

COLOMBIA

ROUND 2021



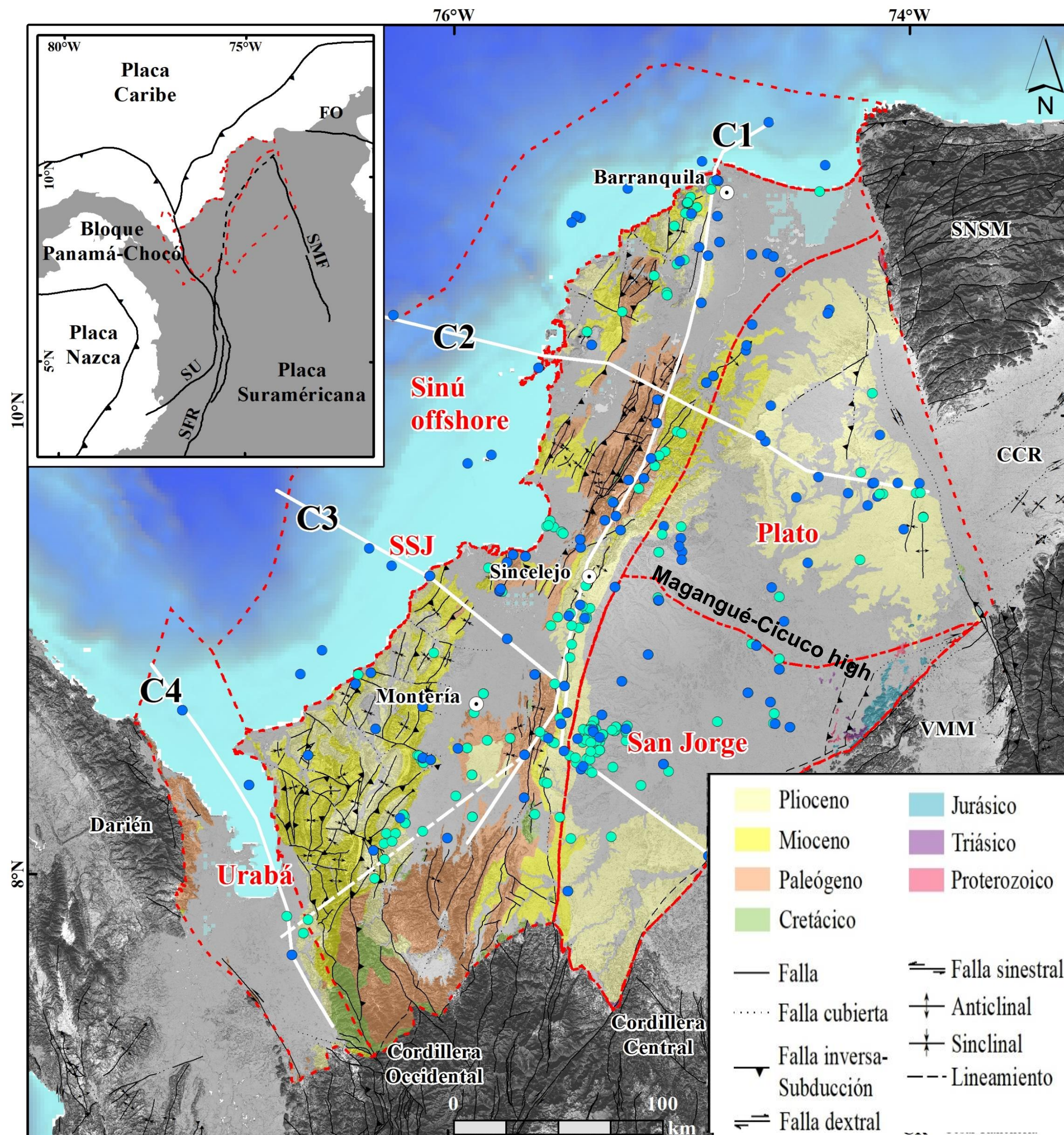
El futuro
es de todos

Minenergía

GEOLOGICAL INTEGRATION, PETROLEUM SYSTEMS AND PROSPECTIVITY OF COLOMBIA'S FRONTIER BASINS: SINÚ-SAN JACINTO AND SAN JORGE (LOWER MAGDALENA VALLEY)

Enrique Velásquez - Project Director
Andres Pardo – Stratigraphy Leader
Roberto Linares – Structural Geologist
Cesar Mora – Petroleum System

CHRONO STRATIGRAPHIC CHARTS AND PALEOGEOGRAPHIC MAPS



Regional Geology - Stratigraphy

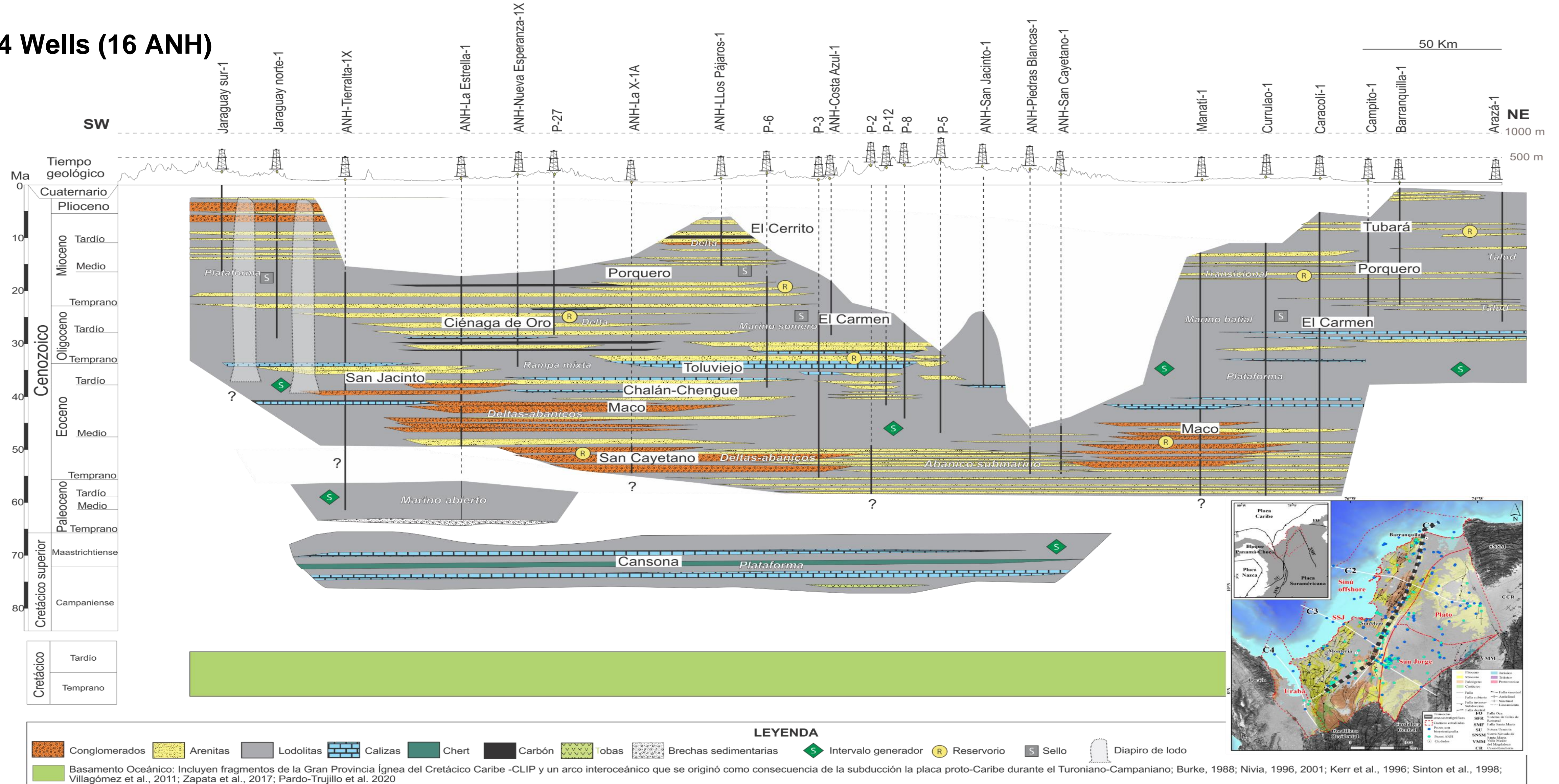
58 Wells (many new ANH Wells) ● ●
Surface Geology (SGC)

- 1 Strike section
- 3 Dip sections
- Lengths
 - T1: 498 km
 - T2: 282 km
 - T3: 323 km
 - T4: 204 km

Total: 1 307 km

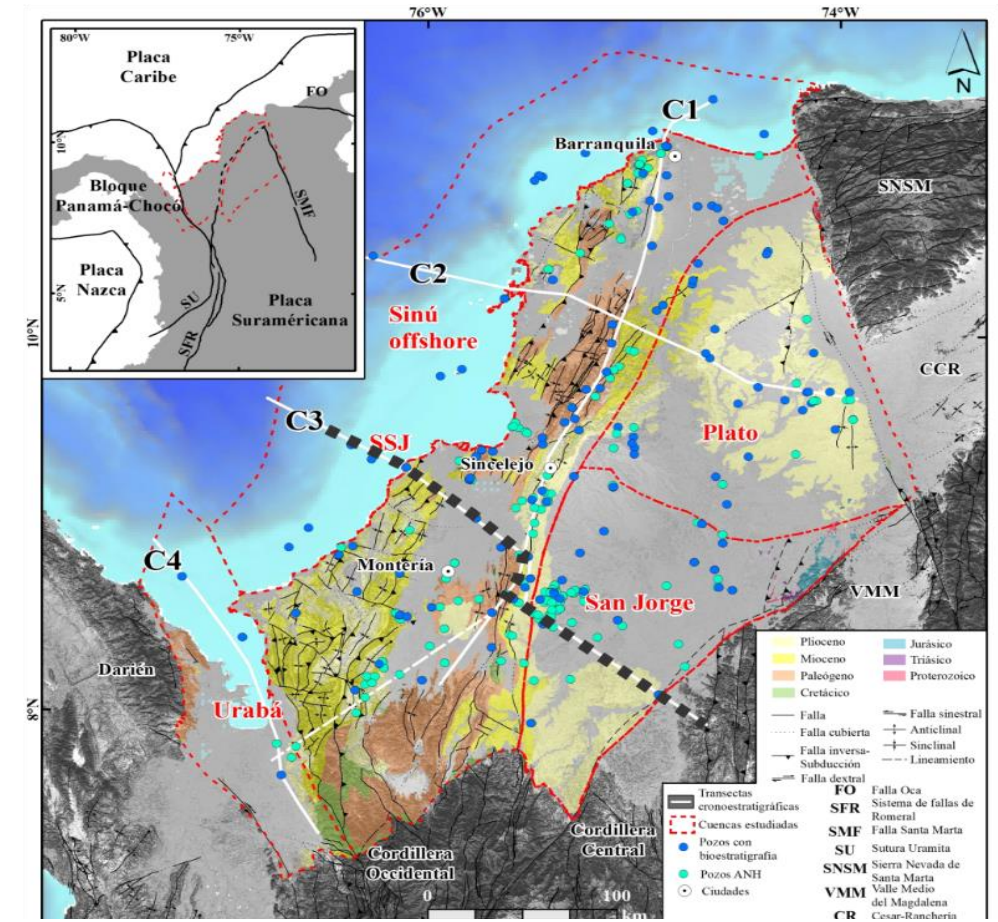
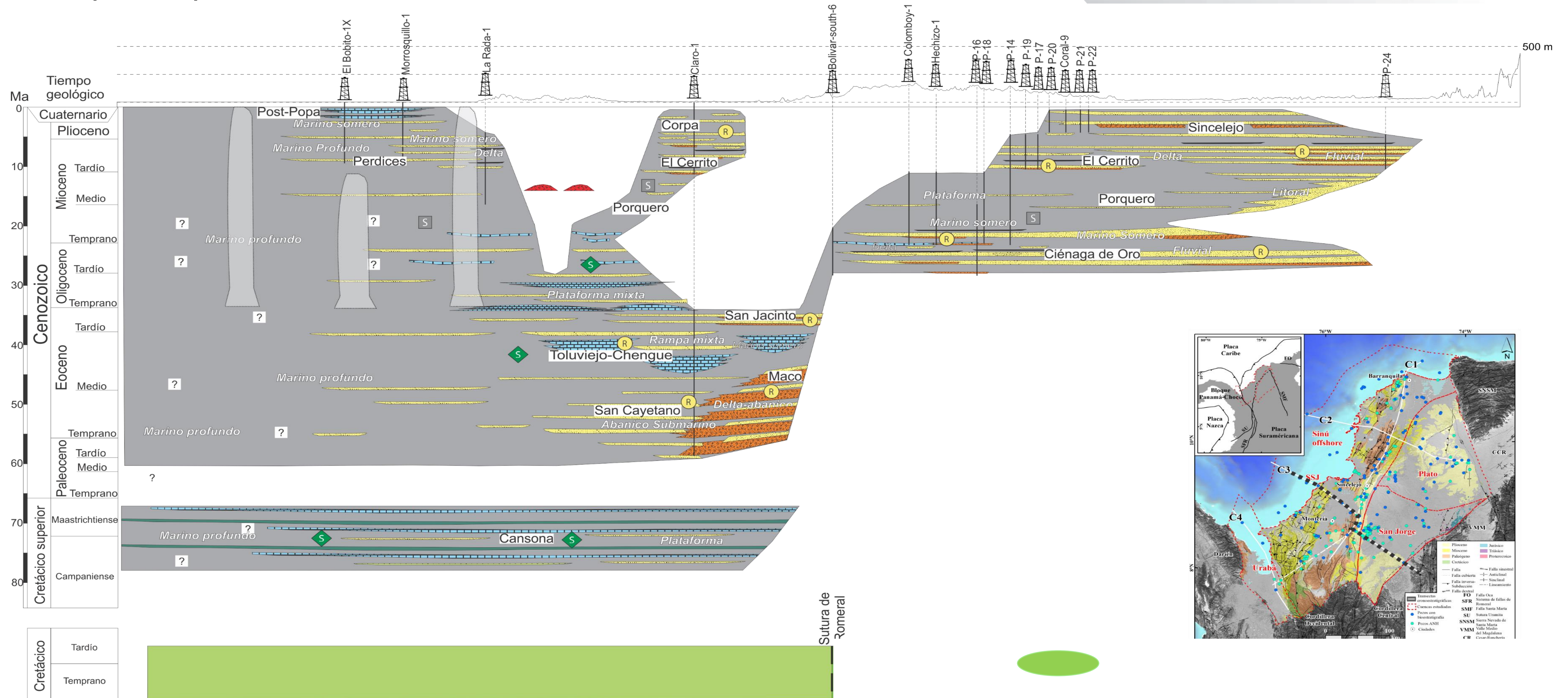
CHRONOSTRATIGRAPHIC CHART 1

24 Wells (16 ANH)



CHRONOSTRATIGRAPHIC CHART 3

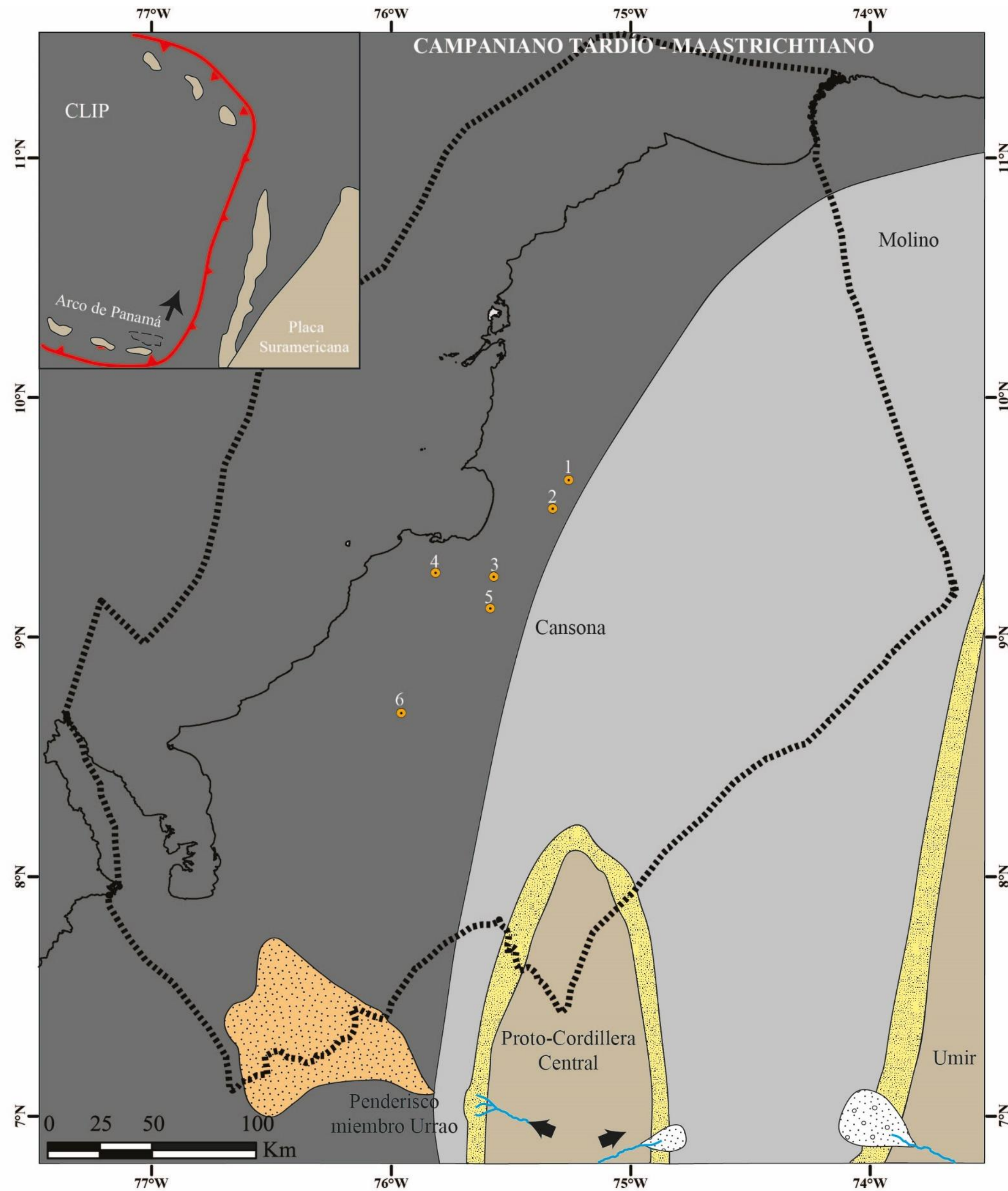
17 Wells (10 ANH)



Sinú Offshore

Sinú-San Jacinto

San Jorge



Campanian-Maastrichtian

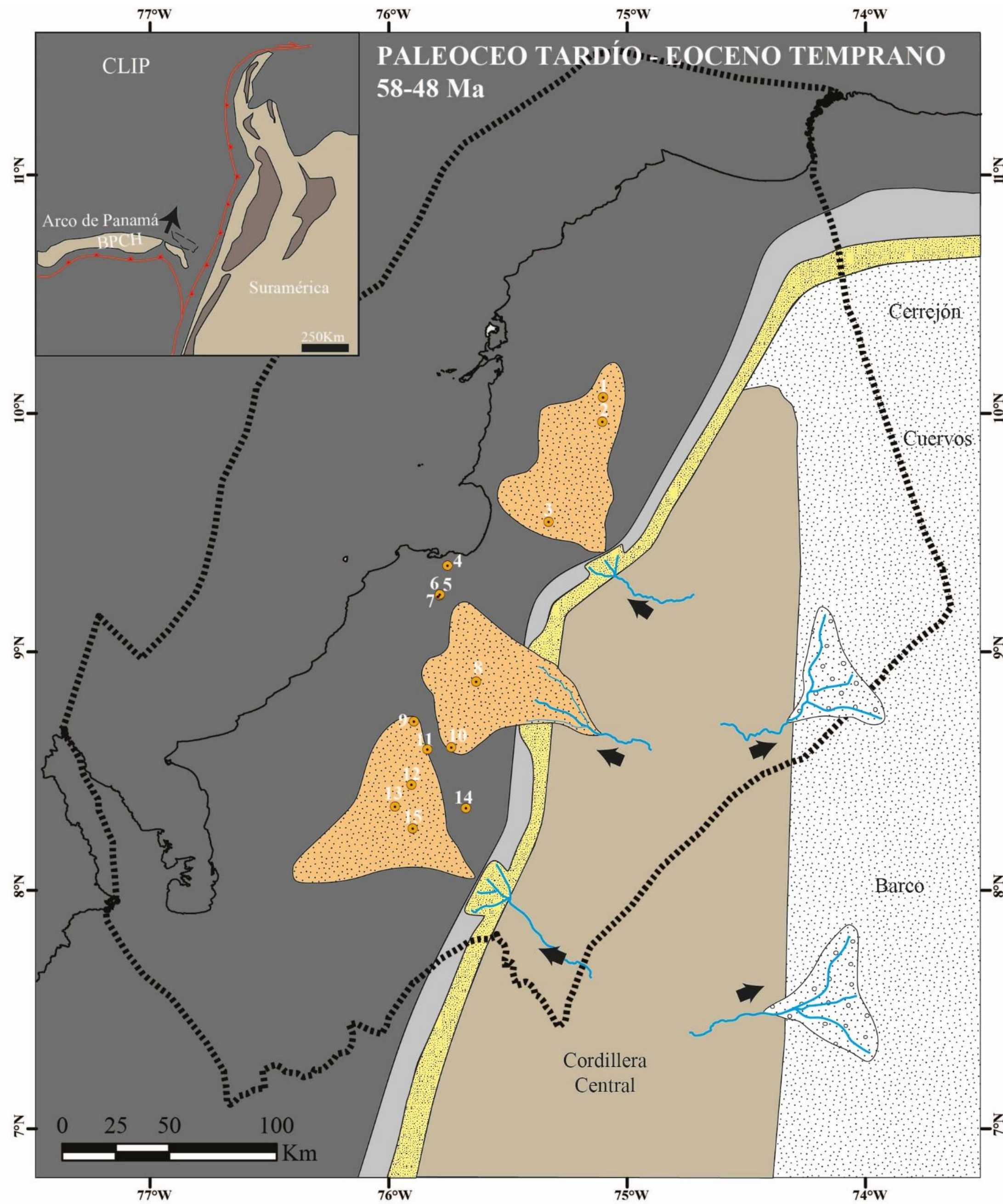
LEYENDA

- Área emergida
- Ambiente transicional (delta, llanuras mareales, *foreshore* y *shoreface*)
- Ambiente marino somero (*offshore*-plataforma)
- Ambiente marino profundo (talud-llanura abisal)
- Abanicos deltaicos y submarinos
- Abanicos aluviales, depósitos fluviales
- Límite área de estudio
- Dirección de aporte de sedimentos
- Drenajes

