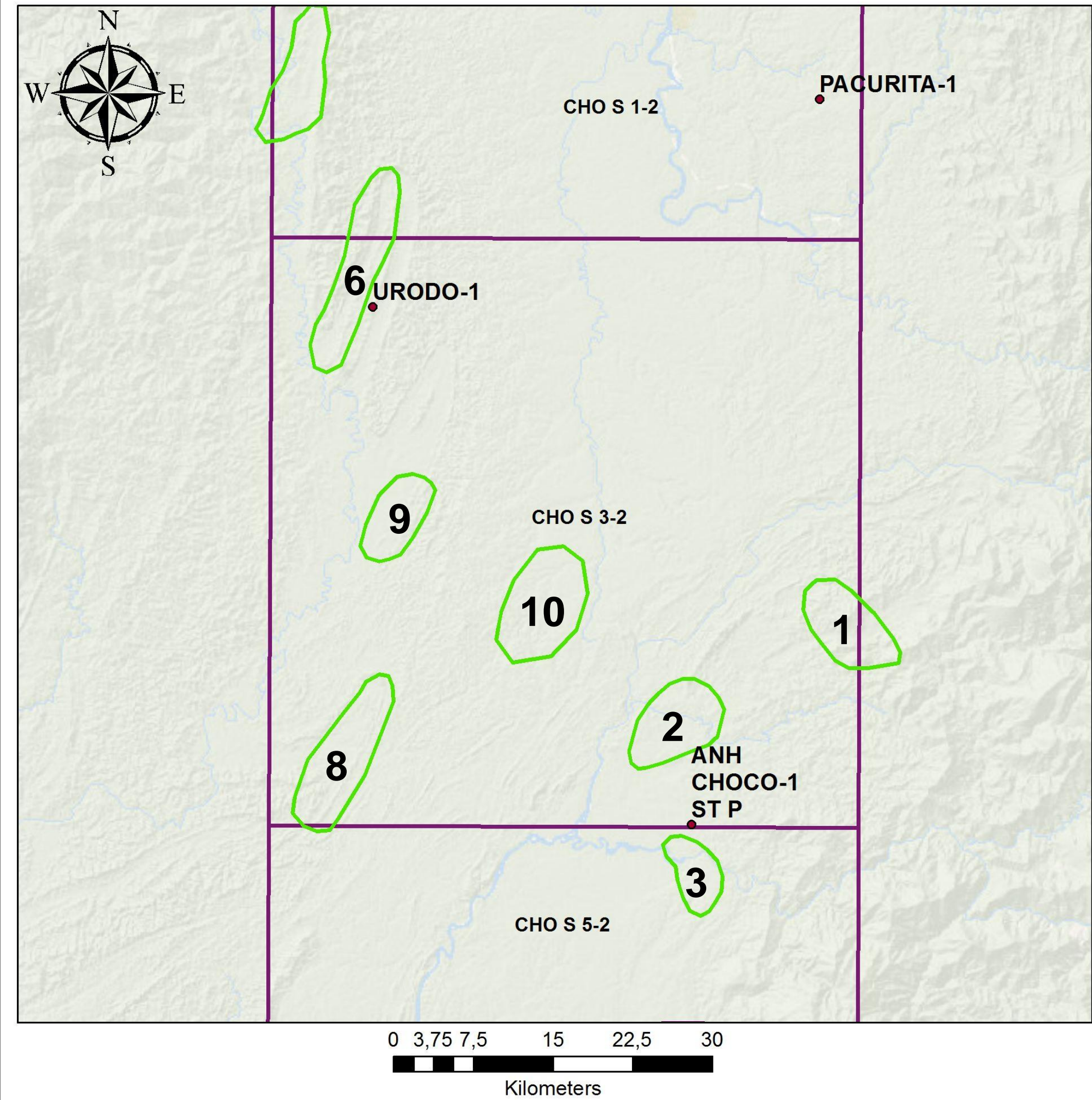
2 LEADS

Recoverable Prospective Resources

Lead No	OOIP MMBO	R. Prospective Resources MMBO
6	3,160.7	79,02
7	2,298.1	57,45

Lead	Area
6	68,7 km ²
7	49,95 km ²

VOLUMETRICS CHO S 3-2:



6 LEADS
Recoverable Prospective Resources

Lead No	OOIP MMBO	R. Prospective Resources MMBO
1	2,231.39	55.78
2	2,323.41	58.08
6	1,188.85	79.02
8	3,064.13	76.60
9	1,647.09	41.17
10	3,043.89	76.10