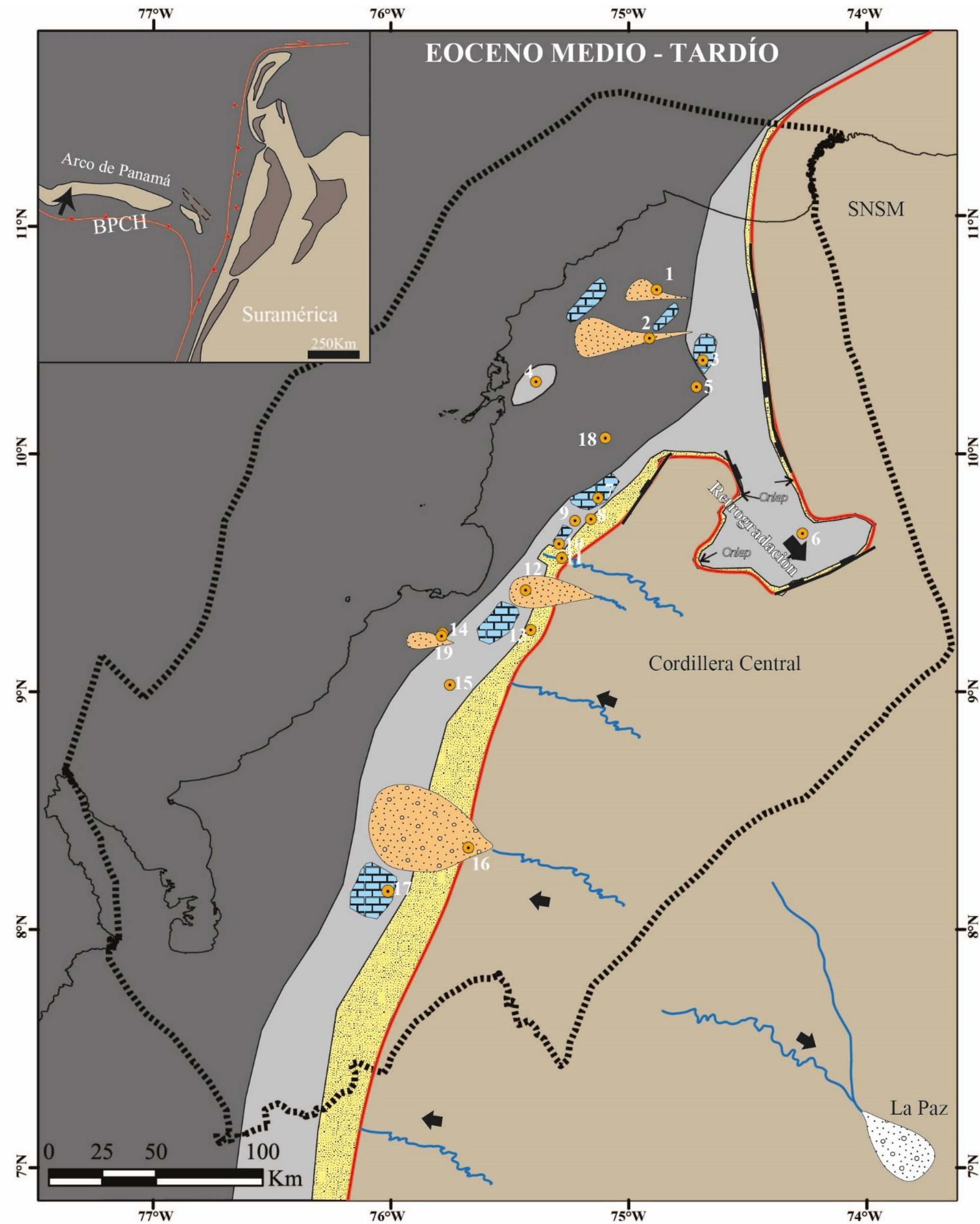
SECCIONES ESTRATIGRÁFICAS

- 1 Cerro Cansona
- 2 Arroyo Peñitas
- 3 Sección San Carlos
- 4 San Carlos
- 5 Sección Chicoral
- 6 Purgatorio 2

Late Paleocene – Early Eocene



LEYENDA		POZOS	
	Área emergida		1 ANH-San Cayetano-1
	Ambiente transicional (delta, llanuras mareales, foreshore y shoreface)		2 ANH-Piedra Blanca-1
	Ambiente marino somero (offshore-plataforma)		3 P-2 Chalan
	Ambiente marino profundo (talud-llanura abisal)		4 ANH-San Antero-1
	Abanicos deltaicos y submarinos		5 P-13 Nueva Estrella
	Abanicos aluviales, depósitos fluviales		6 P-11 San Sebastian
	Límite área de estudio		7 ANH-Moambo-1
	Dirección de aporte de sedimentos		8 ANH-La X-1
	Drenajes		9 ANH-SSJ-015-STR-S
			10 ANH-SSJ-18-STR-S
			11 ANH-SSJ-17-STR-S
			12 ANH SSJ-4A ST R S
			13 ANH SSJ-10 ST R S
			14 ANH-SSJ-La-Estrella-1X
			15 ANH SSJ-8A ST R S



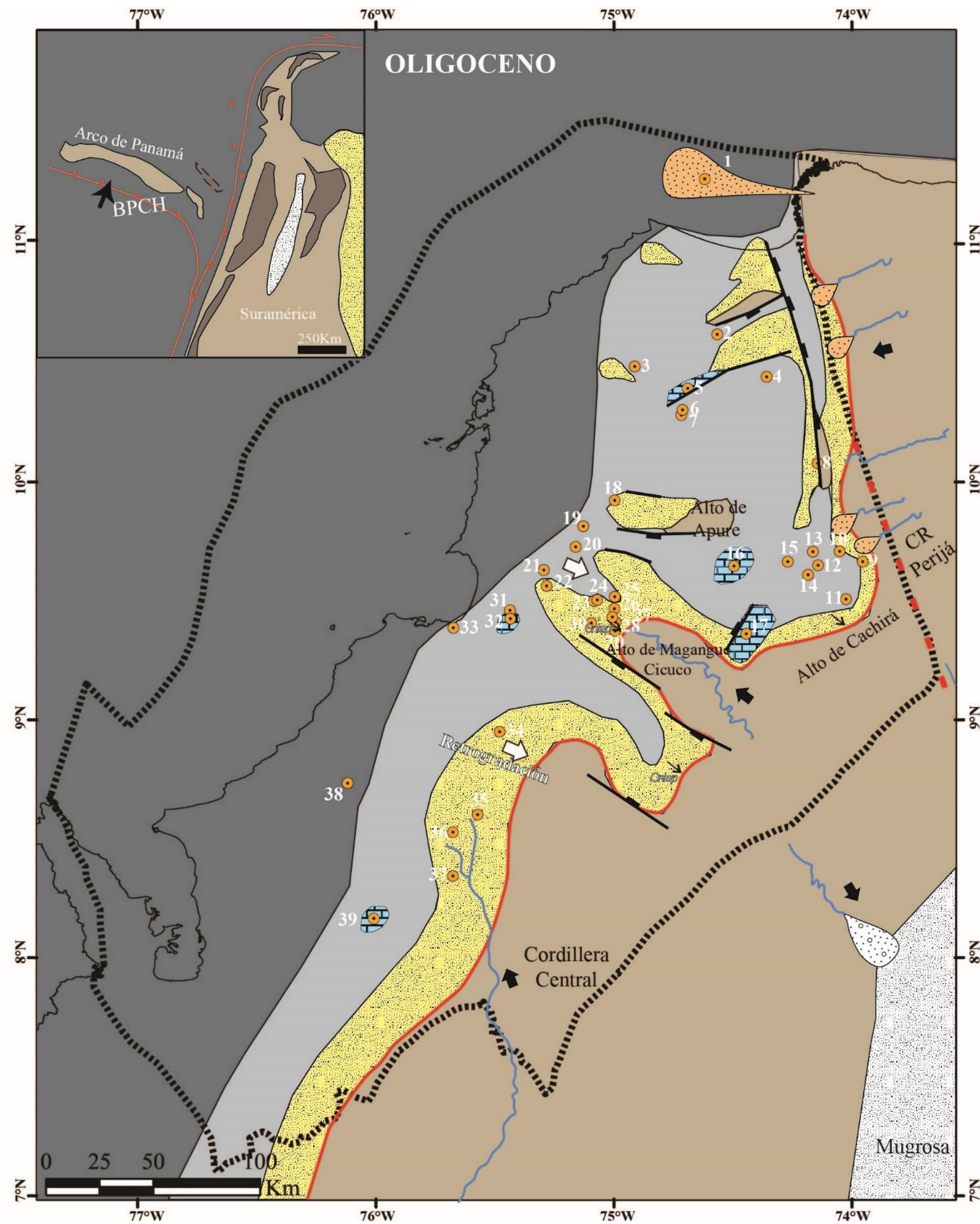
Late - Middle Eocene

LEYENDA

Área emergida	Carbonatos
Ambiente transicional (delta, llanuras mareales, foreshore y shoreface)	Ambiente marino somero (<i>offshore</i> -plataforma)
Ambiente marino profundo (talud-llanura abisal)	Abanicos deltaicos y submarinos
Abanicos aluviales, depósitos fluviales	Límite área de estudio
Dirección de aporte de sedimentos	Falla normal
Drenajes	Patrones en <i>Onlap</i> a partir de sísmica

POZOS

1 Currulao-1	10 P8(2)-Don Gabriel
2 Manati-1	11 P12-Almagra
3 Pivijay-1	12 P3-Toluviejo
4 ANH-L Cantera-1	13 P6(3)-Hacienda La Estancia
5 Balsamo-1	14 P13-Nueva Estrella
6 ANH-Plato 1-X-P	15 Claro-1
7 ANH-San Jacinto-1	16 ANH-SSJ-La Estrella 1-X
8 P7-Arroyo Arena	17 ANH-Tierra Alta 2X
9 P5-Caracolí	18 ANH-San Cayetano-1
	19 ANH-Moambo-1X



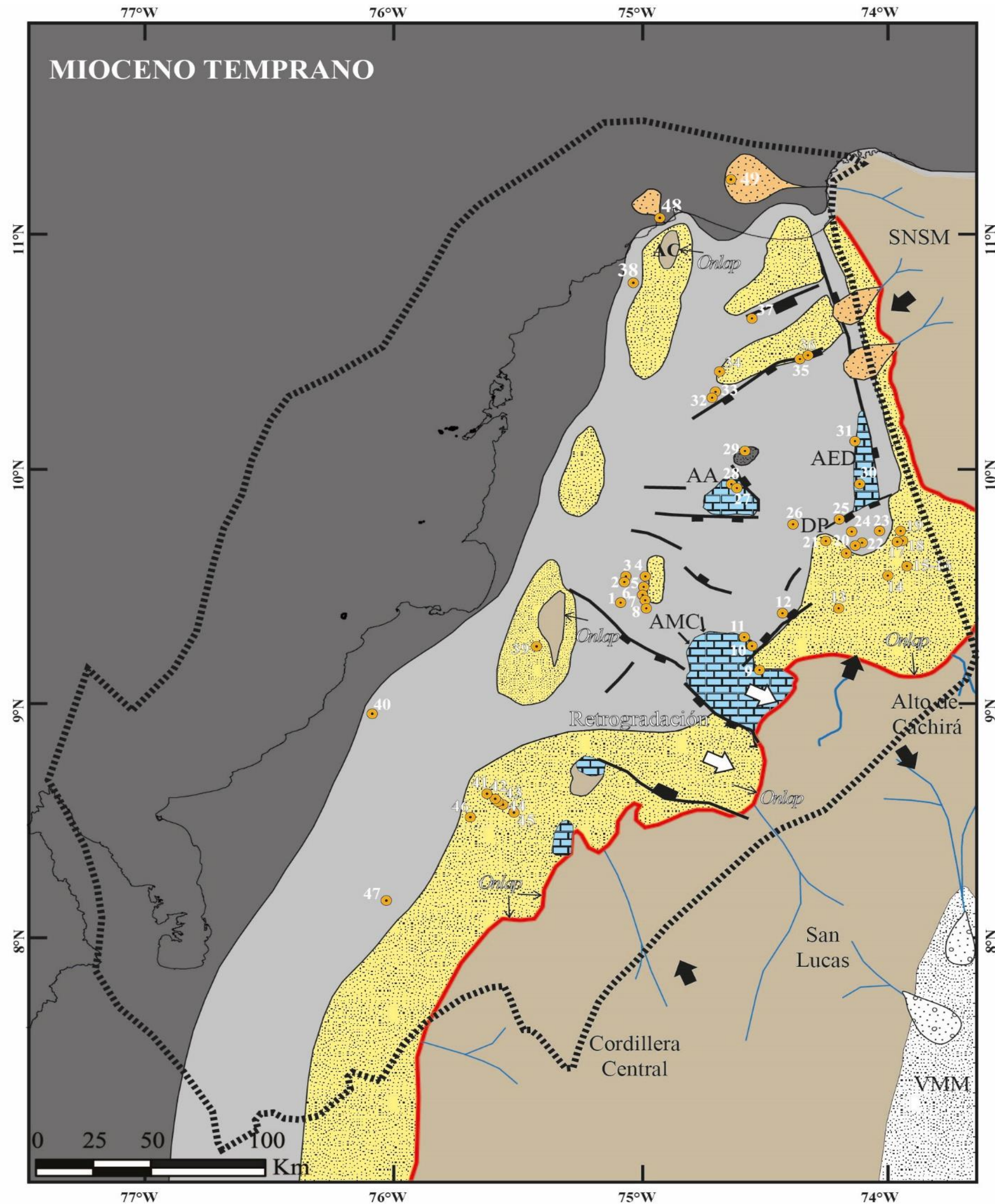
Oligocene

LEYENDA

Área emergida	Carbonatos
Ambiente transicional (delta, llanuras mareales, foreshore y shoreface)	
Ambiente marino somero (offshore-plataforma)	
Ambiente marino profundo (talud-llanura abisal)	
Abanicos deltaicos y submarinos	
Abanicos aluviales, depósitos fluviales	
Límite área de estudio	Falla normal
Dirección de aporte de sedimentos	Patrones en Onlap a partir de sísmica
Drenajes	

POZOS

● 1 Araza-1	● 16 Pinto-1	● 31 ANH-Costa Azul-1
● 2 Buena vista-1	● 17 Pijino-1	● 32 P3-Toluviejo
● 3 Manatí-1	● 18 Saman Est-1	● 33 P10-Torrente
● 4 Piñuela-1	● 19 ANH-San jacinto-1	● 34 Sahagun-1
● 5 Pivijay-1	● 20 P7-Arroyo Arena	● 35 P15-El Contento
● 6 Danta-1	● 21 P8(2)-Don Gabriel	● 36 ANH-Nueva Esperanza-1
● 7 Balsamo-1	● 22 P12-Almagra	● 37 ANH-SSJ-La Estrella-1X
● 8 San Angel-6	● 23 Mamey-1	● 38 La Mora-1 ANH-Tierra
● 9 La Florida-1	● 24 Bonga-1	● 39 Alta-2X
● 10 El Castillo-1	● 25 Piragua-1	
● 11 El Retiro-1	● 26 Ayombe-1	
● 12 Cotorra-1X	● 27 Güepaje-2	
● 13 Guamito-1	● 28 Güepaje-1	
● 14 Ligia-1	● 29 Güepaje-3	
● 15 ANH-Plato 1X-P	● 30 La Creciente-1	



Early Miocene

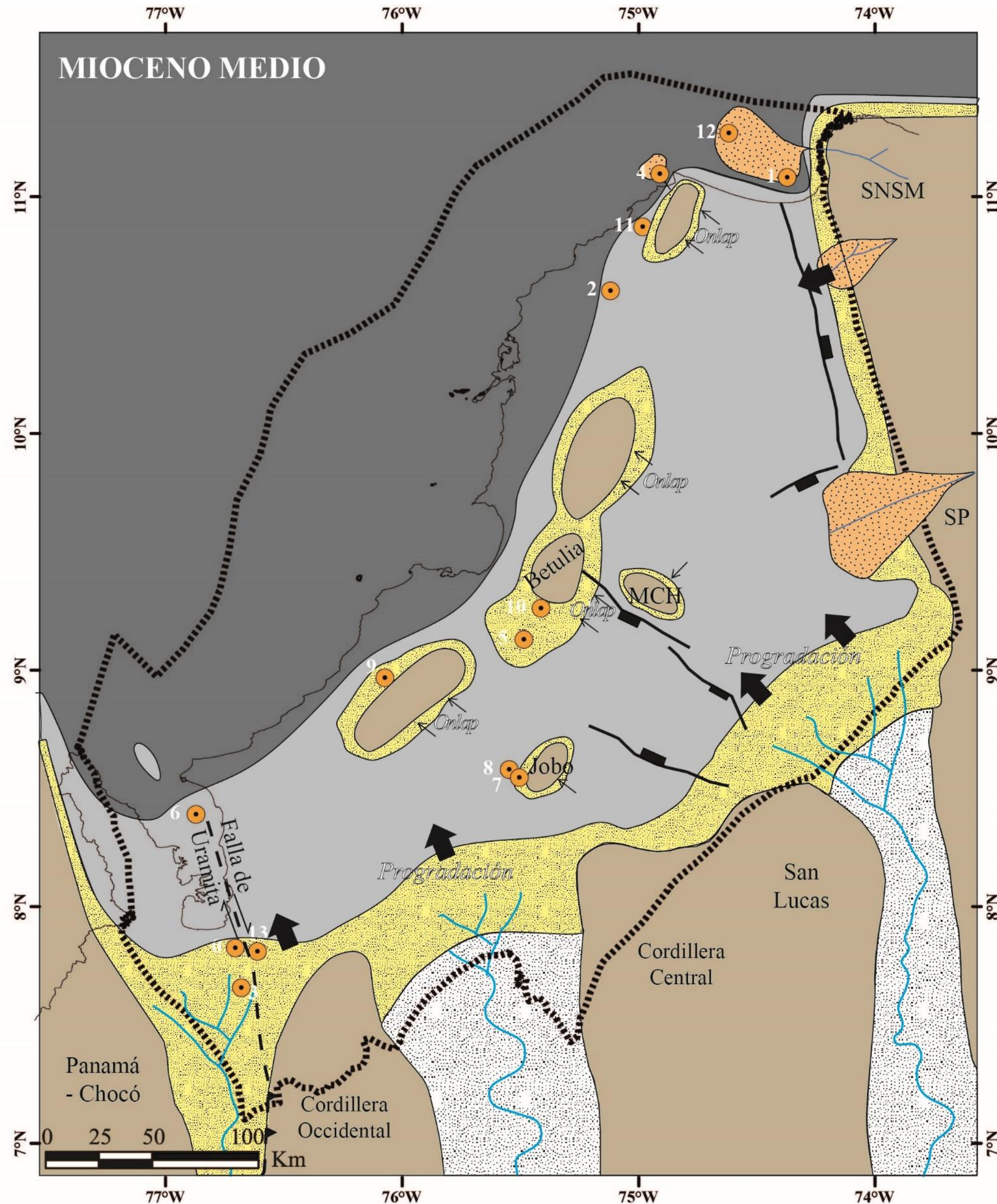
LEYENDA

- | | |
|---|--|
| Área emergida | Carbonatos |
| Ambiente transicional (delta, llanuras mareales, foreshore y shoreface) | |
| Ambiente marino somero (<i>offshore</i> -plataforma) | |
| Ambiente marino profundo (talud-llanura abisal) | |
| Abanicos deltaicos y submarinos | |
| Abanicos aluviales, depósitos fluviales | |
| Límite área de estudio | Falla normal |
| Dirección de aporte de sedimentos | Falla inversa |
| Drenajes | Patrones en <i>Onlap</i> a partir de sísmica |

POZOS

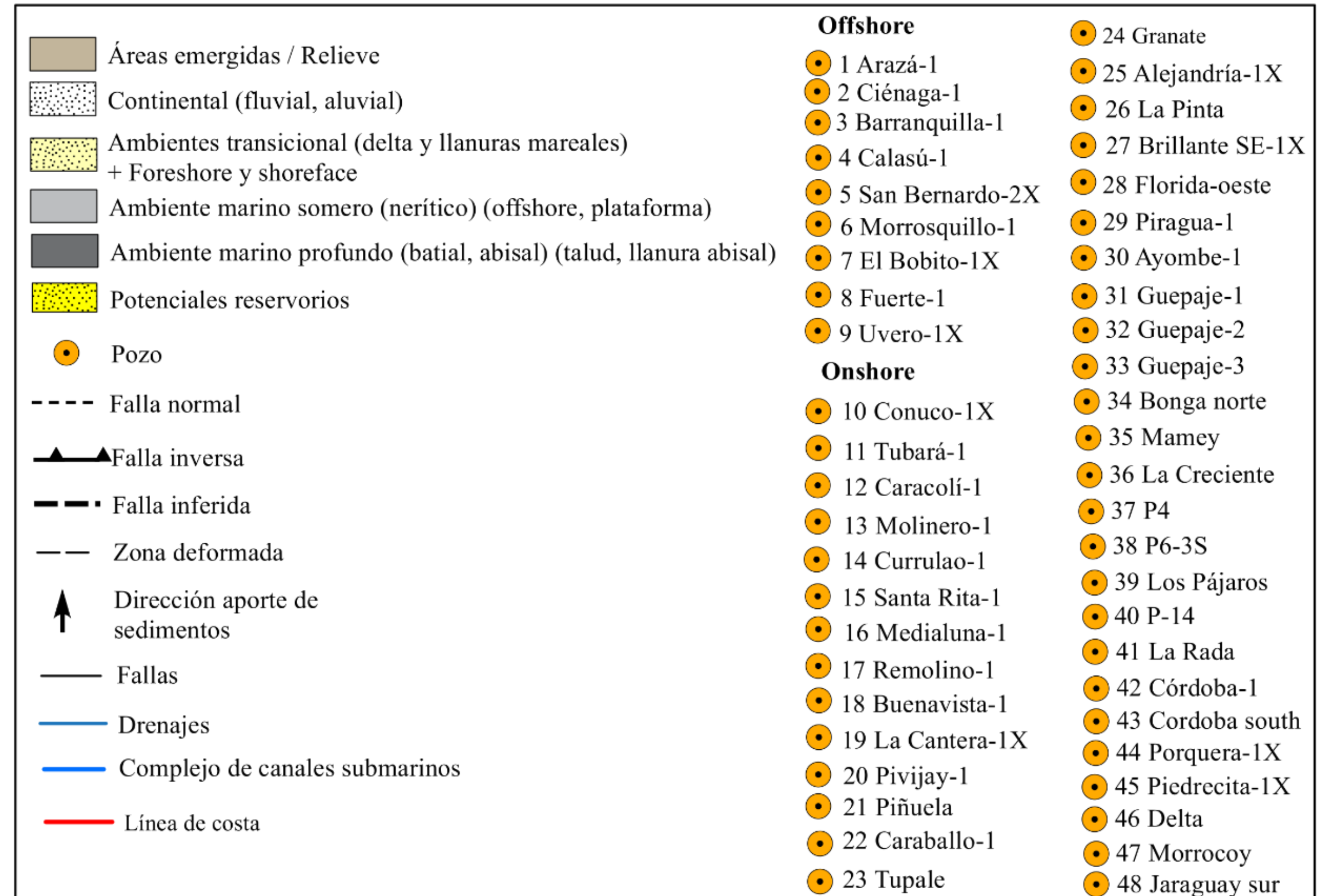
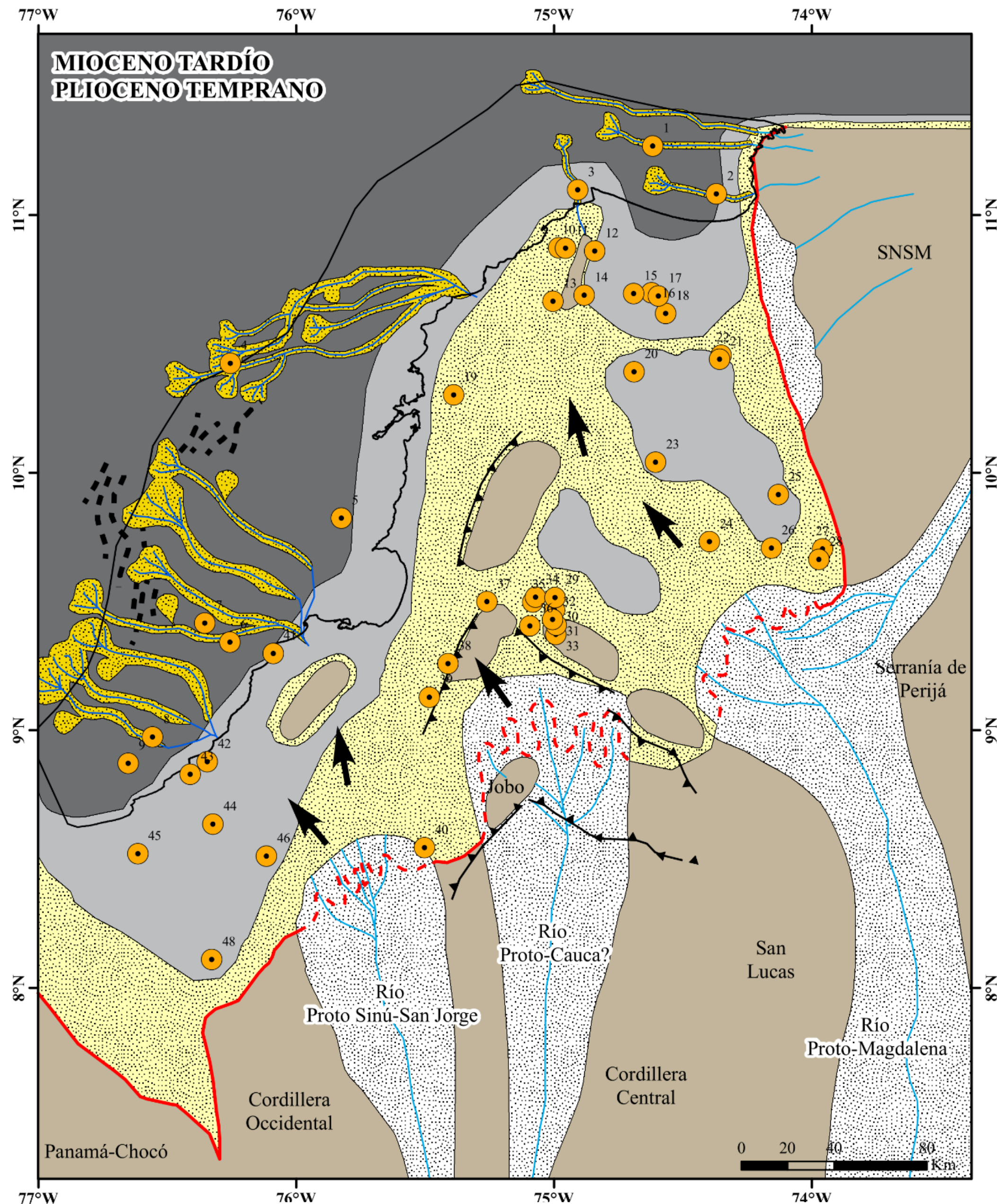
- | | | |
|--------------------|----------------------------|-------------------------------|
| ● 1 La Creciente-1 | ● 16 Arjona-6 | ● 31 San Angel-6 |
| ● 2 Mamey-2 | ● 17 Florida Oeste-1 | ● 32 Bálsamo |
| ● 3 Bonga Norte-1 | ● 18 La Florida-1 | ● 33 Danta-1 |
| ● 4 Piragüa-1 | ● 19 Brillante SE-1X | ● 34 Pivijay-1 |
| ● 5 Ayombe-1 | ● 20 Ligia-1 | ● 35 Piñuela-1 |
| ● 6 Guepajé-1 | ● 21 ANH-Plato-1-X-P | ● 36 Caraballo-1 |
| ● 7 Guepajé-2 | ● 22 Capure-1X, Cotorra-1X | ● 37 Buenavista-1 |
| ● 8 Guepajé-3 | ● 23 El Castillo-1 | ● 38 ANH-Juan de Acosta-1 |
| ● 9 Boquilla-1 | ● 24 Guamito-1 | ● 39 P6-3S |
| ● 10 Boquete-2 | ● 25 Costa Rica-1 | ● 40 P-28 |
| ● 11 Cicuco-22 | ● 26 Granate-1 | ● 41 P-27 |
| ● 12 Pijñio-1 | ● 27 Apure-1 | ● 42 P-26 |
| ● 13 Buena Fe-1 | ● 28 Apure-2 | ● 43 P-18 ● 48 Barranquilla-1 |
| ● 14 El Retiro-1 | ● 29 Tupale-1 | ● 44 P-15 ● 49 Arazá-1 |
| ● 15 Arjona-1 | ● 30 Alejandría-1 | ● 45 P-14 |
| | | ● 46 ANH-Nueva Esperanza-1 |
| | | ● 47 ANH-Tierralta-2-X-P |

Middle Miocene

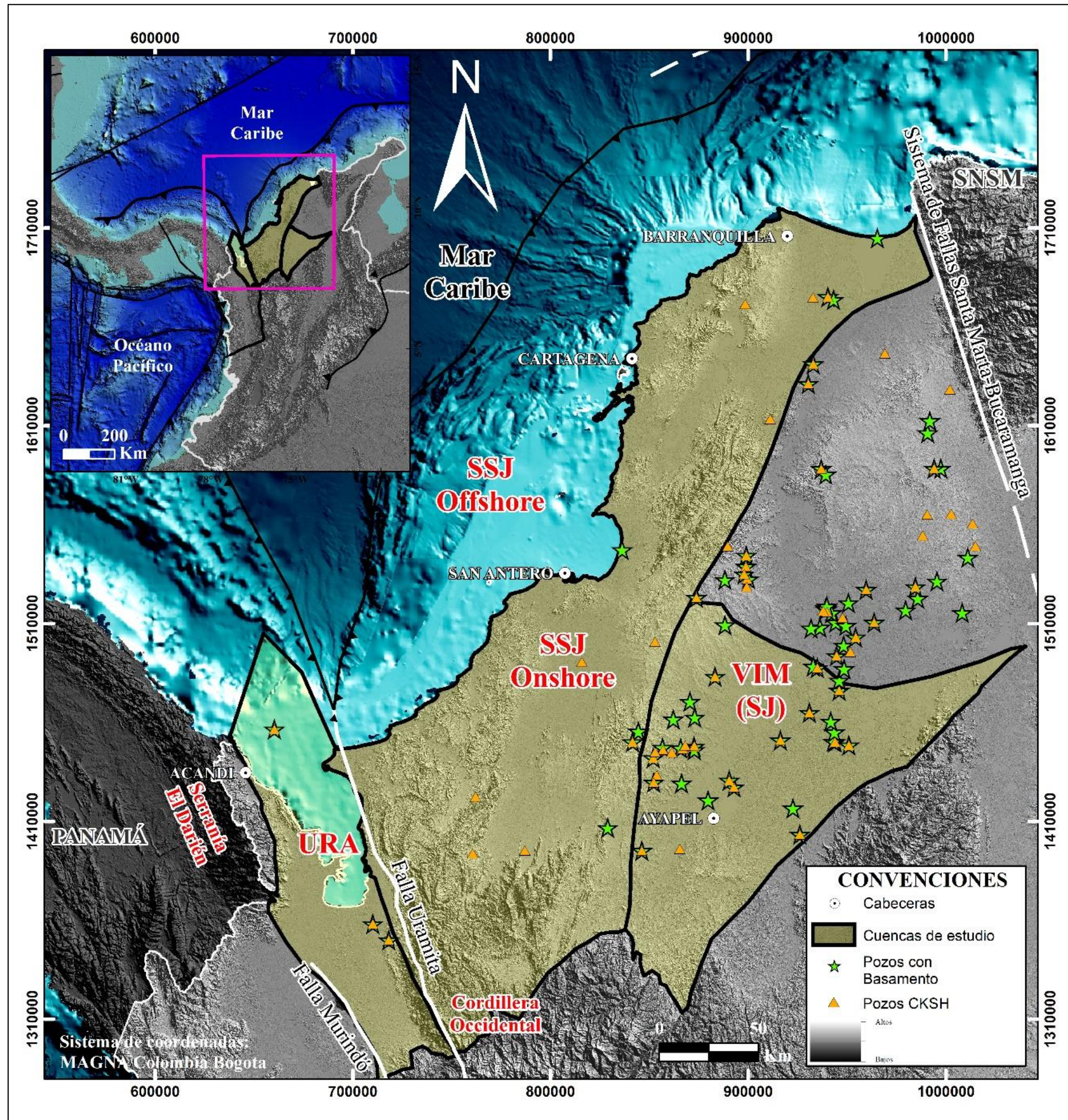


LEYENDA		POZOS	
Área emergida	Carbonatos	0 Apartadó-1	7 P-14 El Varal
Ambiente transicional (delta, llanuras mareales, foreshore y shoreface)	Ambiente marino somero (<i>offshore</i> -plataforma)	1 Ciénaga-1	8 P-18 Finca Villa Laura
Ambiente marino profundo (talud-llanura abisal)	Abanicos deltaicos y submarinos	2 ANH El Pabilo-1	9 P-28 Finca Villa Hermosa
Abanicos aluviales, depósitos fluviales	Falla normal	3 Urabá-1	10 P6-3S Hacienda La Estancia
Límite área de estudio	Falla inversa	4 Barranquilla-1	11 ANH Conuco-1
Dirección de aporte de sedimentos	Falla inferida	5 ANH Los Pájaros-1	12 Arazá-1
Drenajes	Patrones en <i>Onlap</i> a partir de sísmica	6 Urabá 1629-1X	13 Turbo-1

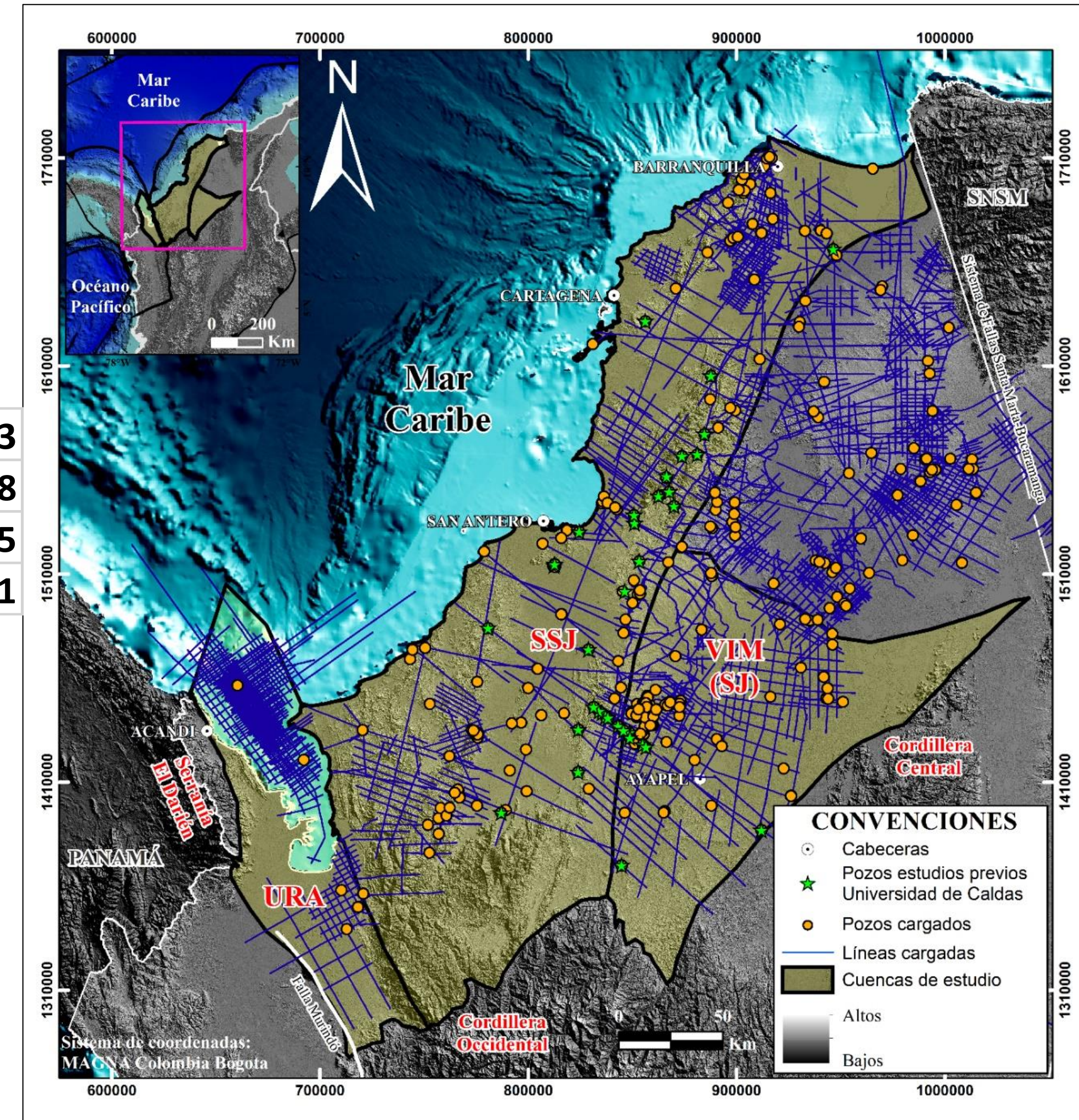
Late Miocene – Early Pliocene



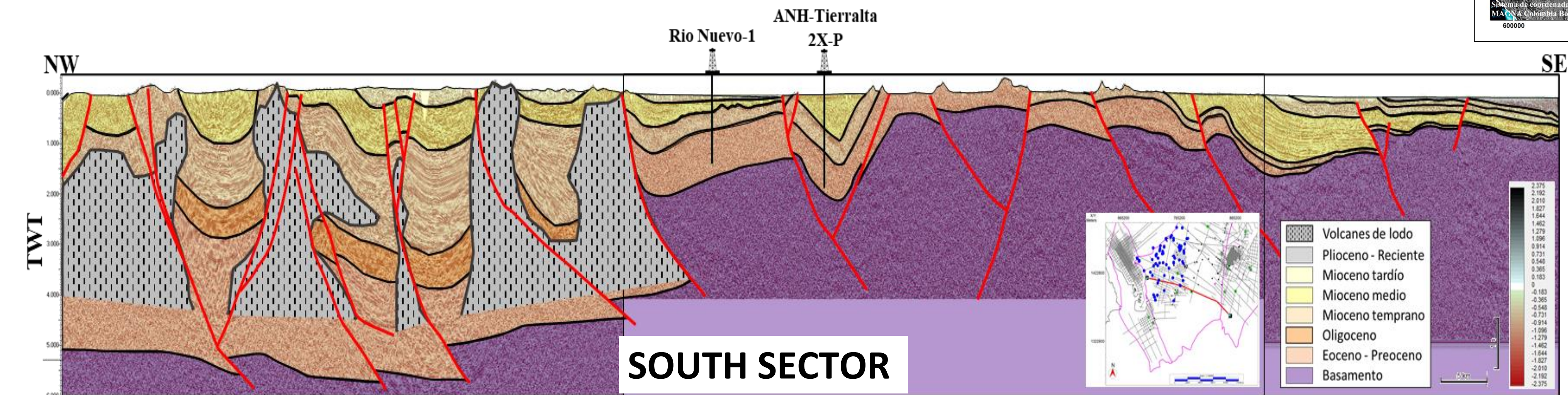
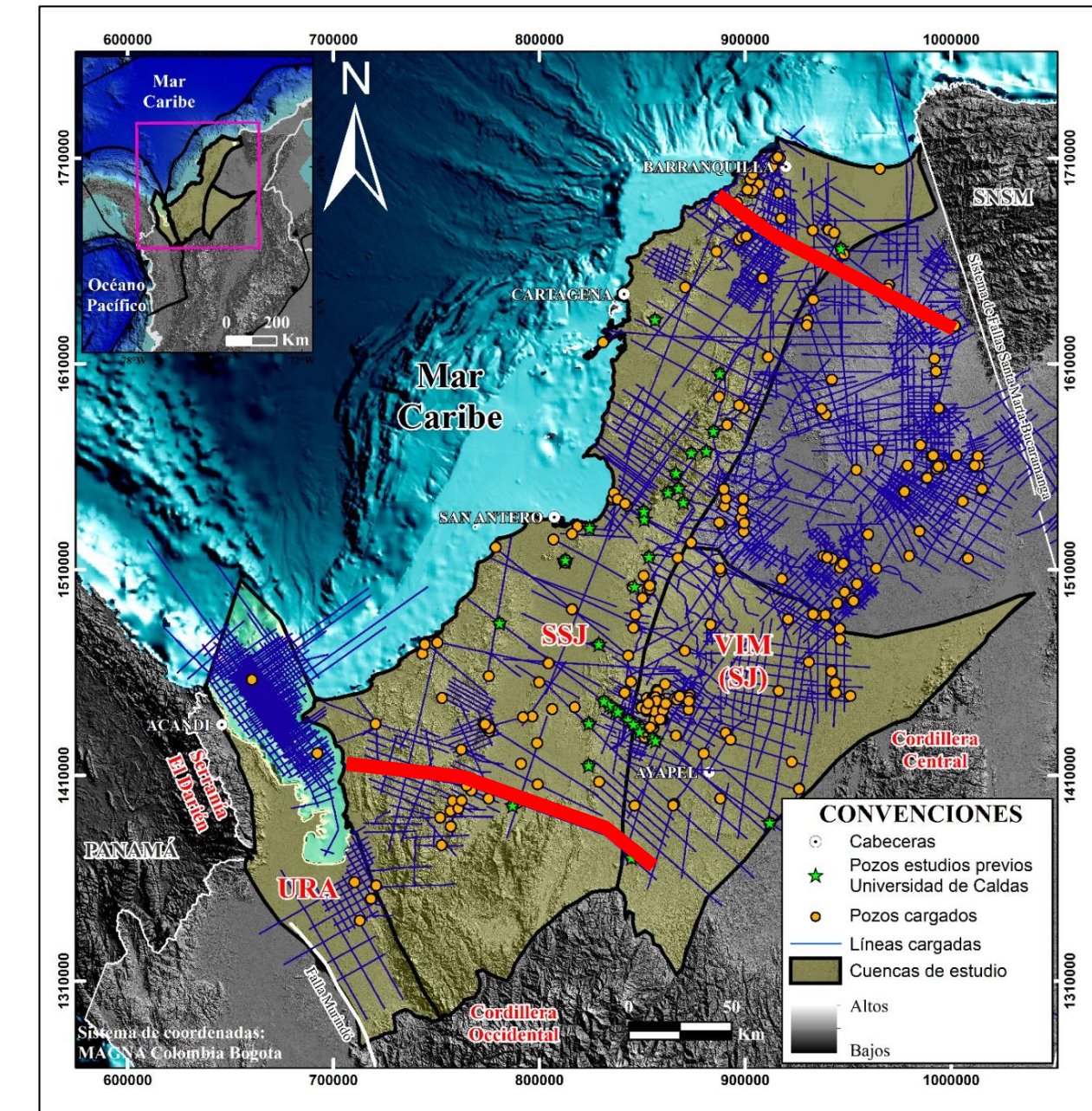
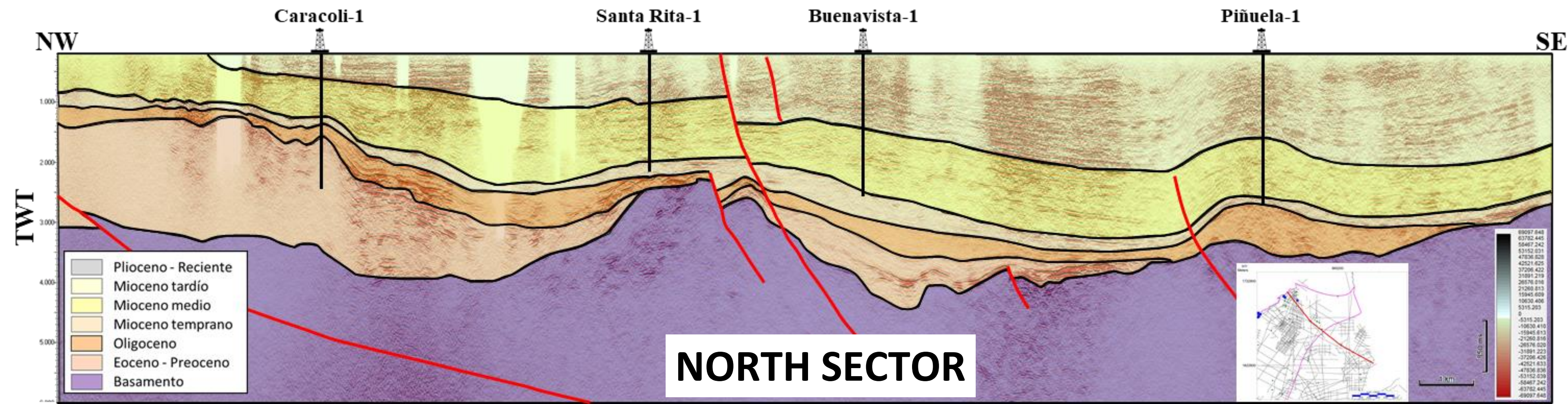
GEOLOGICAL AND GEOPHYSICAL DATA