Lead	Area
1	48.5 Km²
2	50.5 Km²
6	58.7 Km²
8	66.6 Km²
9	35.8 Km²
10	66.16 Km²

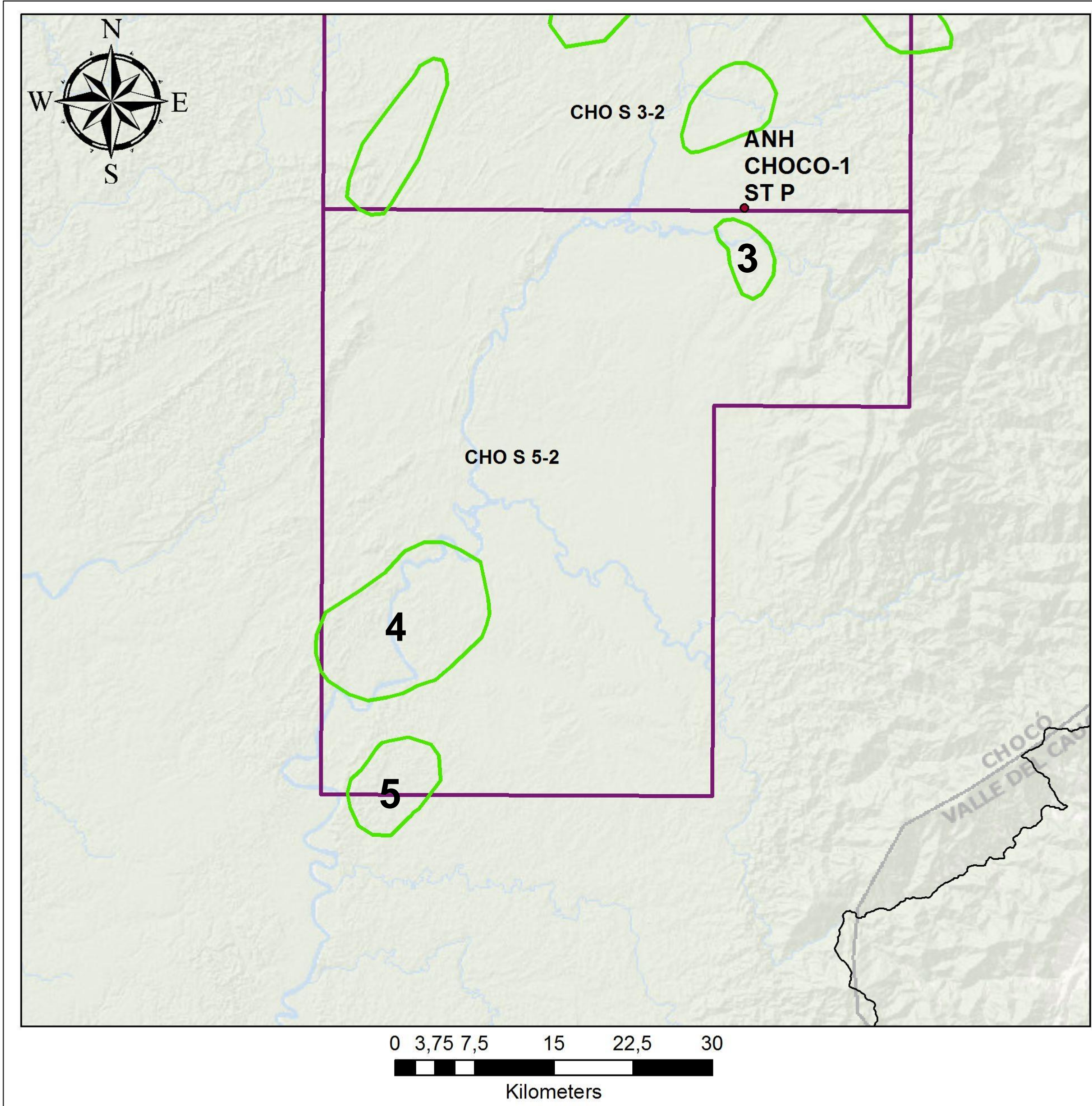
VOLUMETRICS CHO S 5-2

3 LEADS

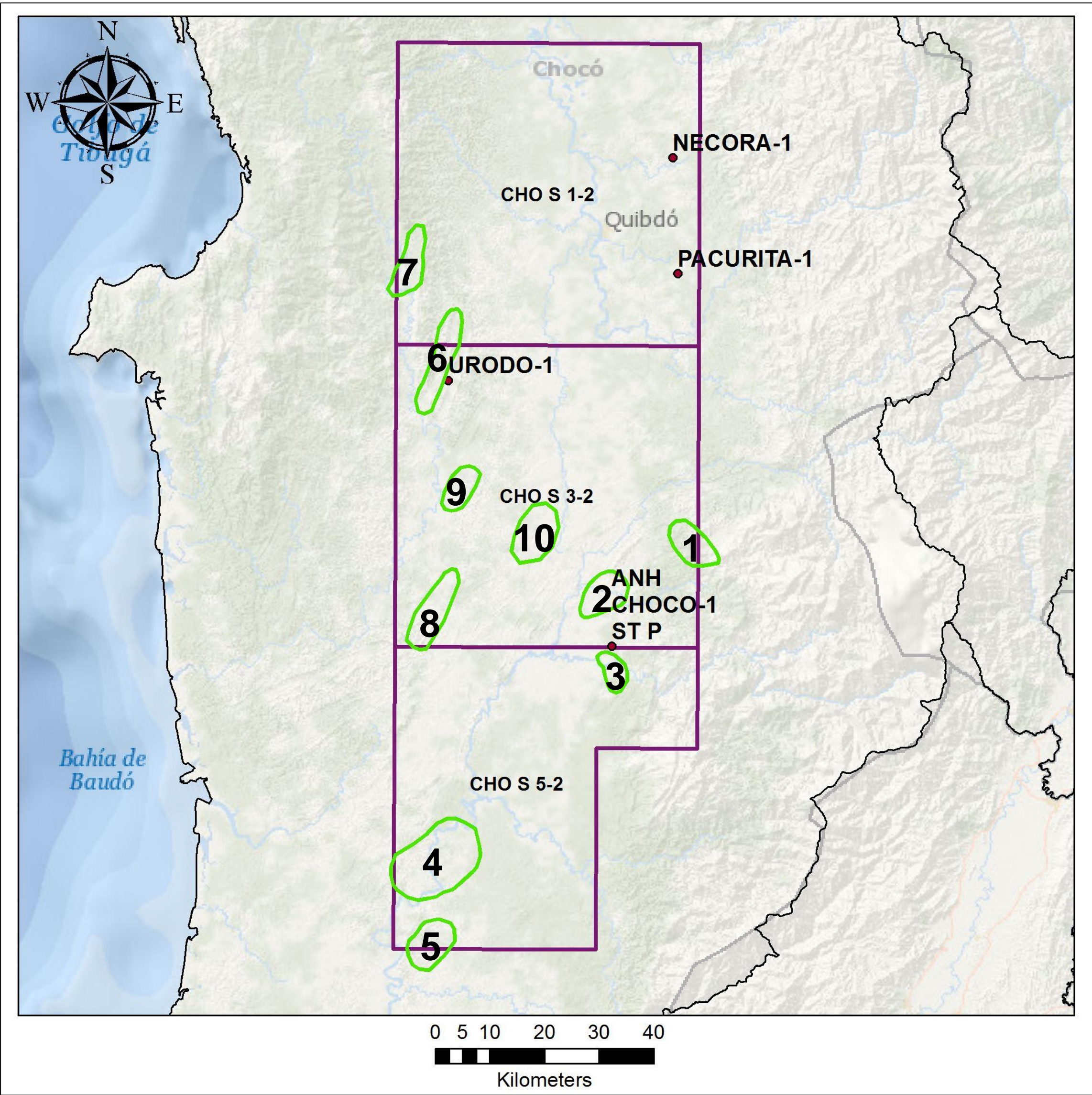
Recoverable Prospective Resources

Lead No	OOIP MMBO	Prospective Resources MMBO
3	1,188.85	29.7
4	7,686.22	192.4
5	2,599.45	64.9

Lead	Area
3	25.84 km ²
4	167.28 km ²
5	56.5 km ²



VOLUMETRICS: TOTAL



Oil (Deterministic)

- 10 leads in total
- OOIP: 29,253.29 MMBls

Recovery factor 25%
Chance of success 10%

- Prospective Resources
 - High Estimate 731.33 MMBls
 - Best Estimate 365.66 MMBls**
 - Low Estimate 73.1 MMBls

CONCLUSIONS

- The three blocks offered by the **ANH: CHO S 1-2, CHO S 3-2, CHO S 5-2** with an area of **853,102.47 hectares** are located in the western part of the country between the **Baudó Complex** and the **Mandé Magmatic Arc**.
- **Three exploratory wells:** Necora-1, Pacurita-1 and Urodo-1, have been drilled in the area from 1973 to 1983 with no commercial success. **One stratigraphic well:** ANH-Choco-1ST, has been drilled in the area by the ANH reaching a total depth of **10,000'** in 2011.
- 977.67 Km of 2D seismic have been acquired in the area in six different programs
- Facilities are located in average 100 Km apart from the areas
- The areas are located in the Atrato and San Juan sub-basins which are separated by the **Istmina-Condoto high**.
- Sierra Fm and Condoto Fm of Miocene age are considered the reservoir and the Iró and Clavo formations of Eocene age area considered as the main source with secondary reservoirs
- The traps in the Urodó area seem to be **related to mud diapirism** while at the southeast of the Istmina-Condoto high traps are related to **transpressive structures**.
- **10 possible leads** have been identified in the blocks with areas ranging from **25 to 167 Km²** with a best estimate of recoverable prospective resources of **365.66 MMBBLS**.

Thanks

www.anh.gov.co