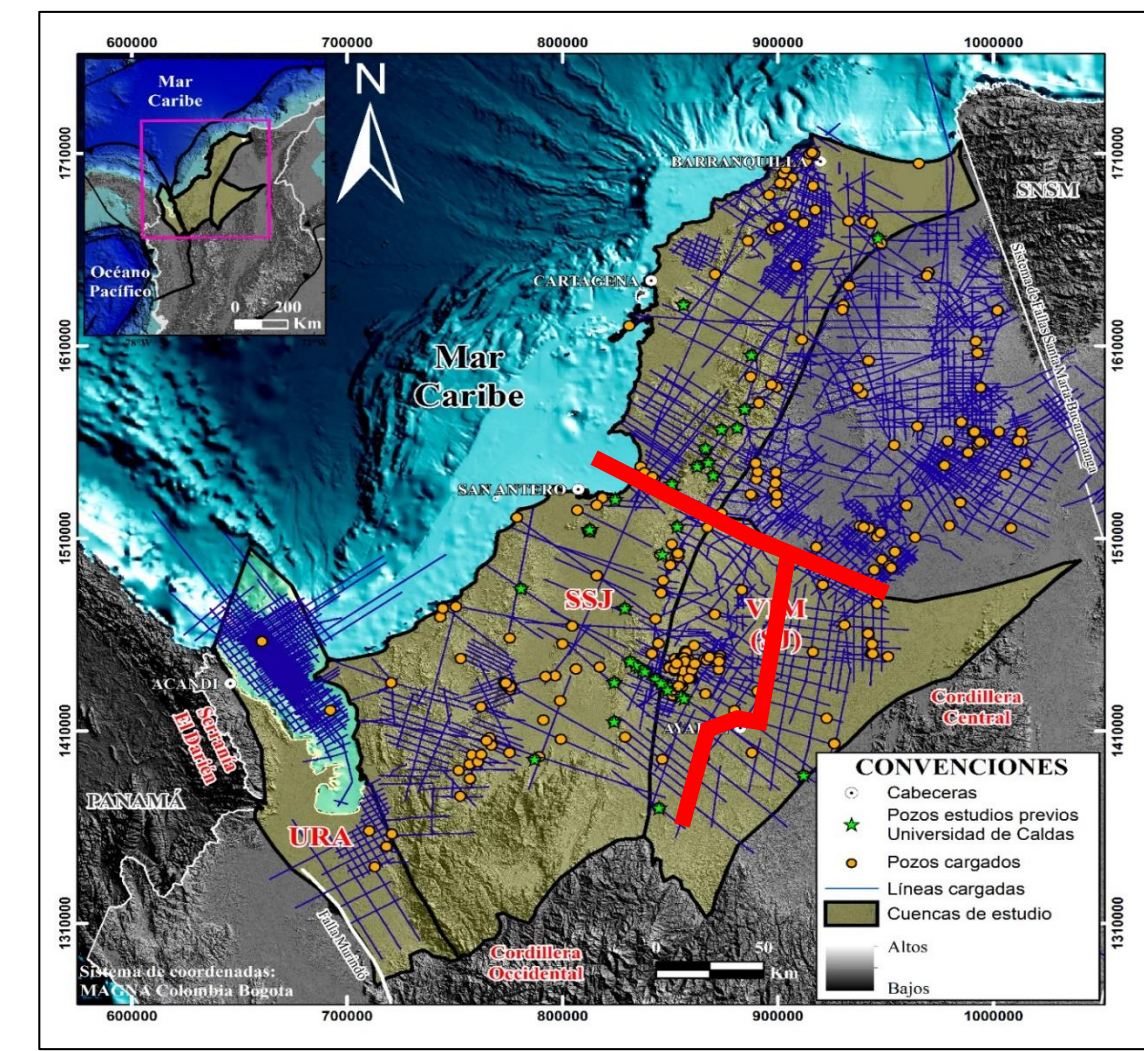
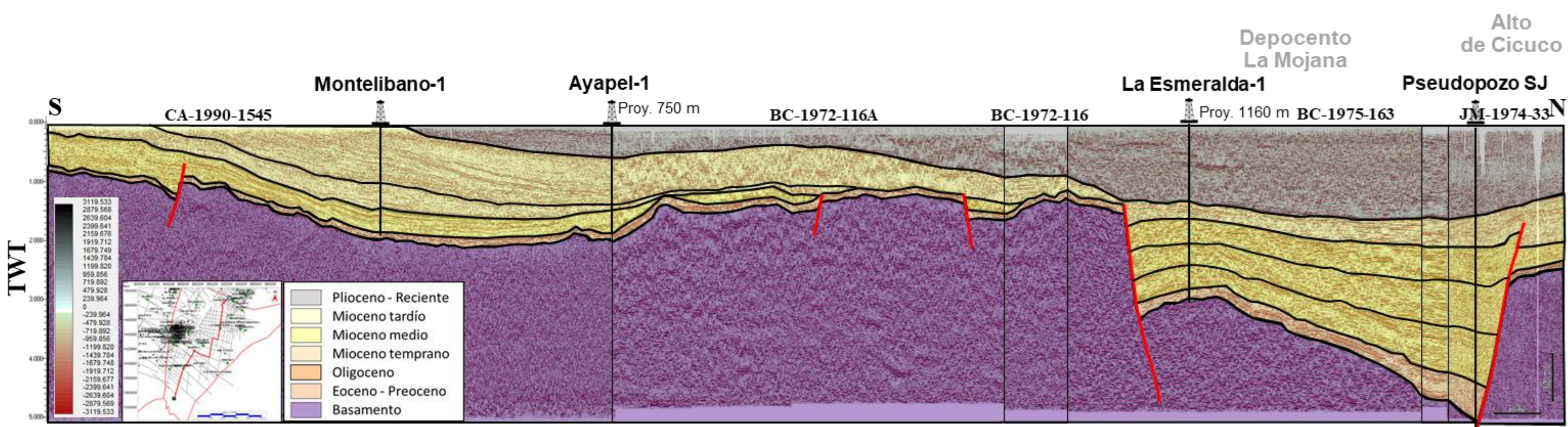
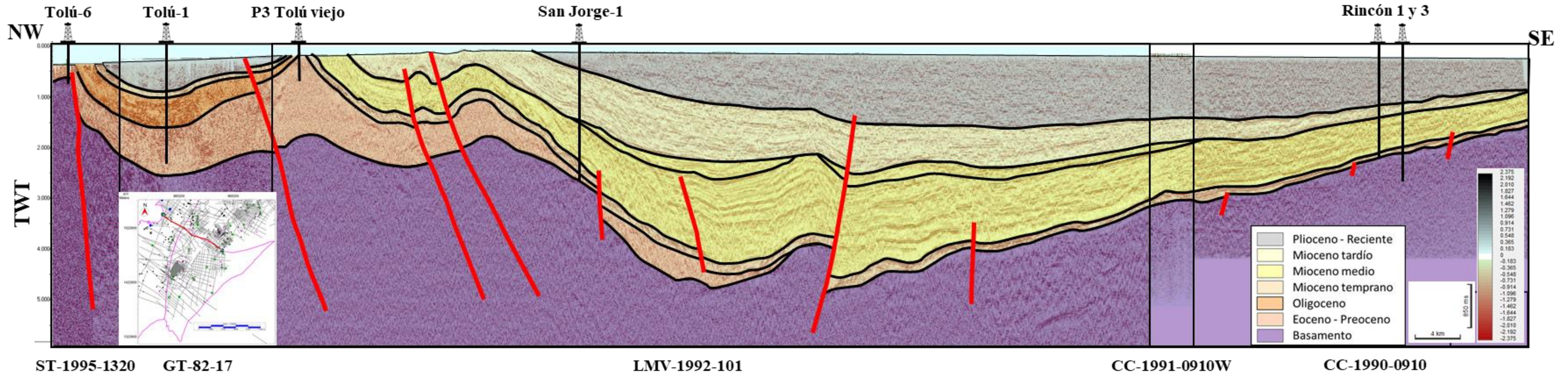
2D SEISMIC	17,783
3D SEISMIC SQ KM	2,188
TOTAL WELLS	295
WELLS W/ CHECK SHOTS	61



SINÚ – SAN JACINTO BASIN

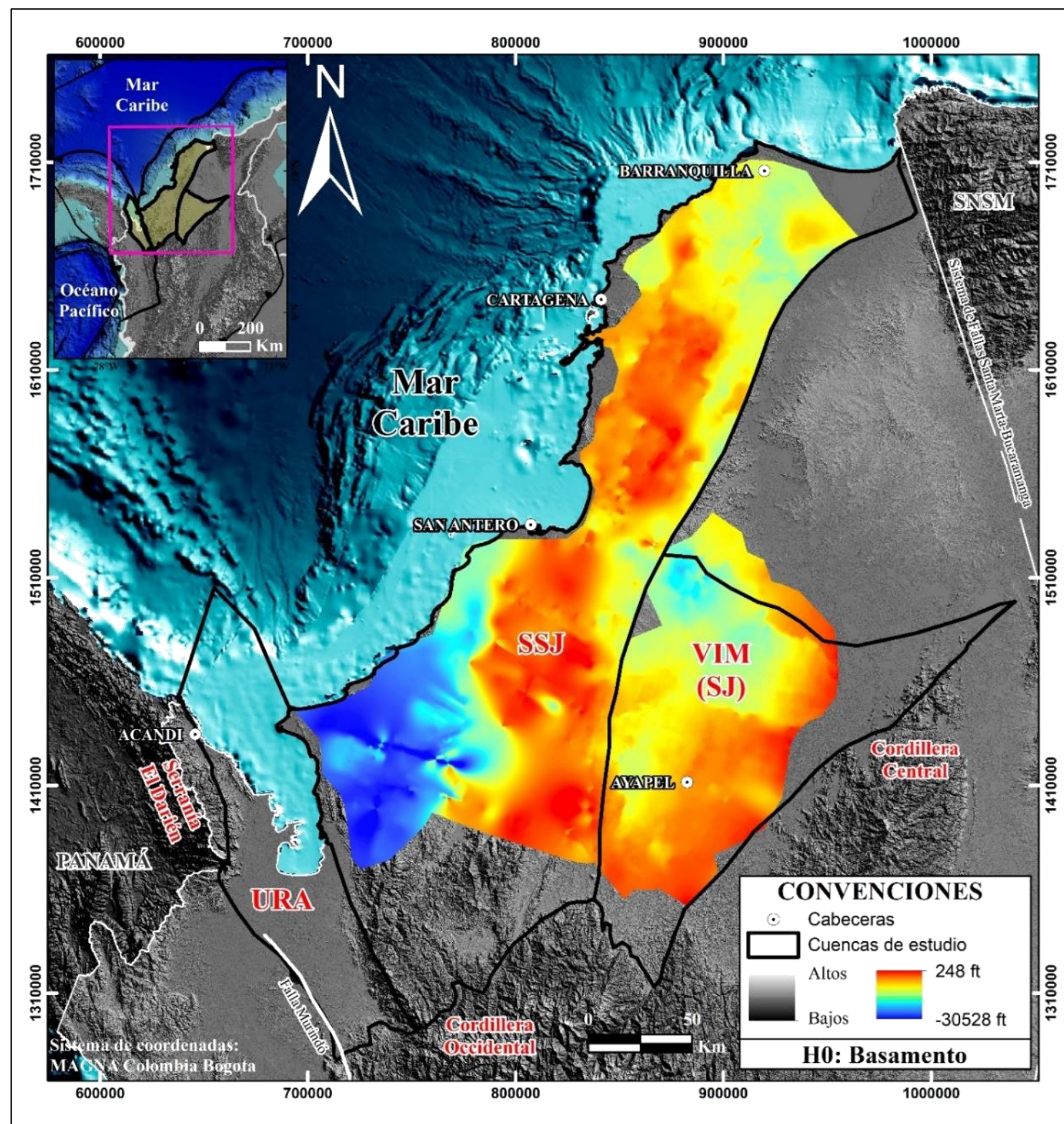


SAN JORGE SUB BASIN

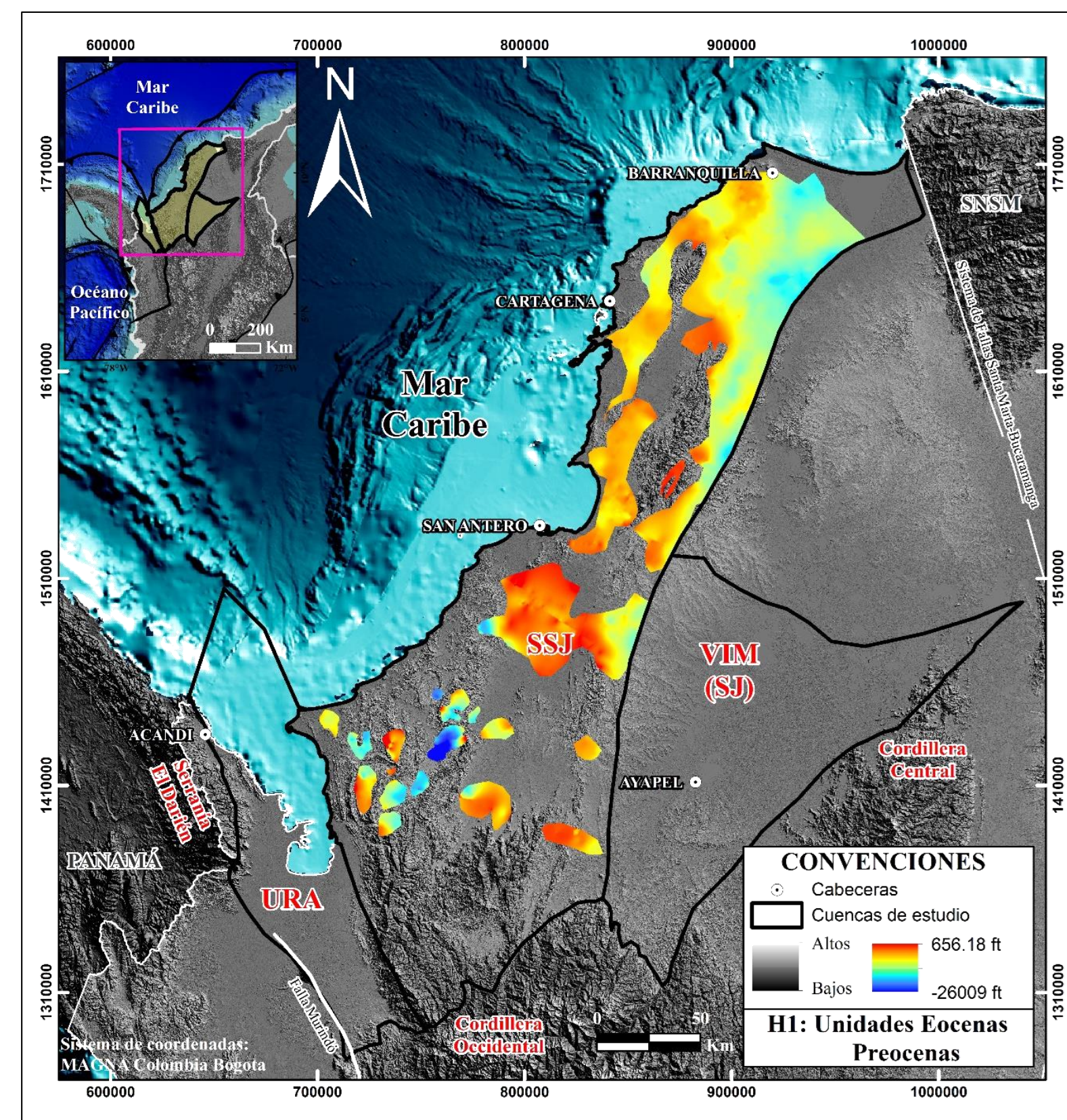


STRUCTURAL MAPS

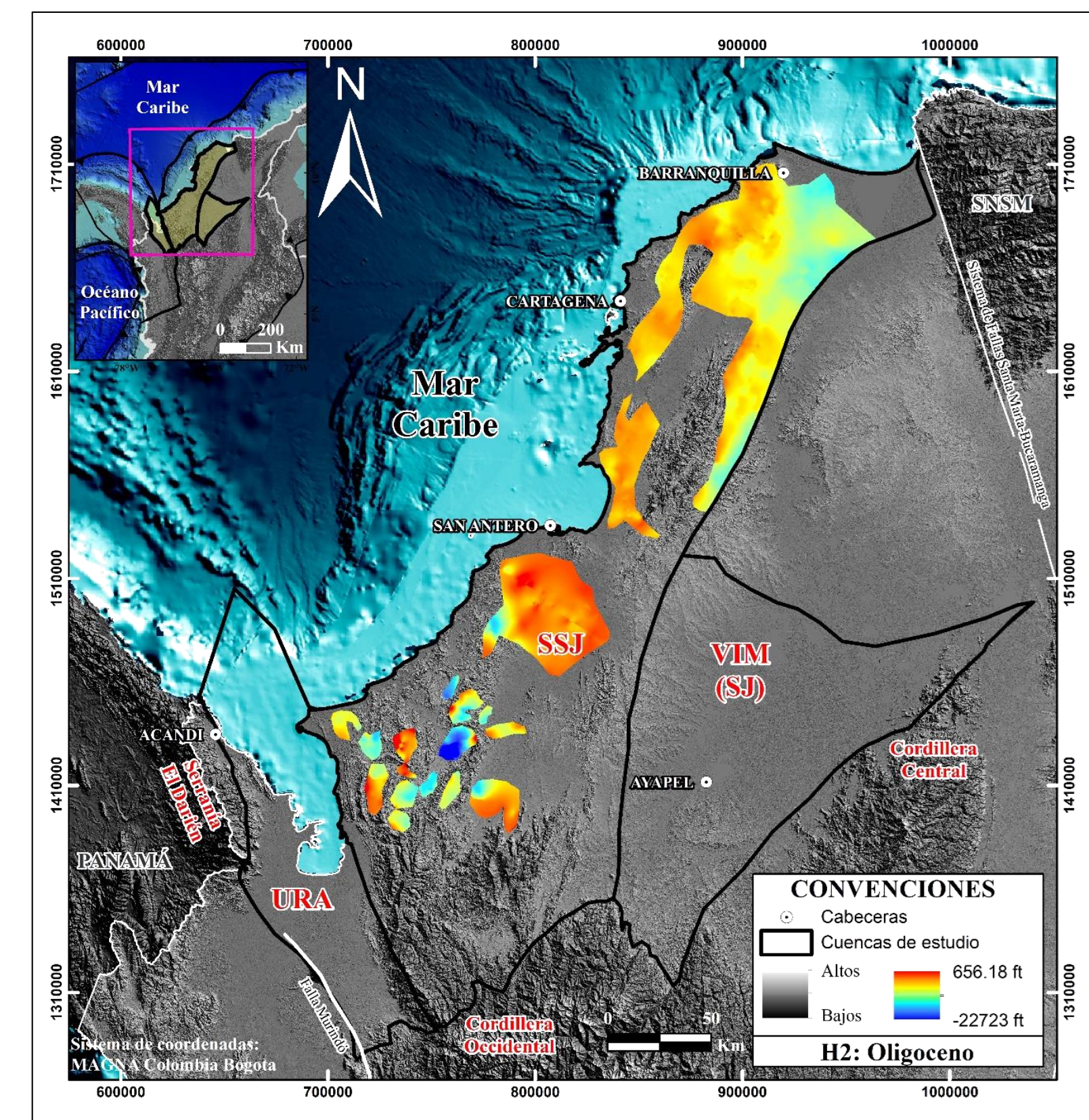
SINÚ – SAN JACINTO BASIN AND SAN JORGE SUB BASIN



BASEMENT (H0)



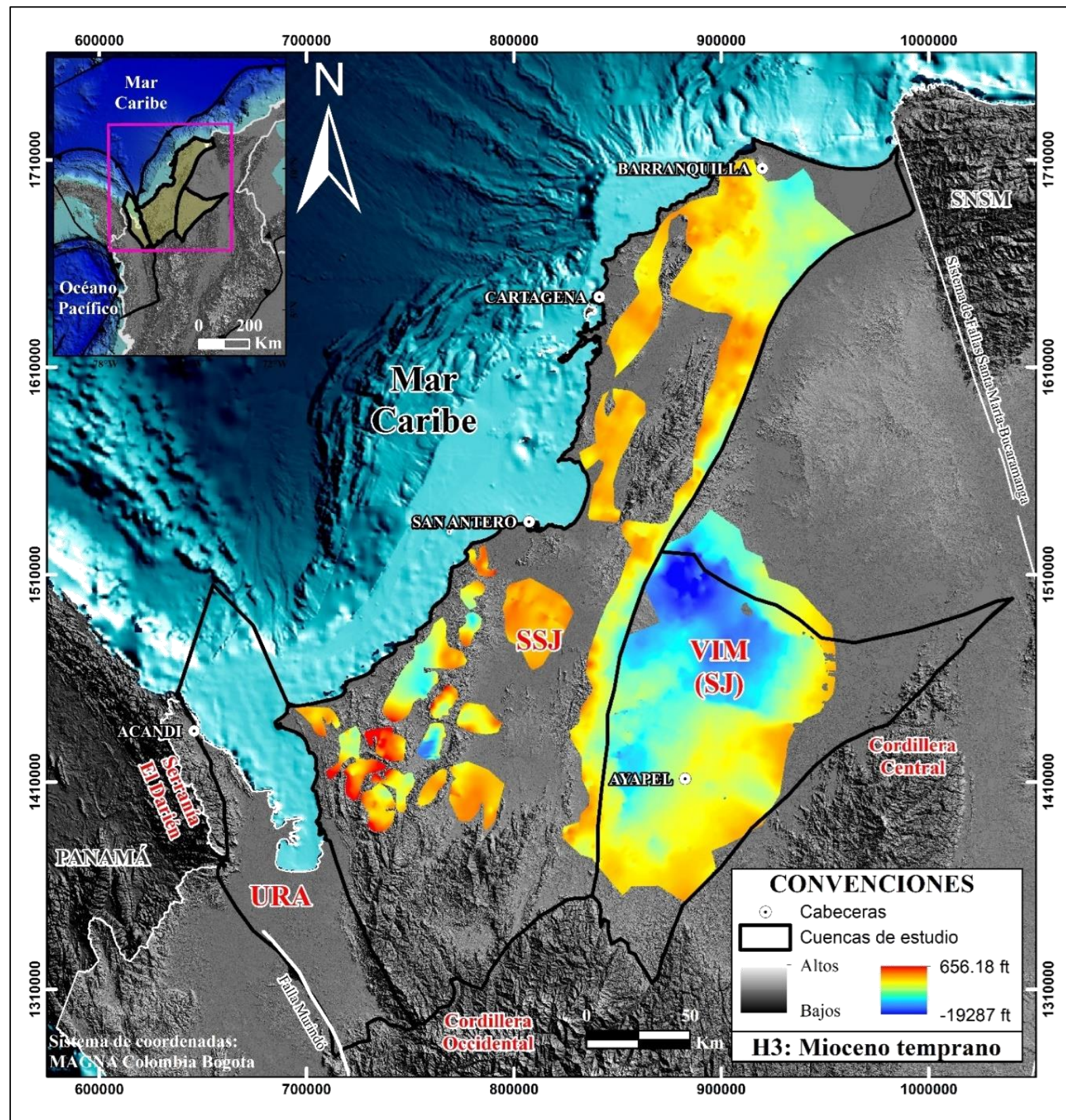
PALEOCE-EOCENE (H1)



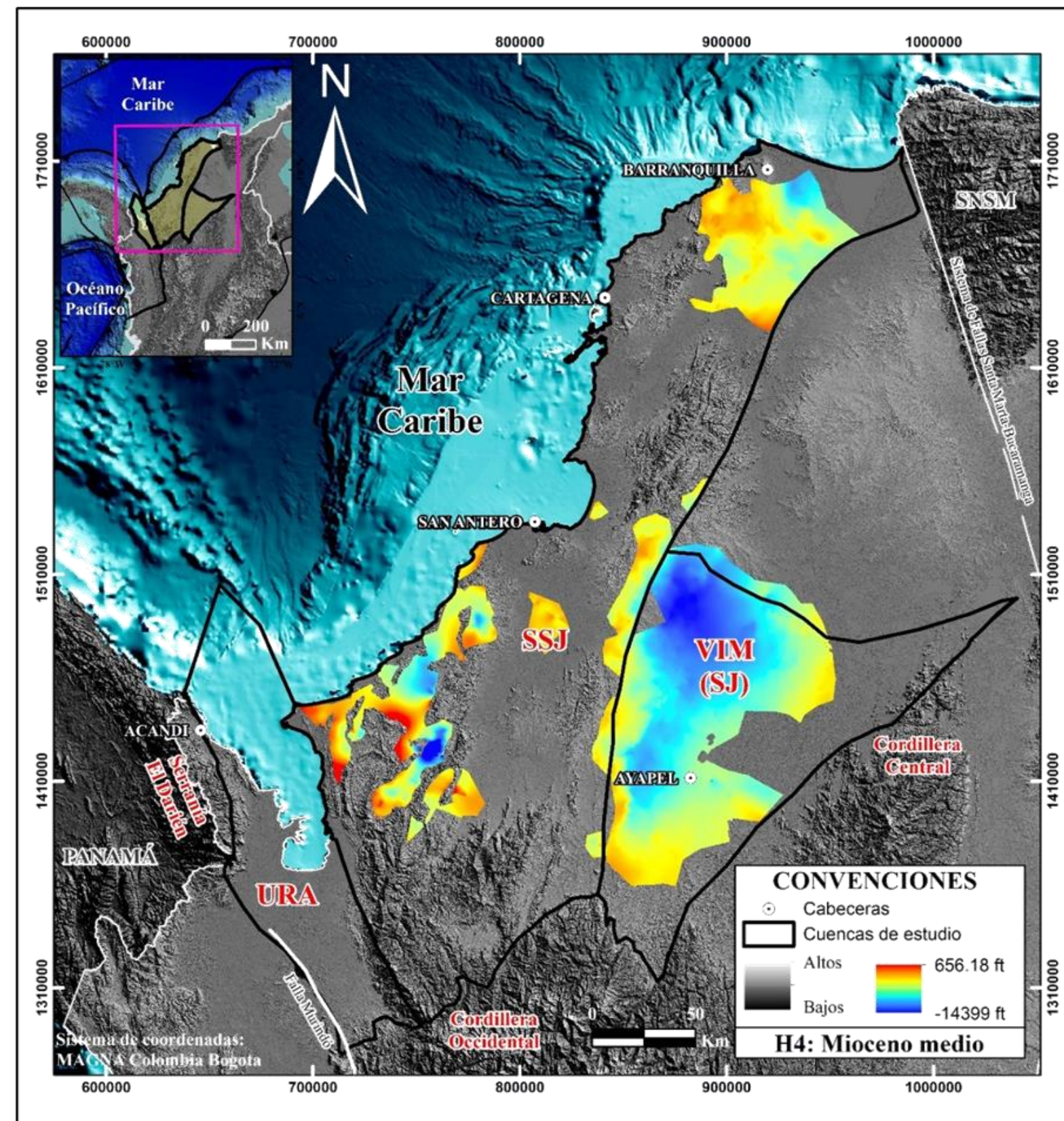
OLIGOCENE (H2)

STRUCTURAL MAPS

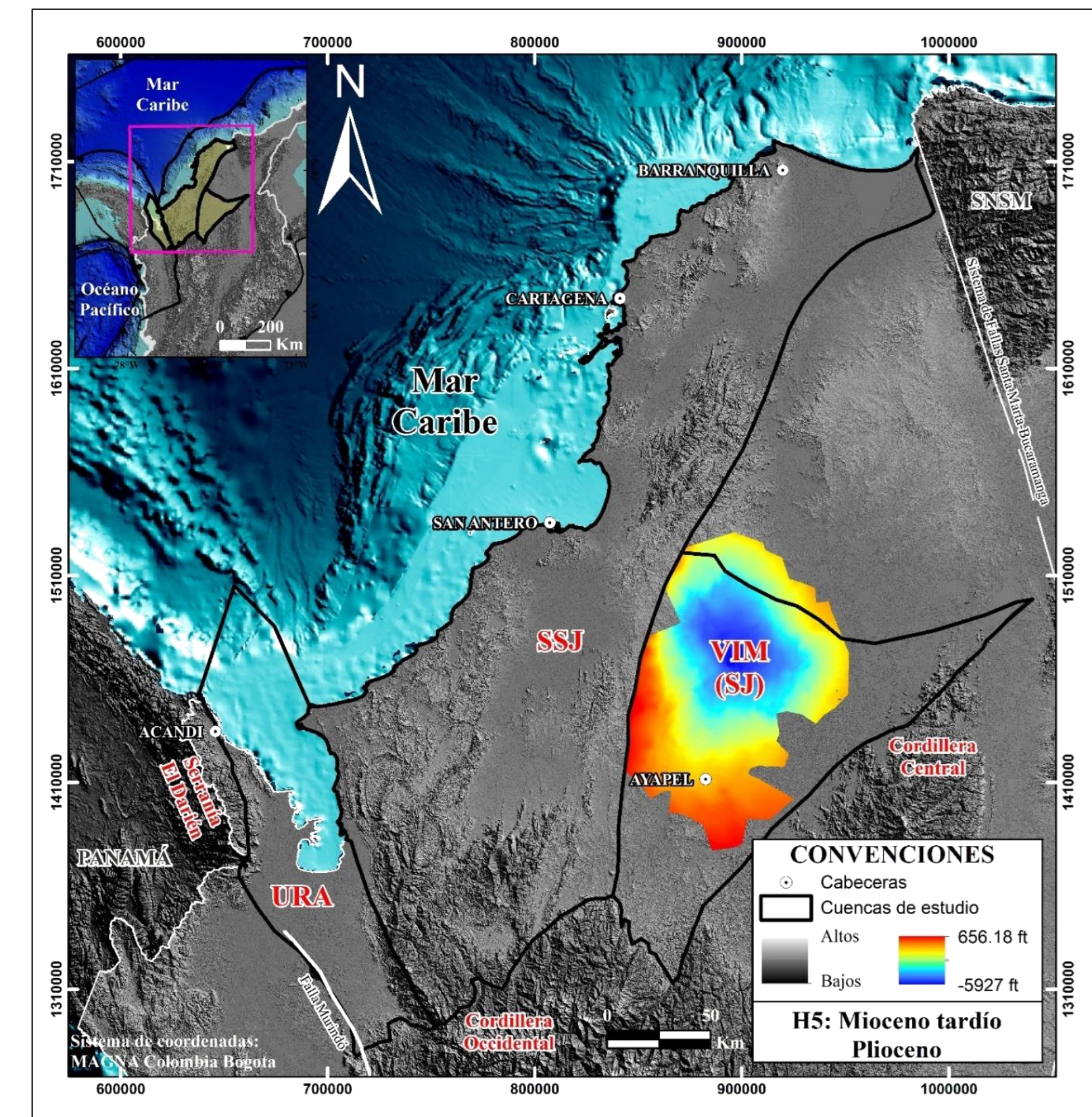
SINÚ – SAN JACINTO BASIN AND SAN JORGE SUB BASIN



OLIGOCENE – EARLY MIOCENE (H3)

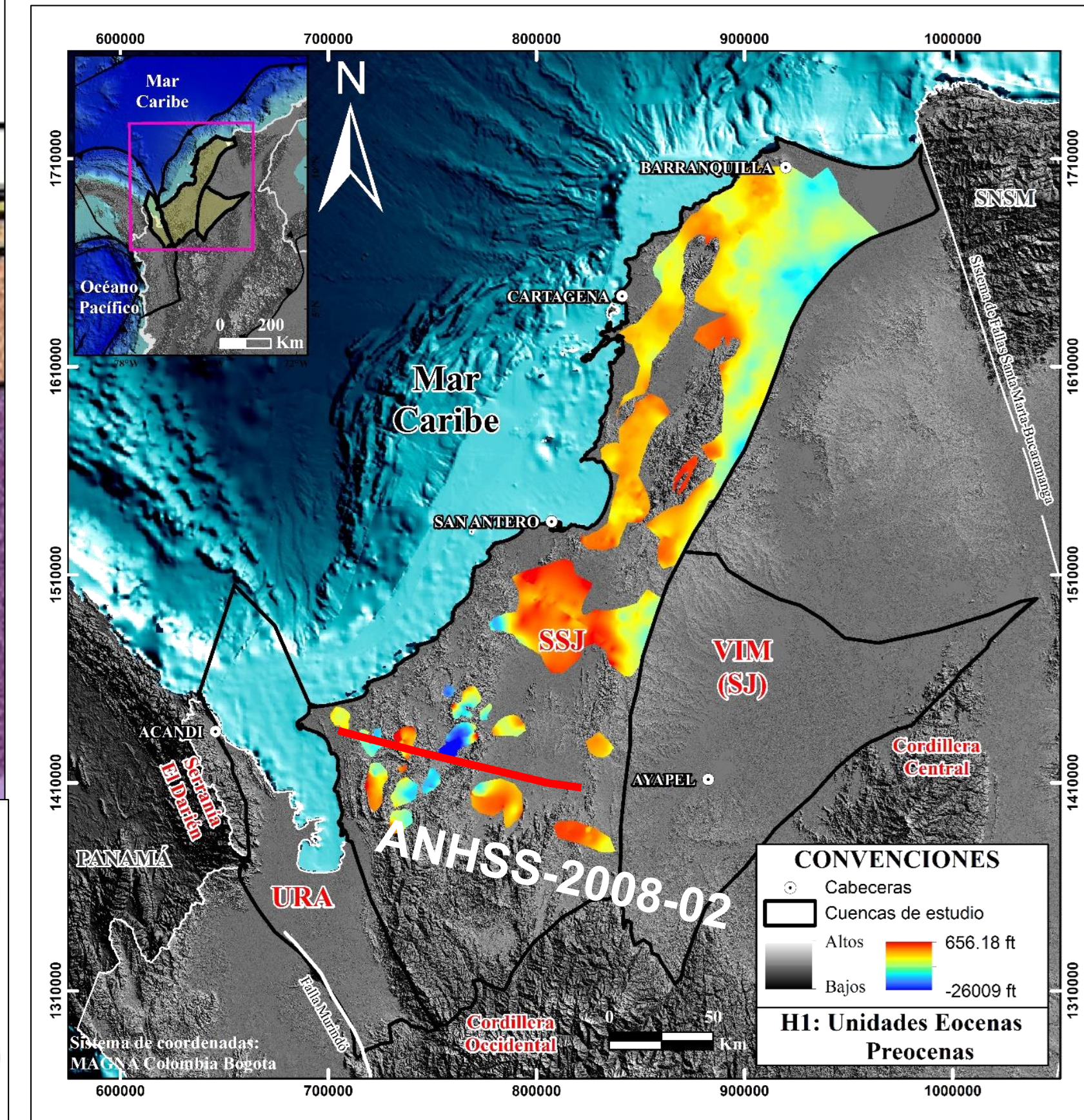
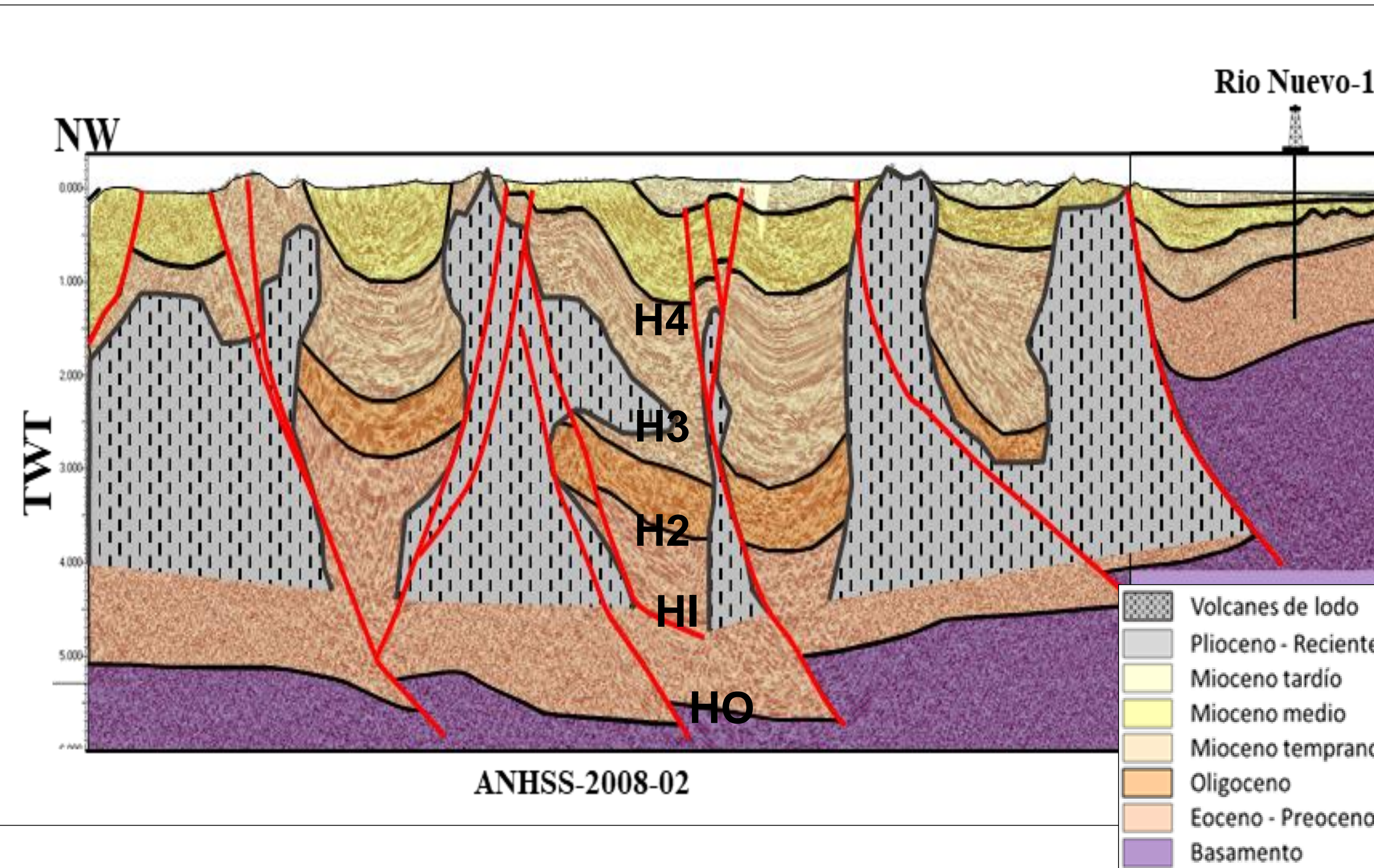


MIDDLE MIOCENE (H4)



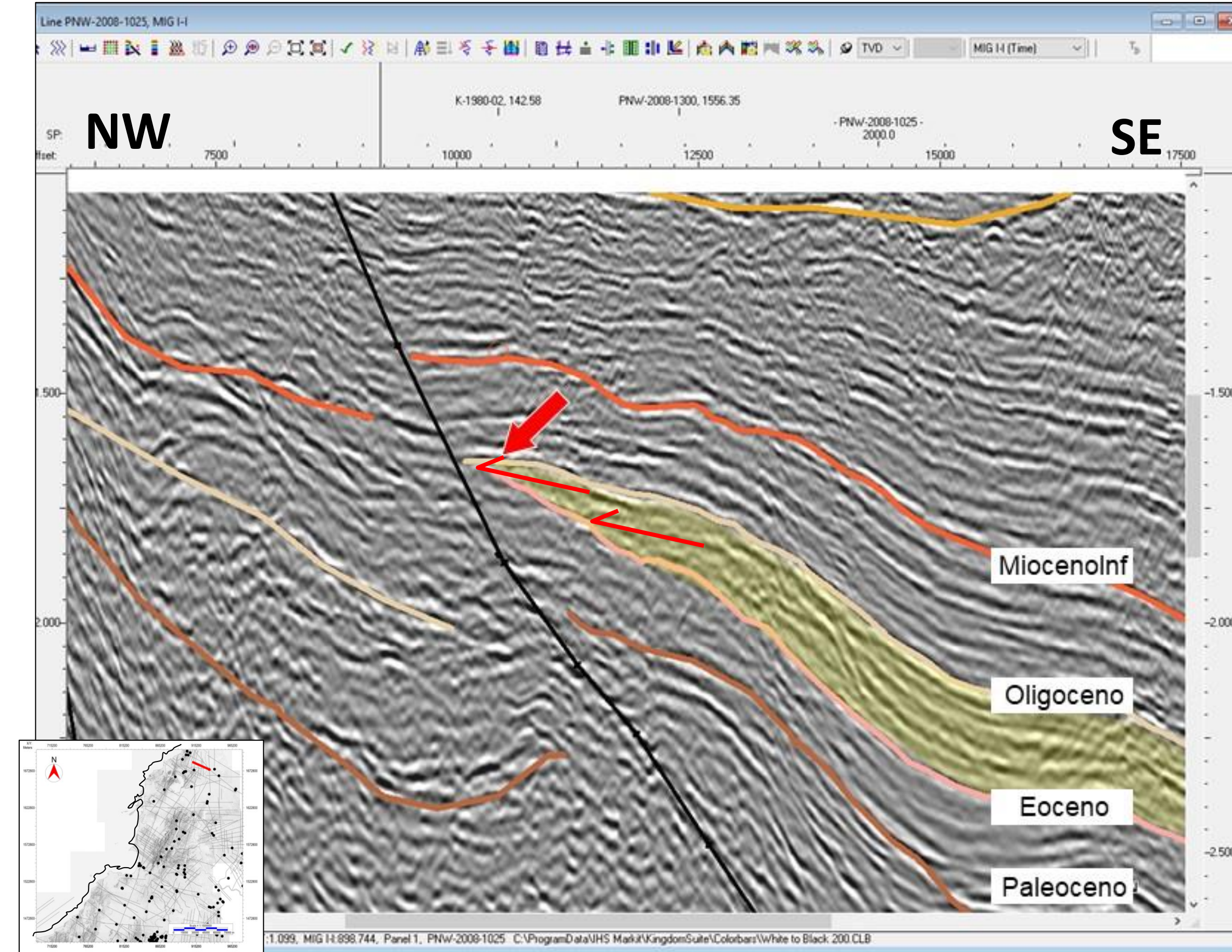
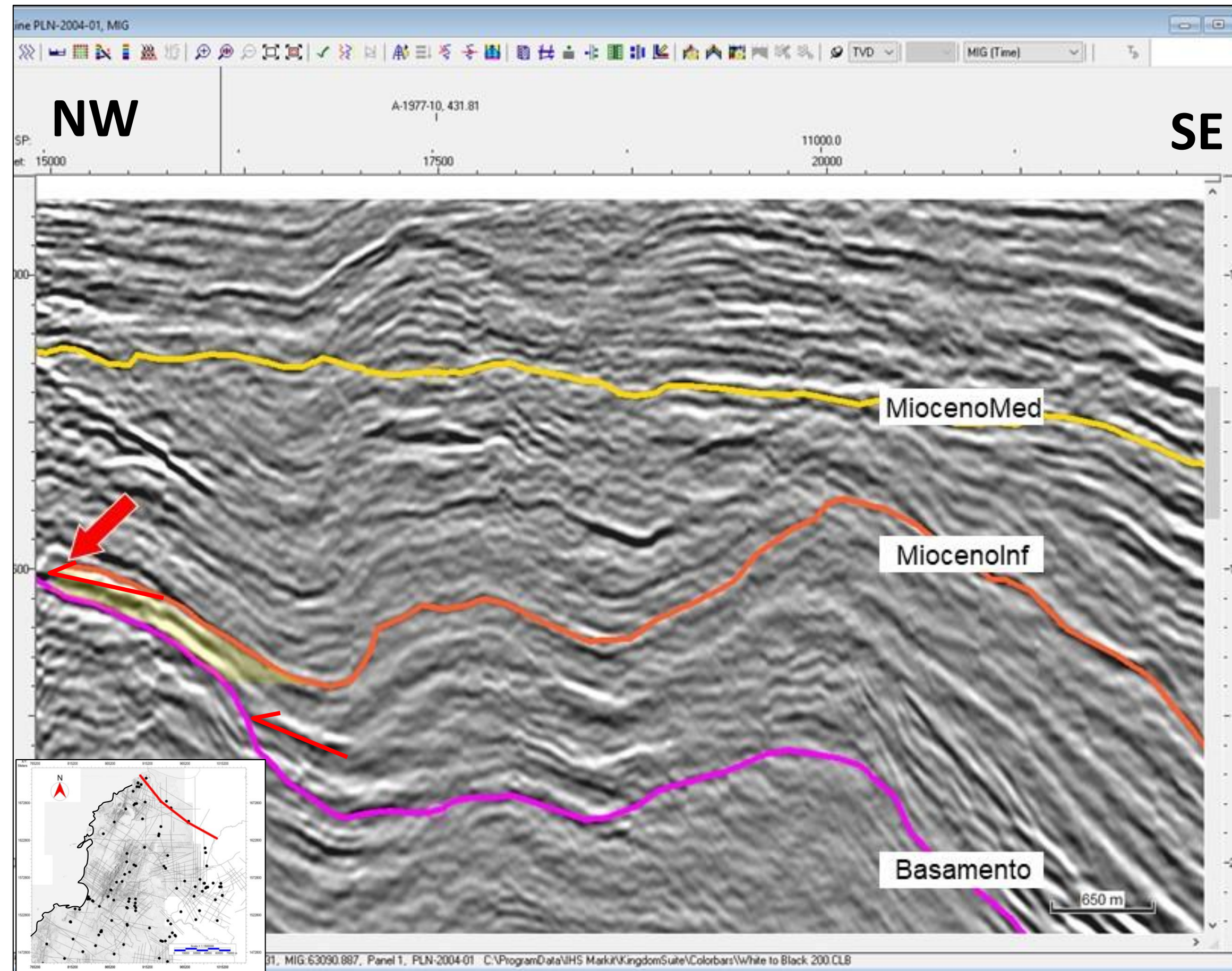
LATE MIOCENE - PLIOCENE (H5)

SINÚ – SAN JACINTO BASIN PLAYS TYPE



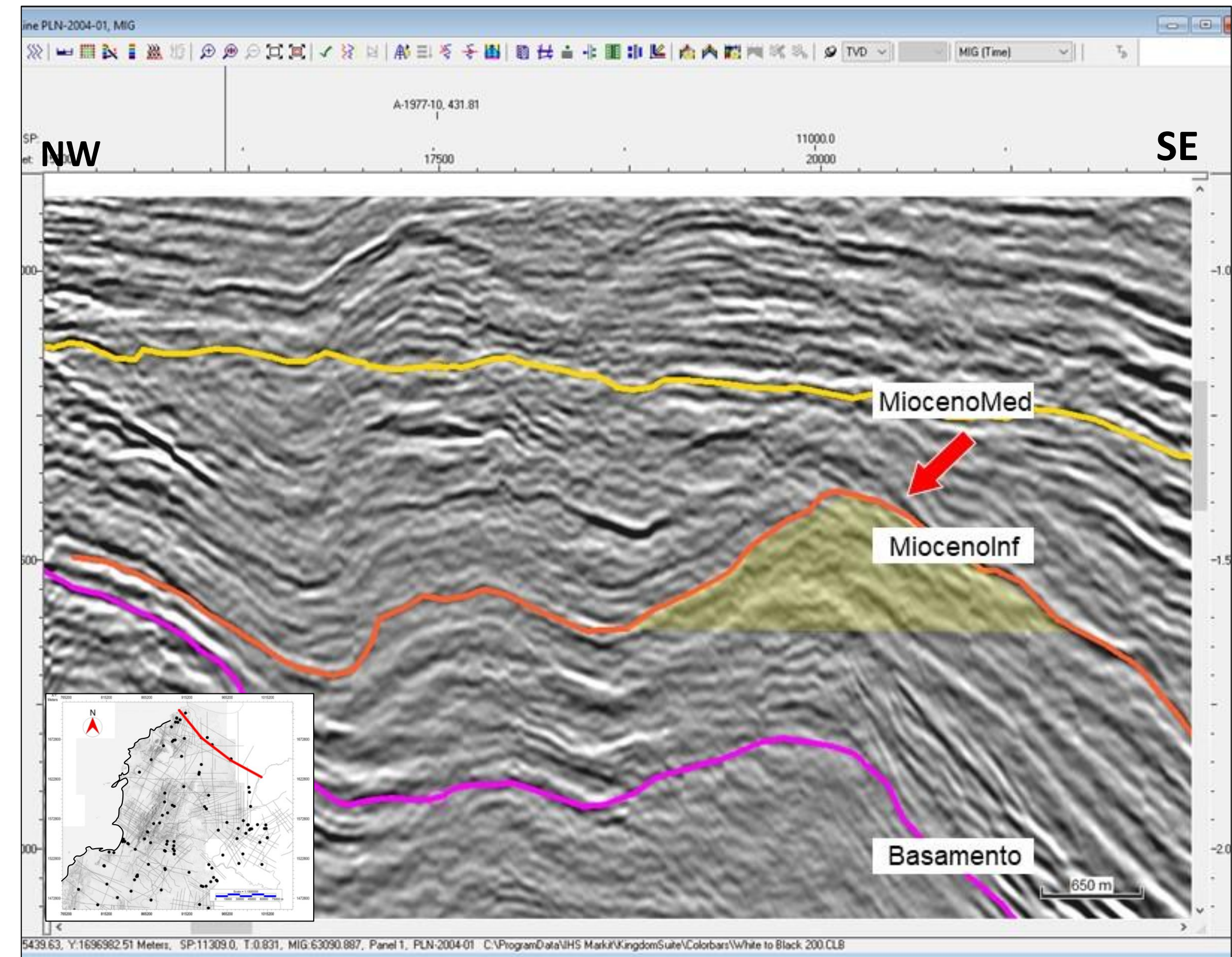
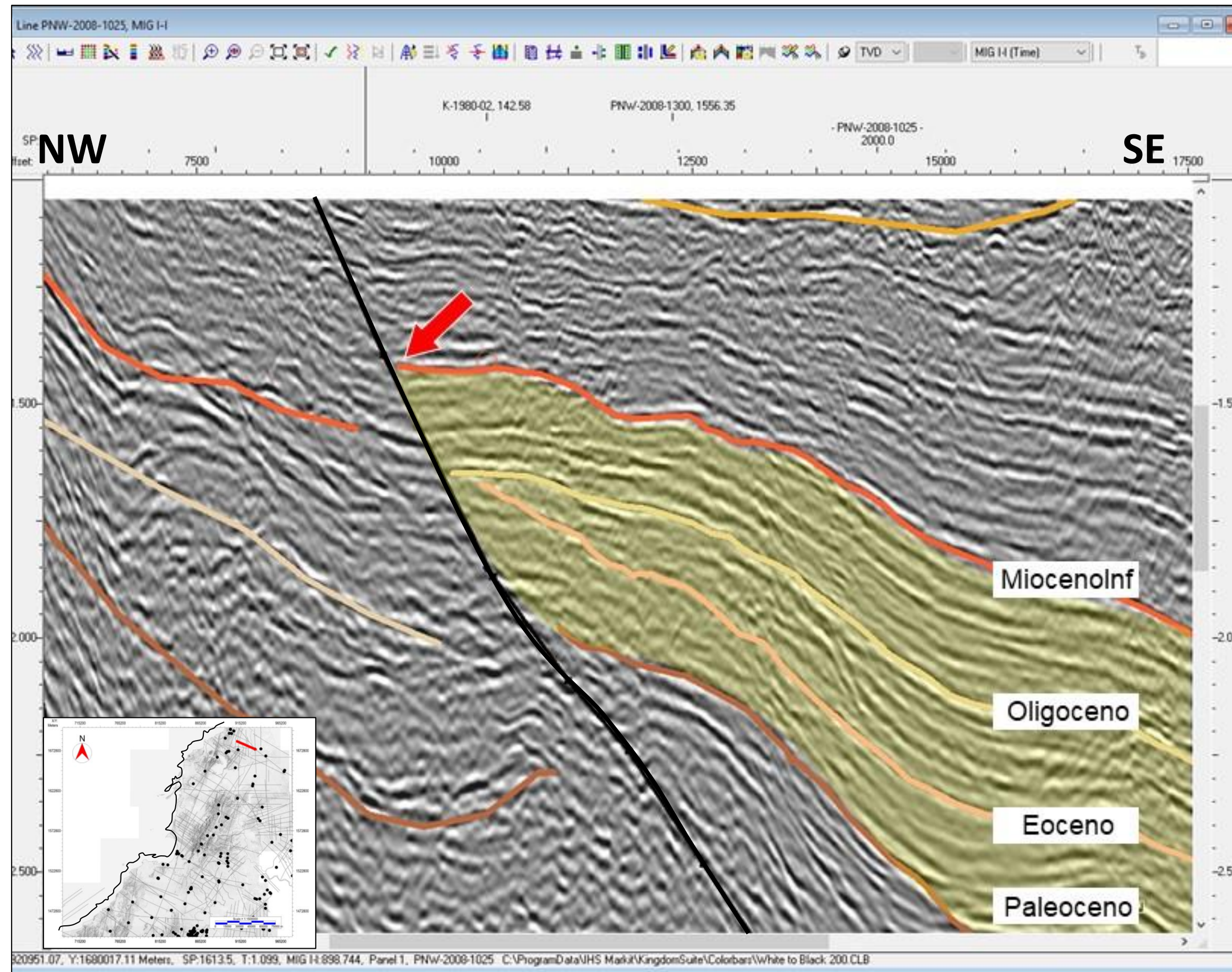
SINÚ – SAN JACINTO BASIN

Stratigraphic Play Type



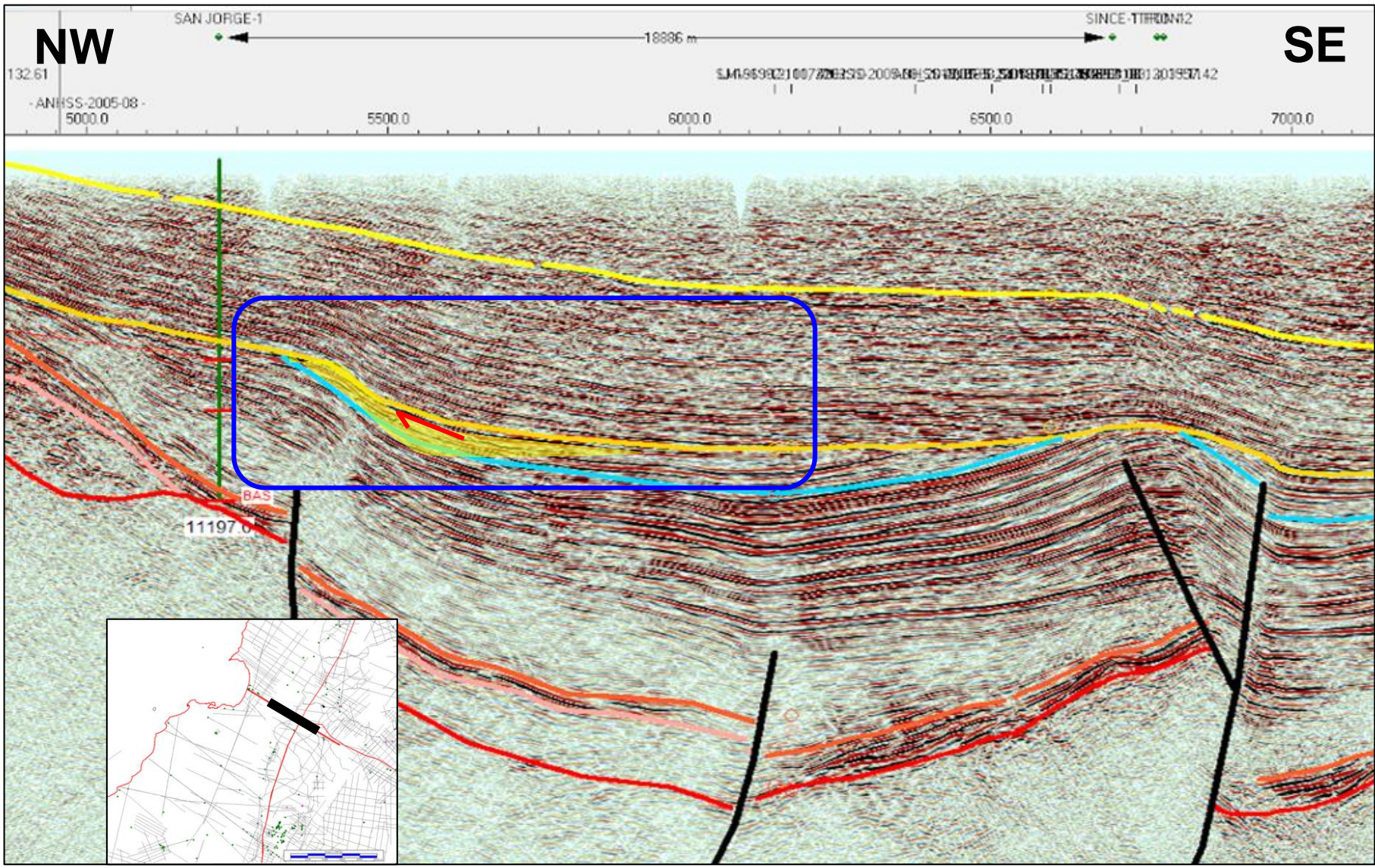
SINÚ – SAN JACINTO BASIN

Structural Play Type

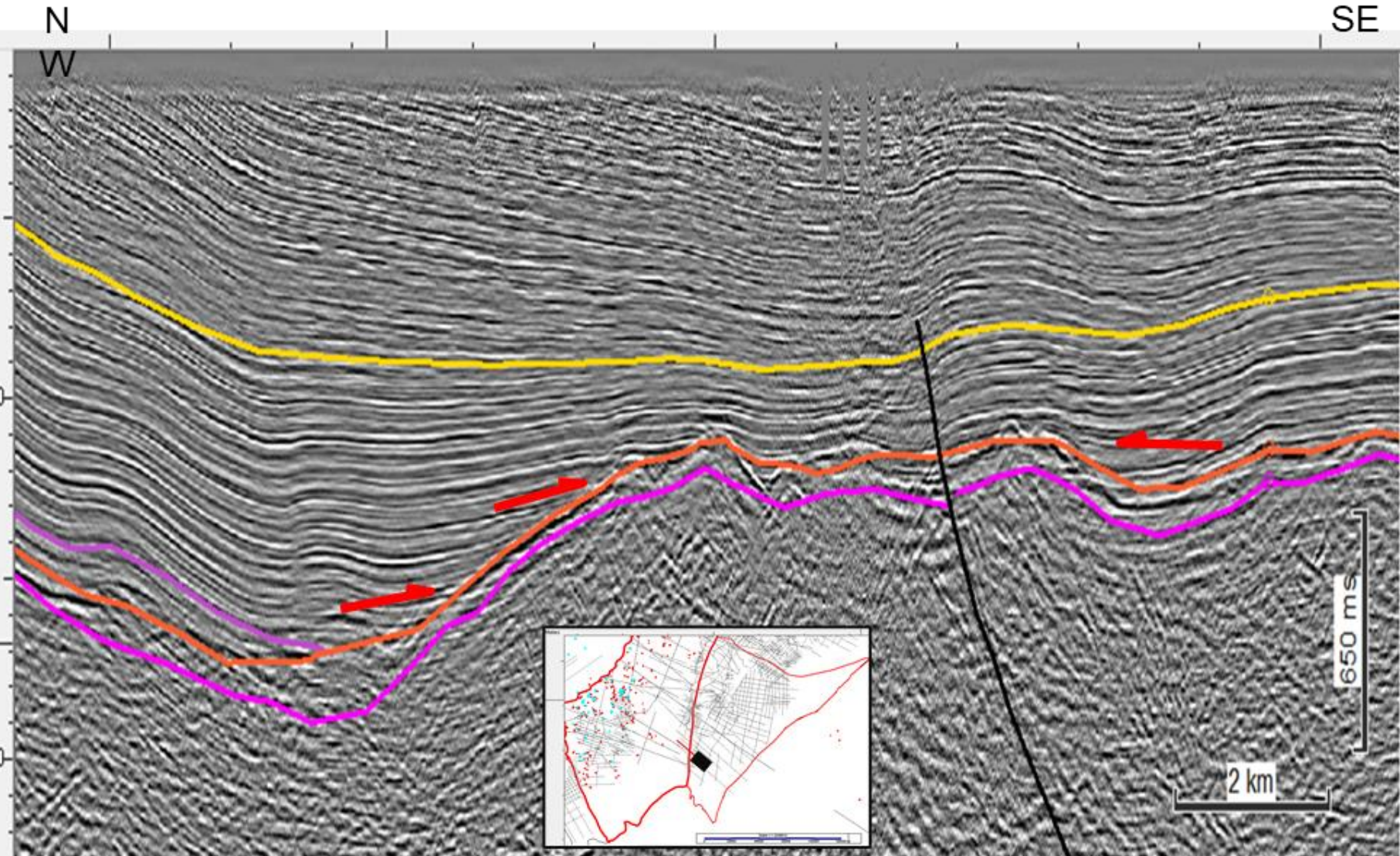


SAN JORGE SUB BASIN

Stratigraphic Play

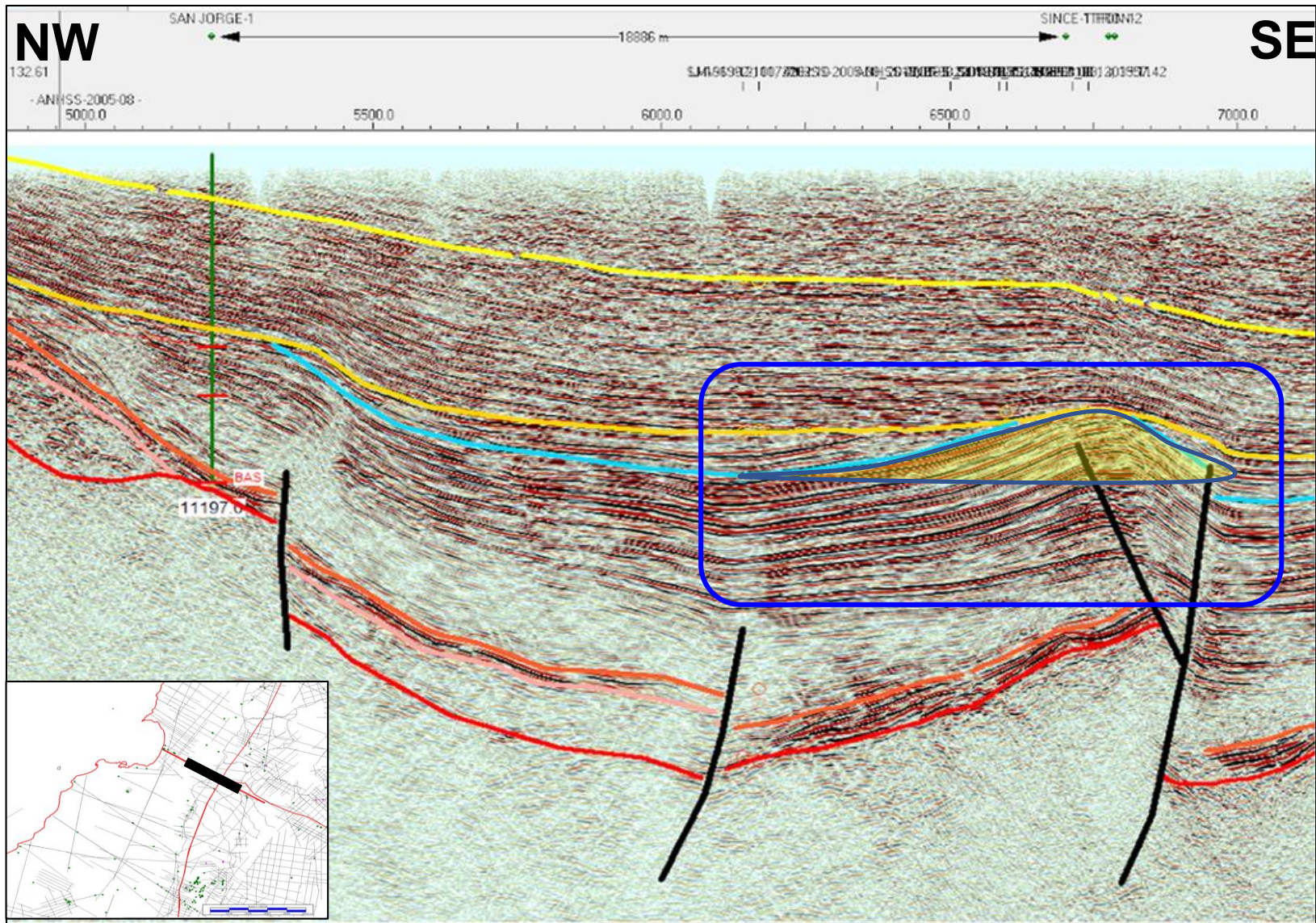


H5 - Tubará
H4 - Porquero
H3 - C. de Oro
H0 - Basement

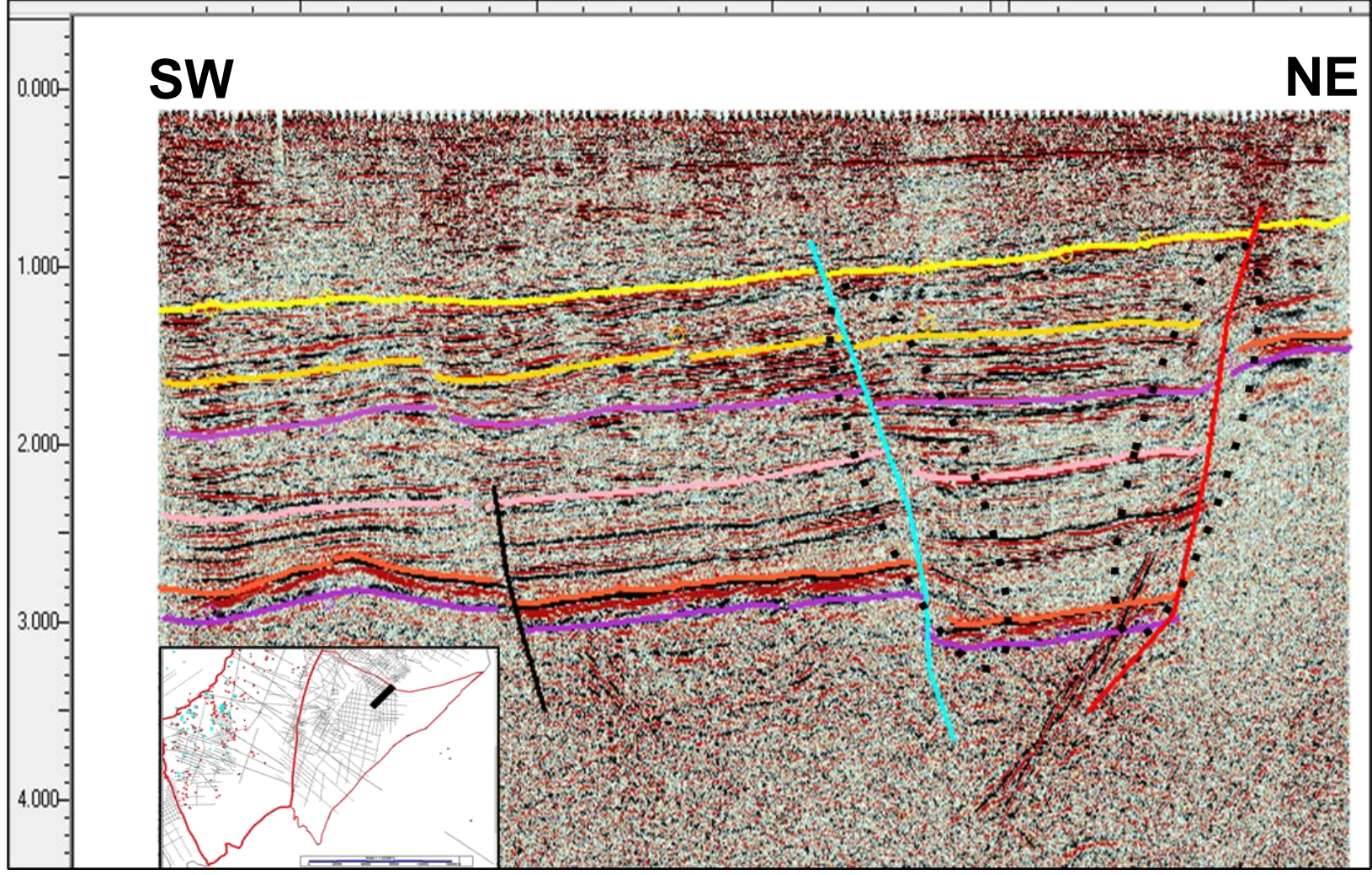


H4 - Porquero
H3 - C. de Oro
H0 - Basement

Structural Play



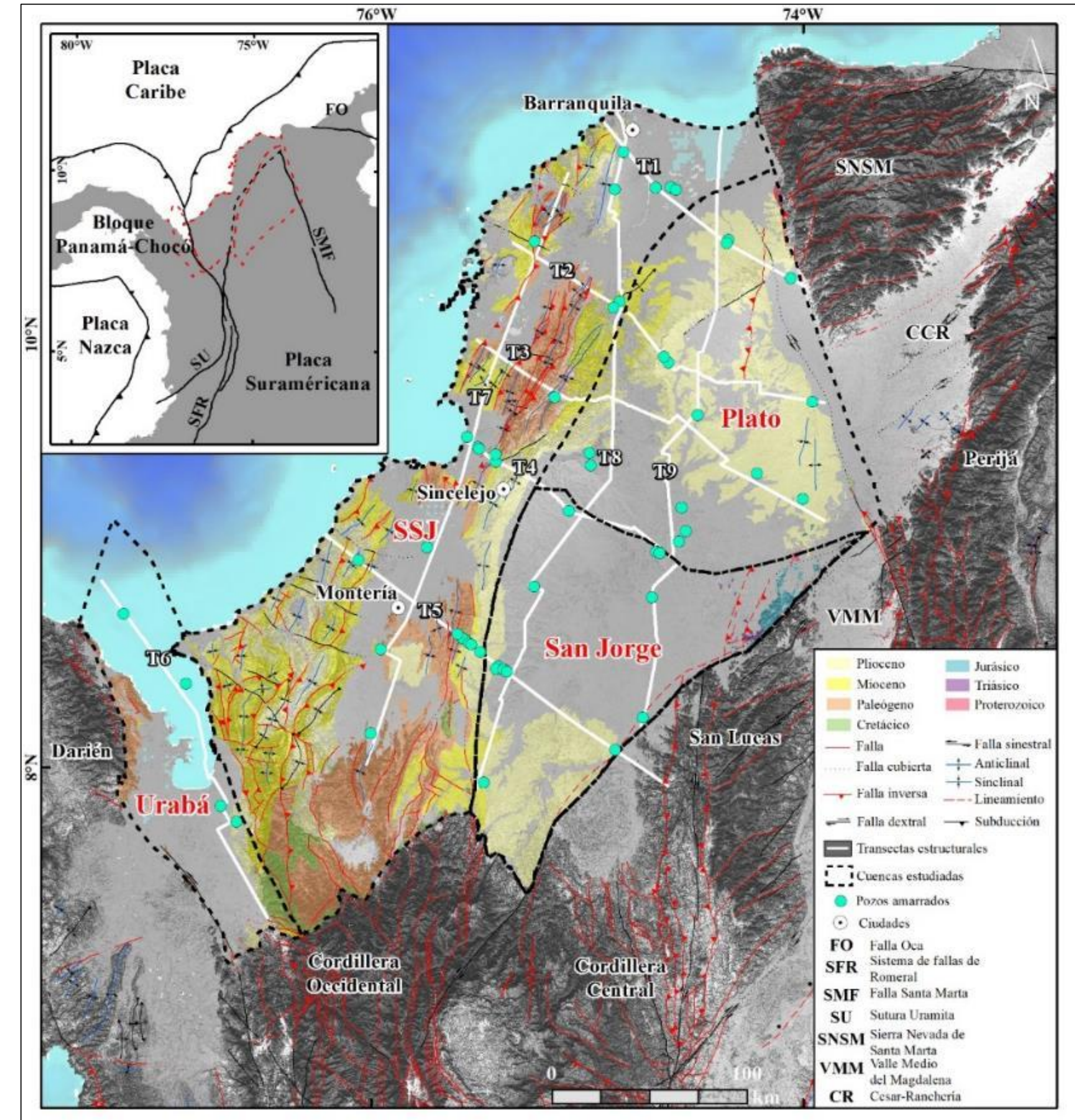
H5 - Tubará
H4 - Porquero
H3 - C. de Oro
H0 - Basement



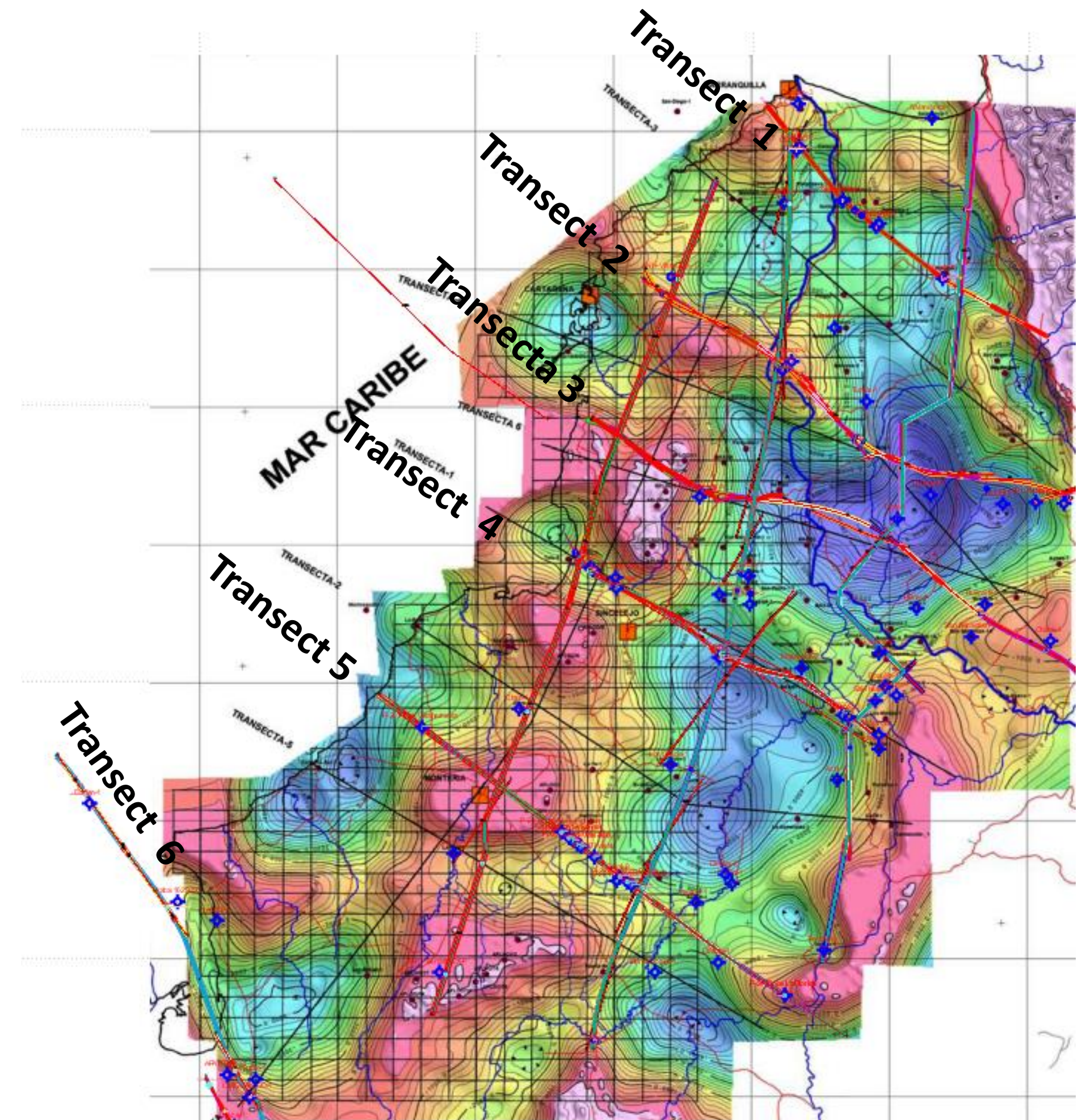
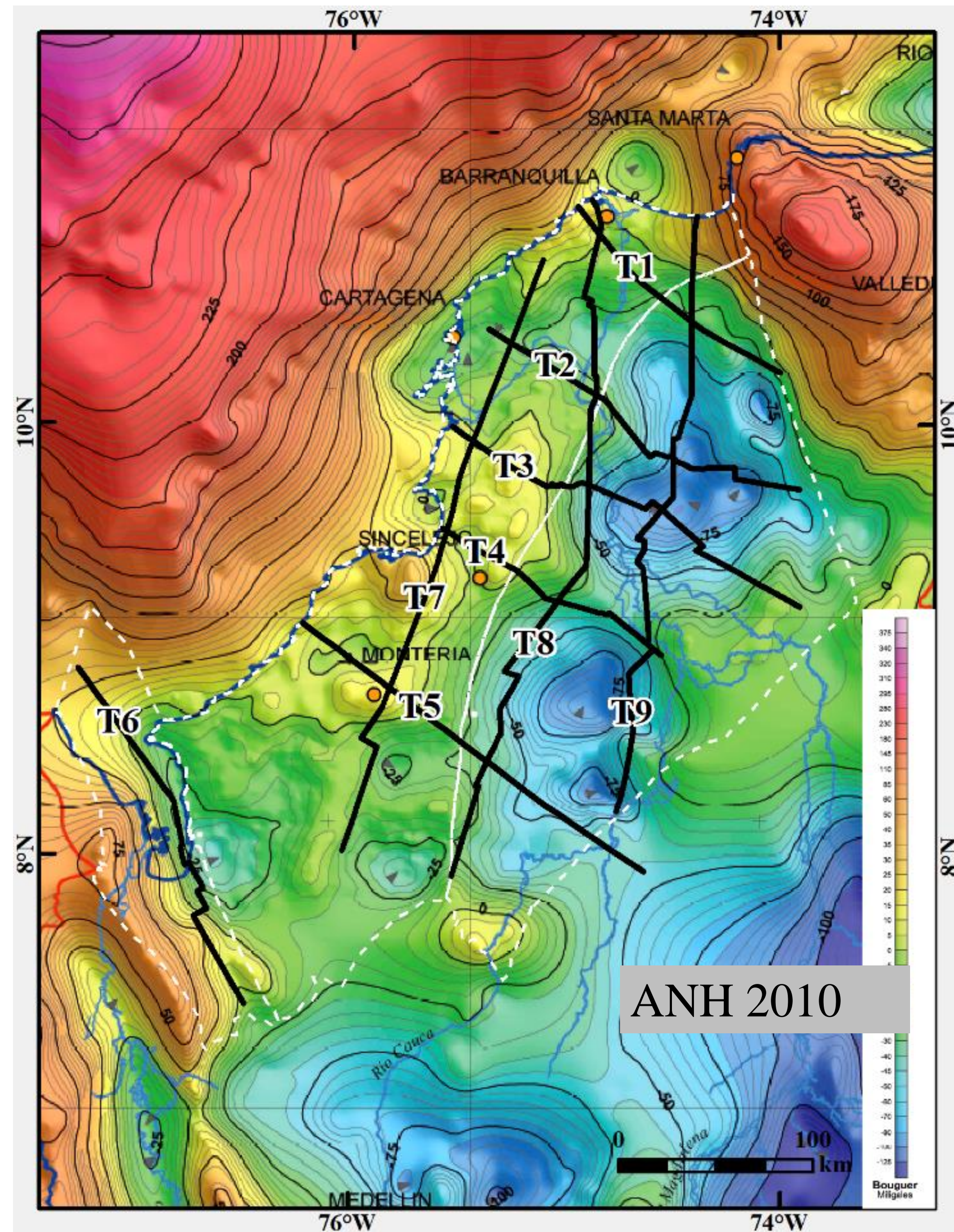
H5 - Tubará
H3 - C. de Oro
H0 - Basement

Nine (9) structural-regional sections in depth based in the seismic interpretation, 60 Wells, Surface geology (SGC) and gravimetry (ANH)

- **9** Dip Sections
- **3** Strike Sections
- Lengths
 - T1: 140 km
 - T2: 194 km
 - T3: 214 km
 - T4: 140 km
 - T5: 224 km
 - T6: 204 km
 - T7: 331 km
 - T8: 372 km
 - T9: 318 km
- **Total: 2317 km**



BOUGUER'S ANOMALIES MAP

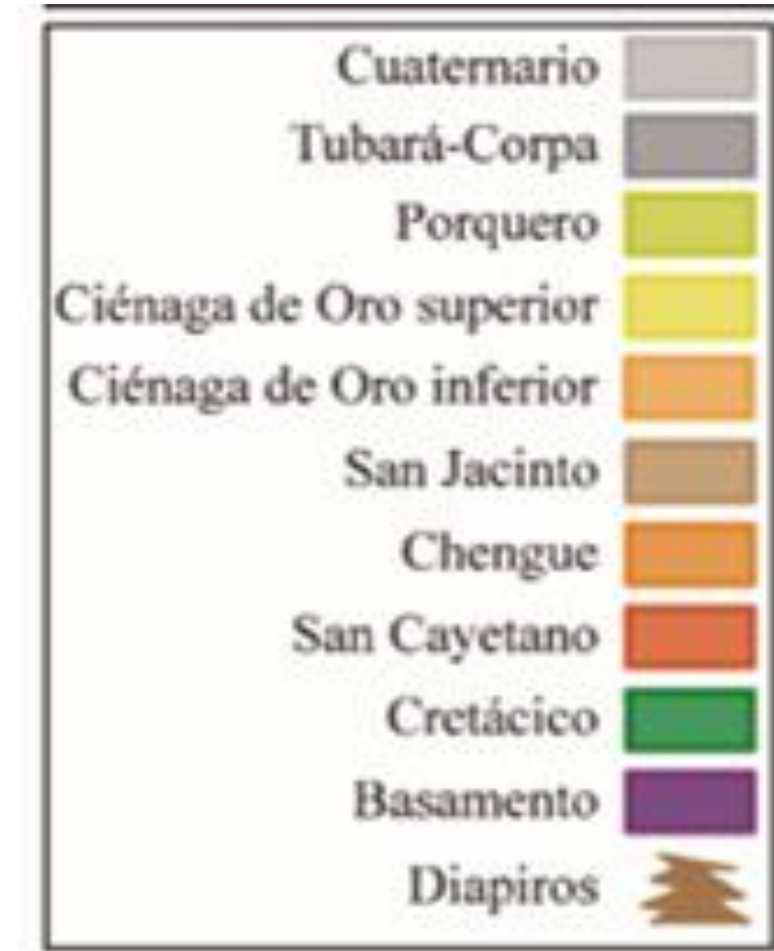
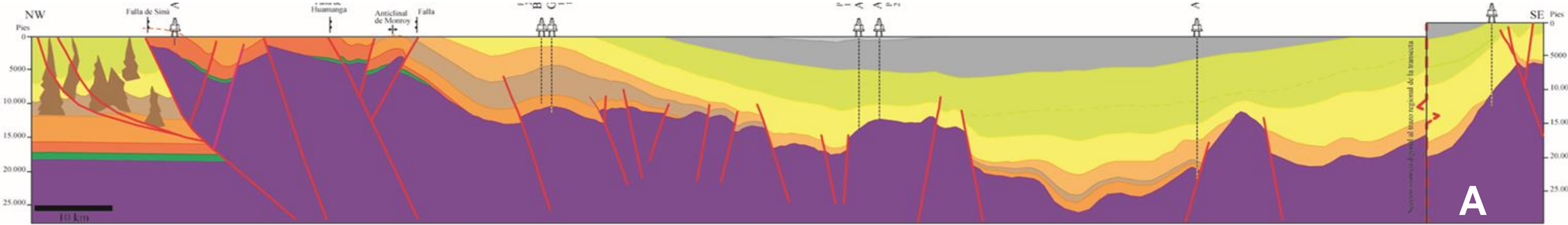


Basement – Pre Tertiary Depth Map

TRANSECT No. 5

NW

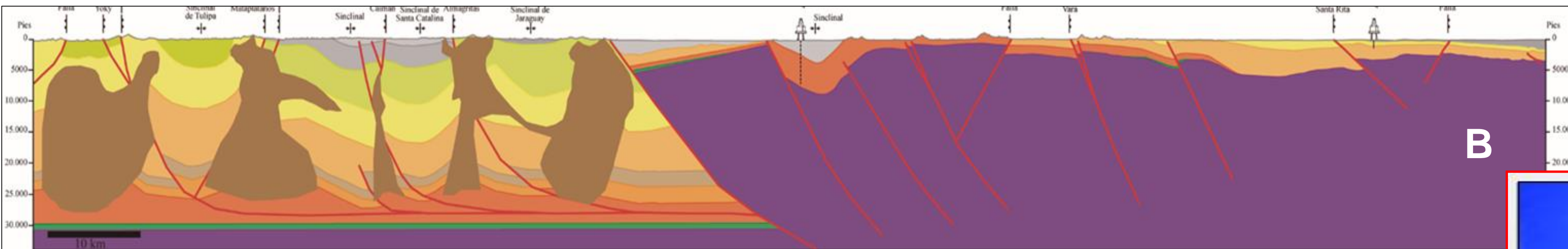
SE



TRANSECT No. 10

NW

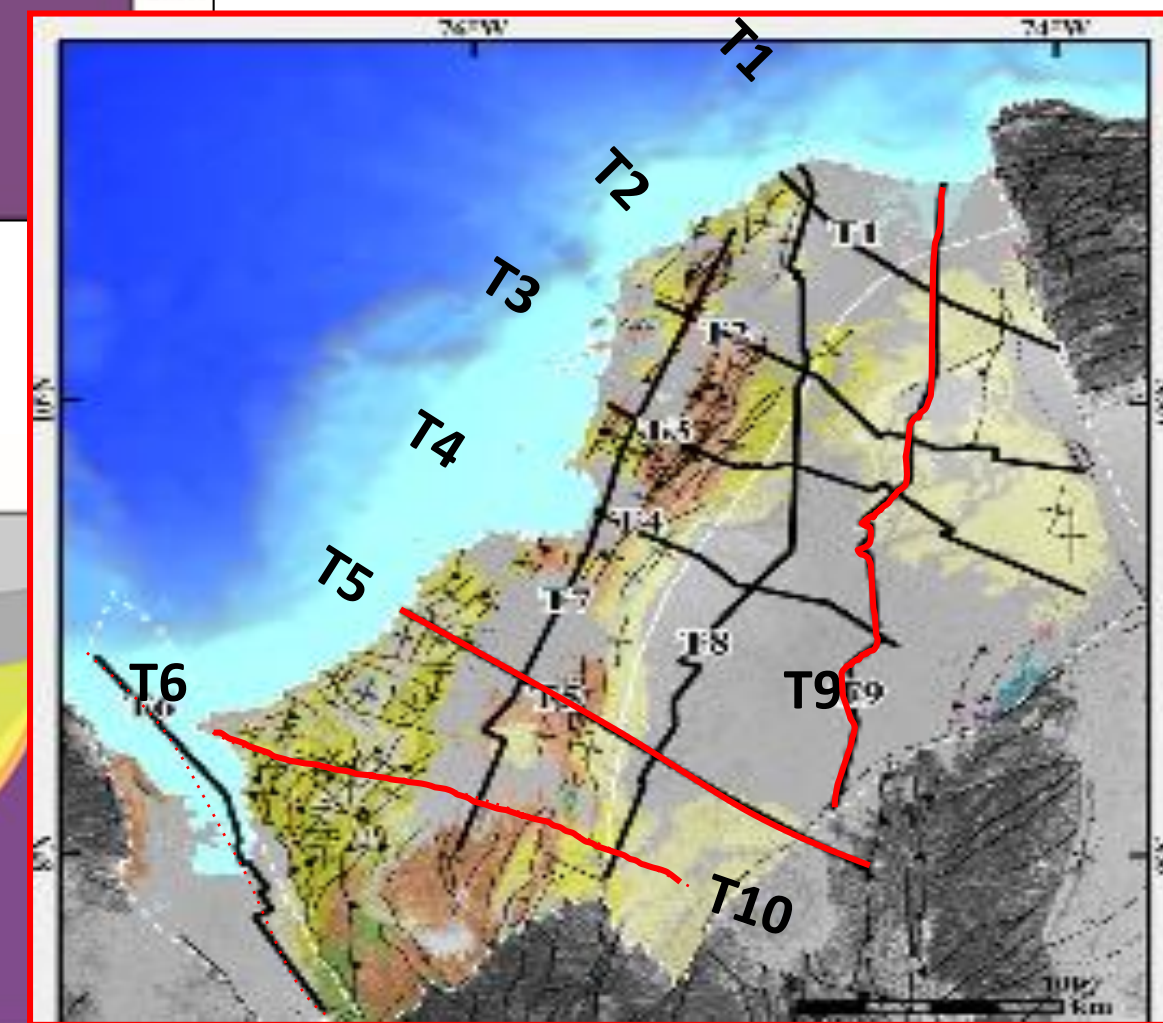
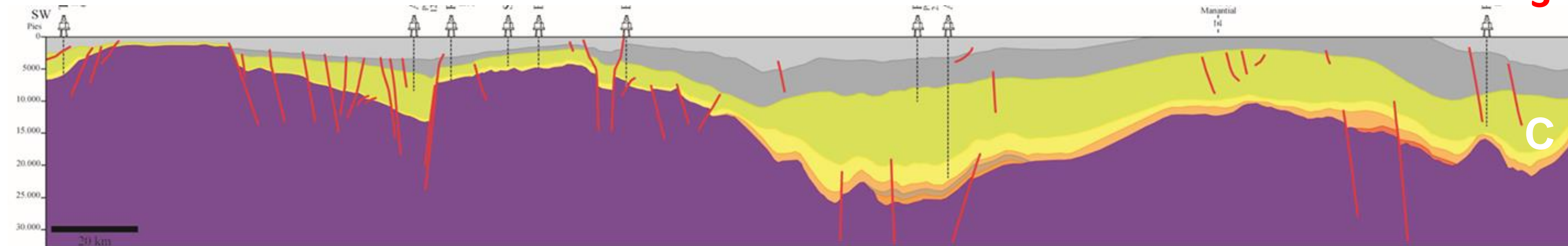
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TRANSECT No. 9

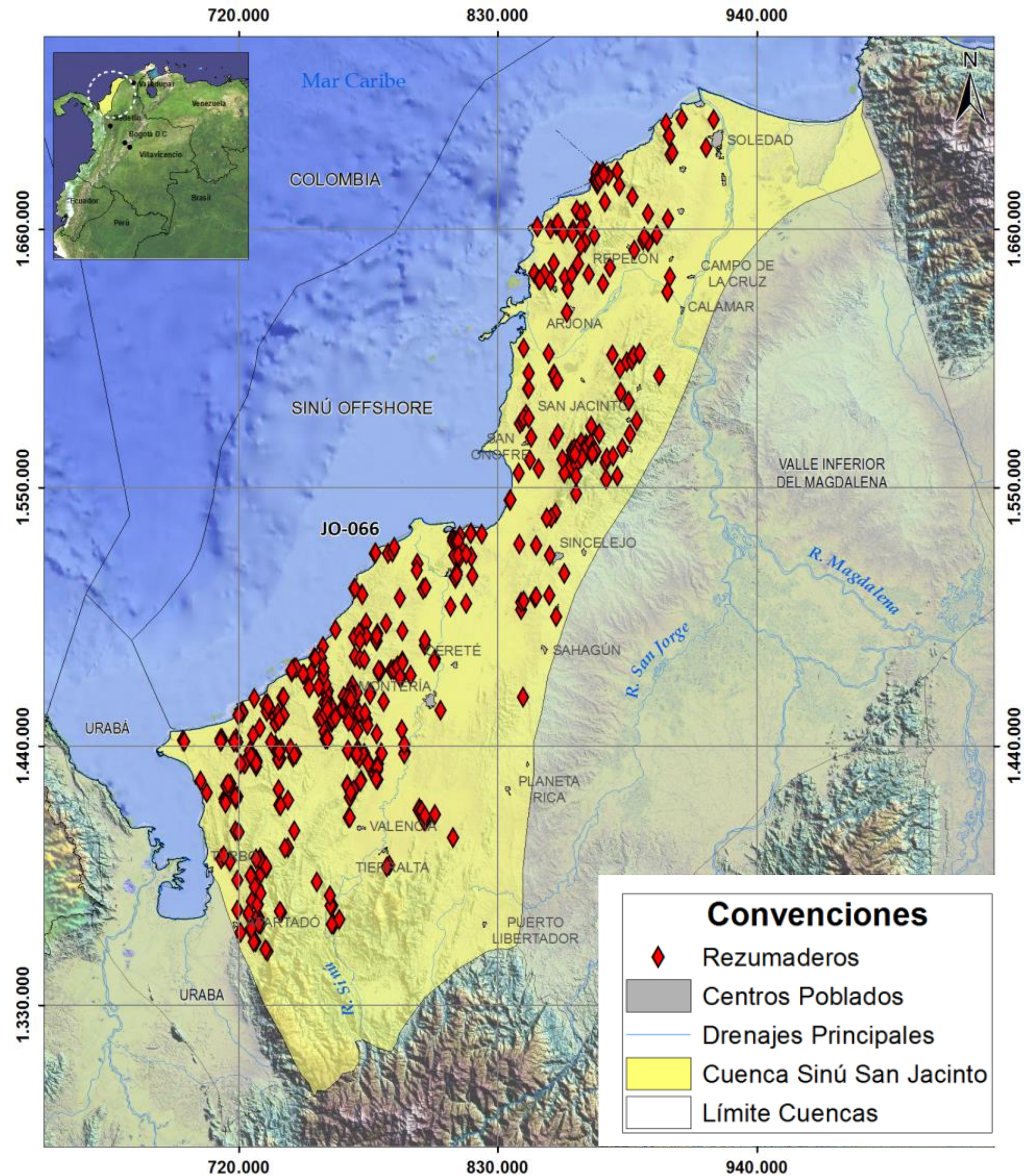
N

S

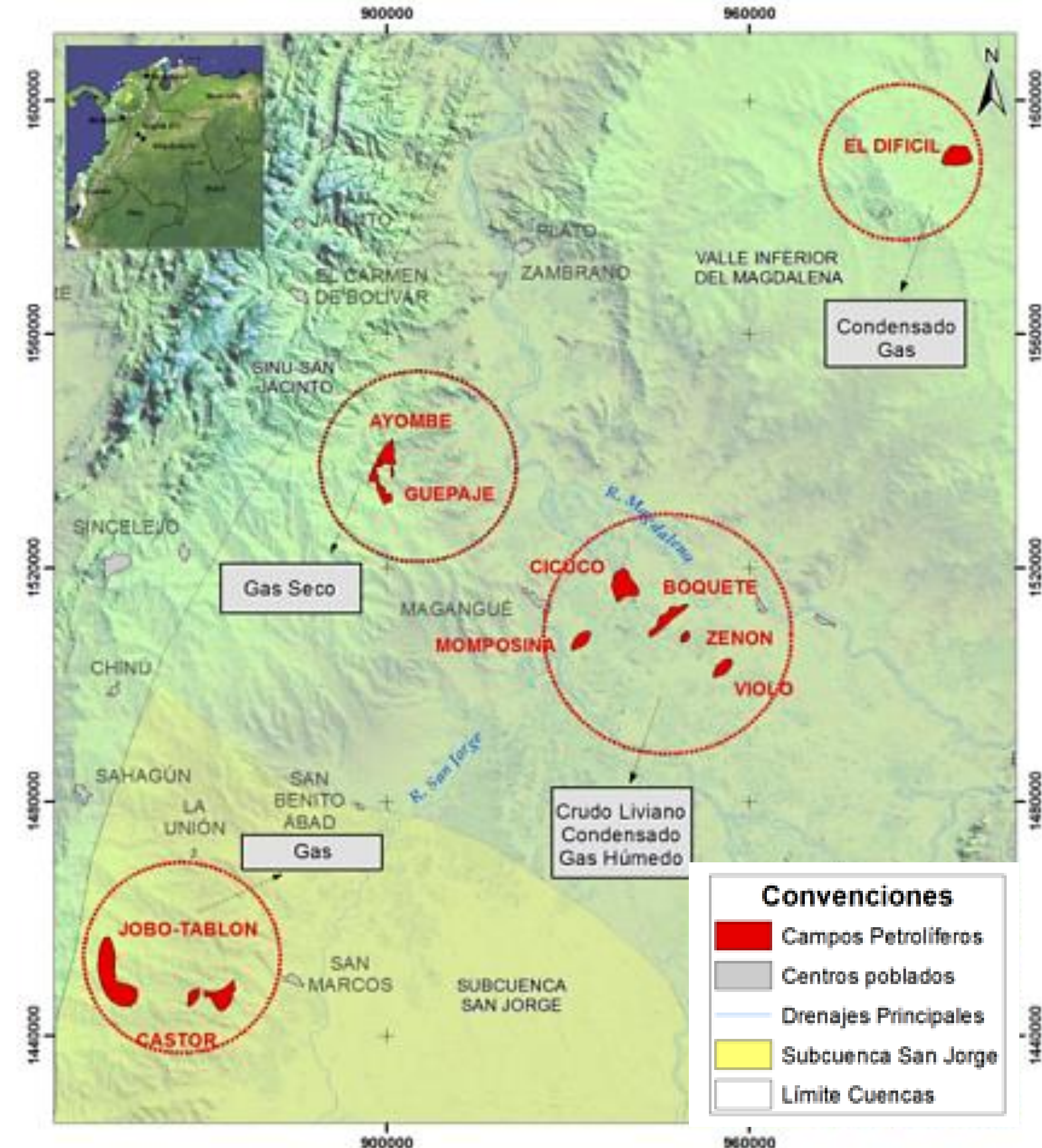


Hydrocarbons Ocurrence

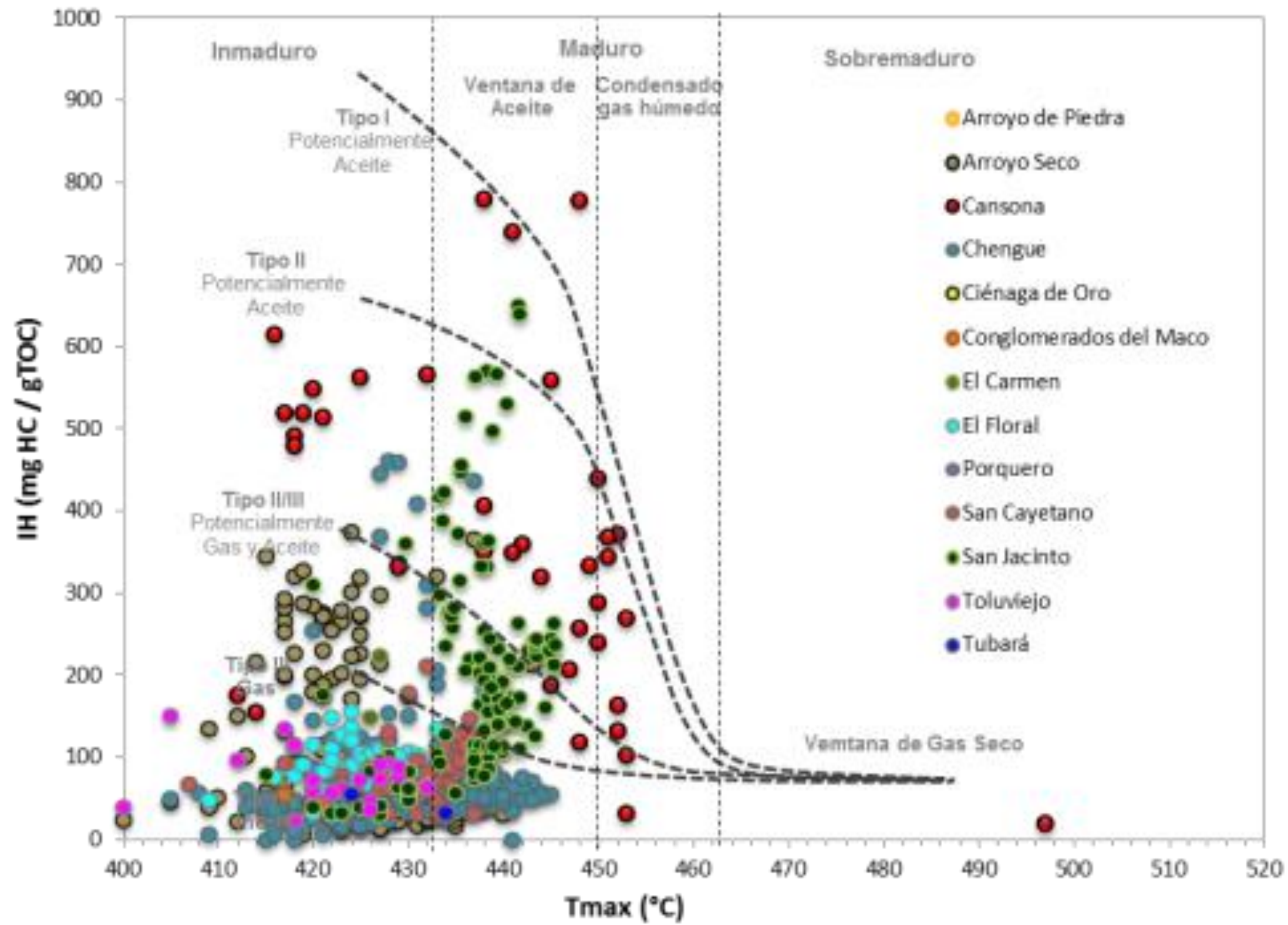
Sinú – San Jacinto Basin



San Jorge Basin

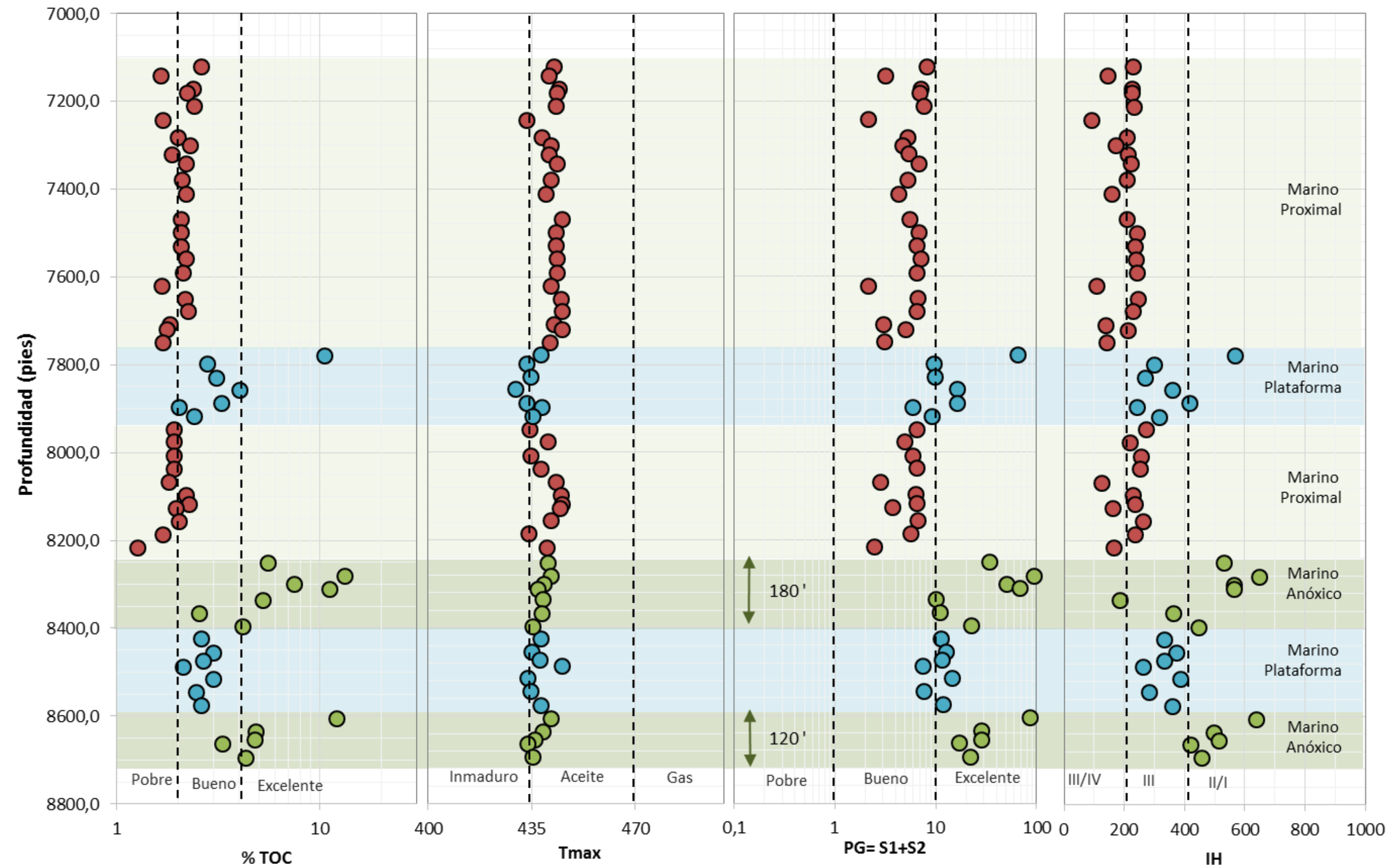


Sinú – San Jacinto Basin



Thermal maturation of lito stratigraphic units of the basin

Source Rocks Geochemistry

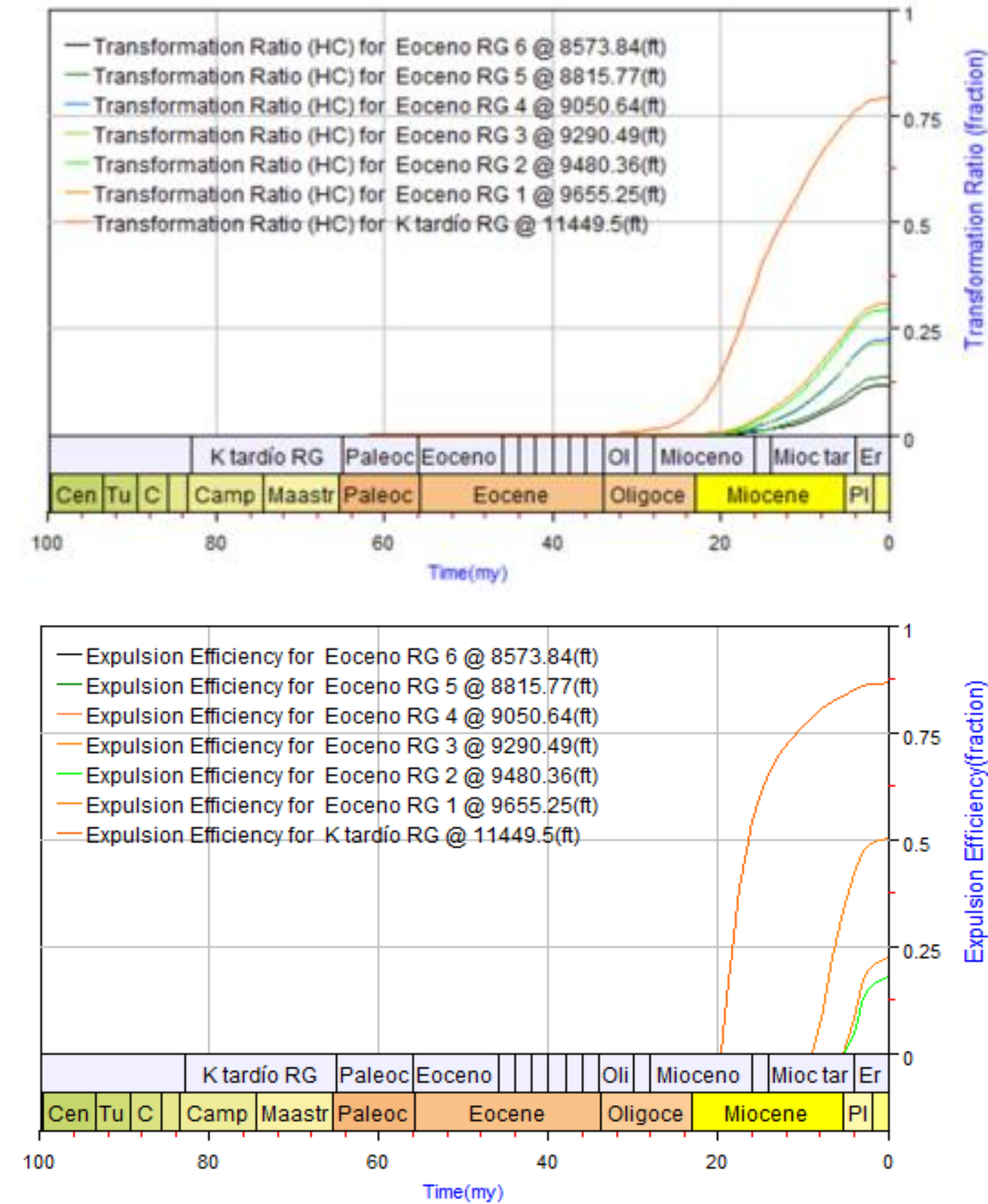
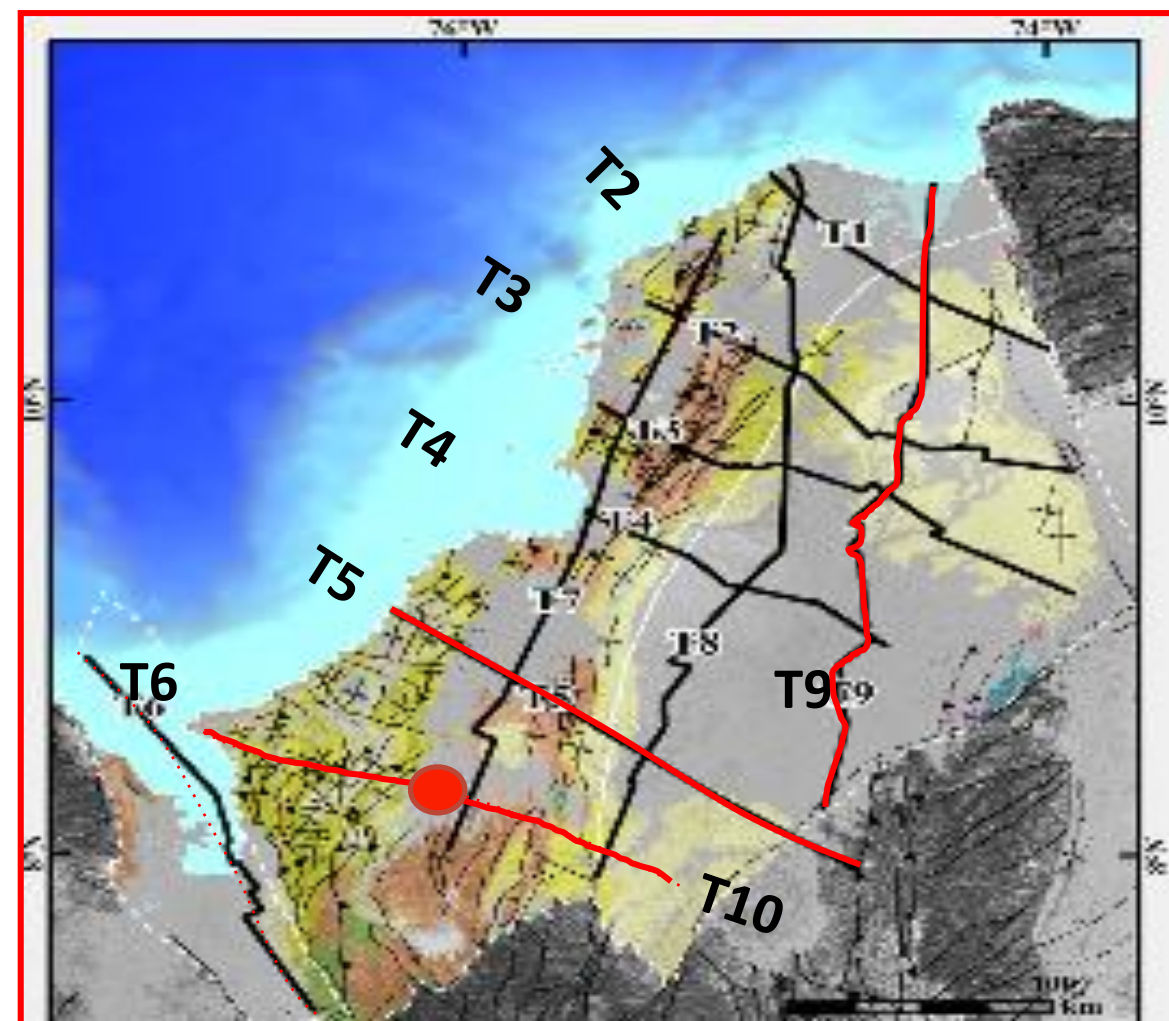
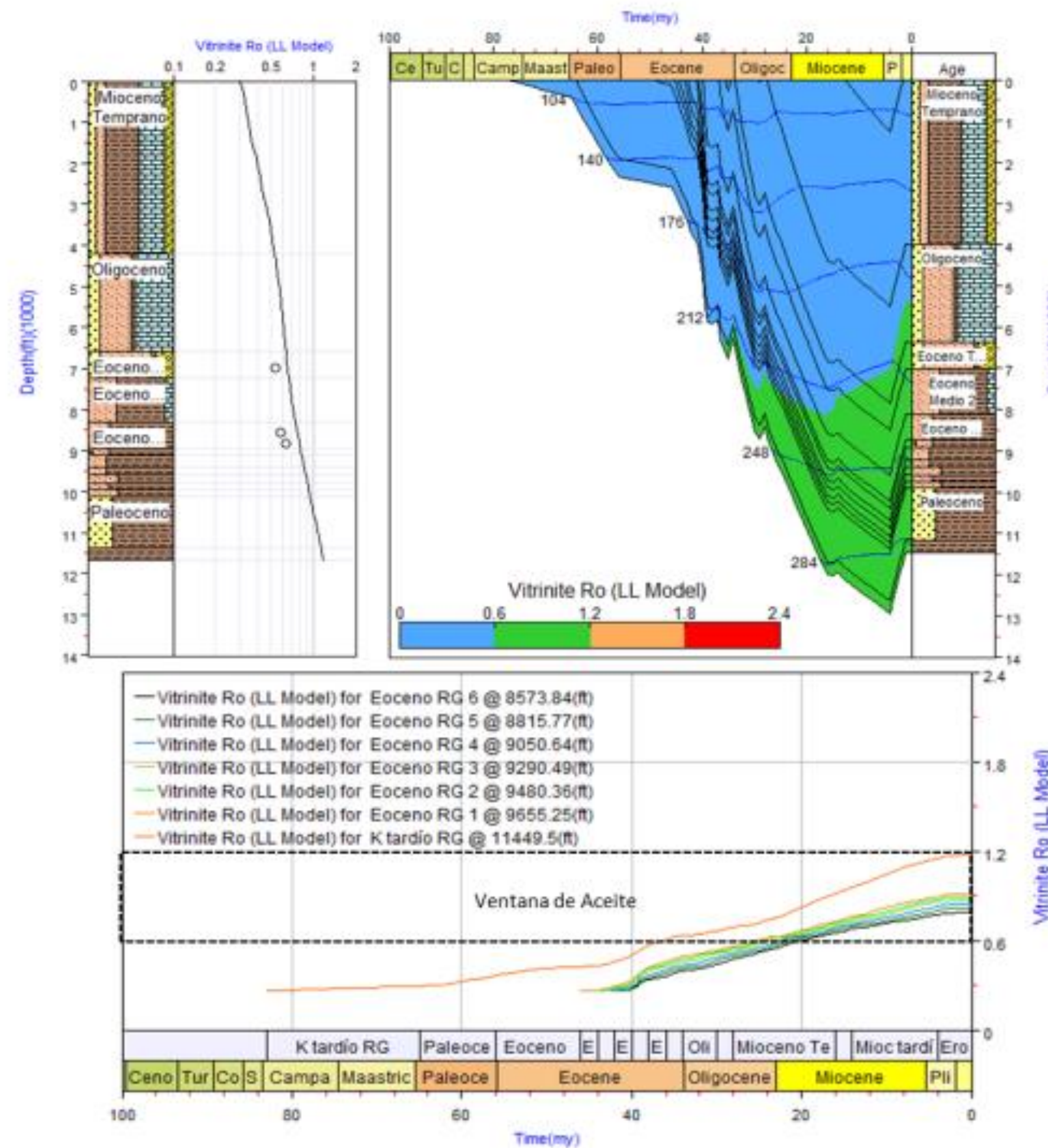
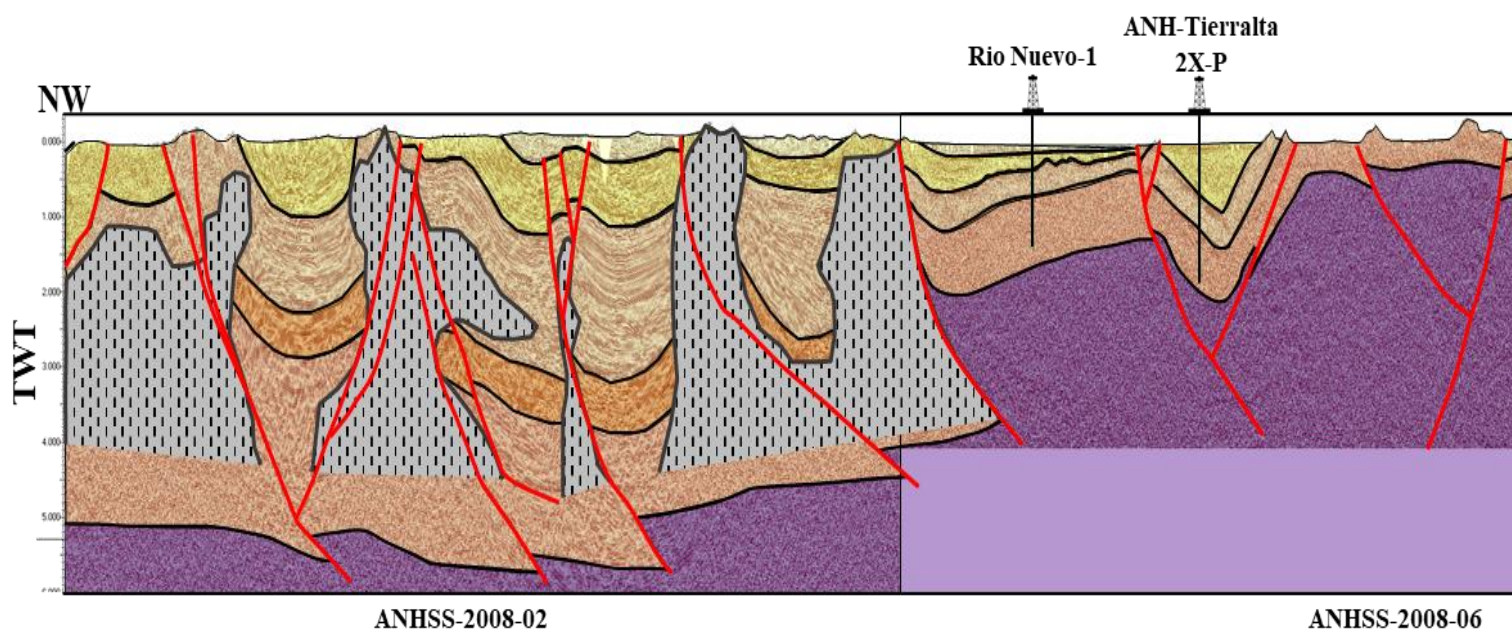


Geochemical profile Tierralta-2-X-P well (ANH)

Sinú – San Jacinto Basin

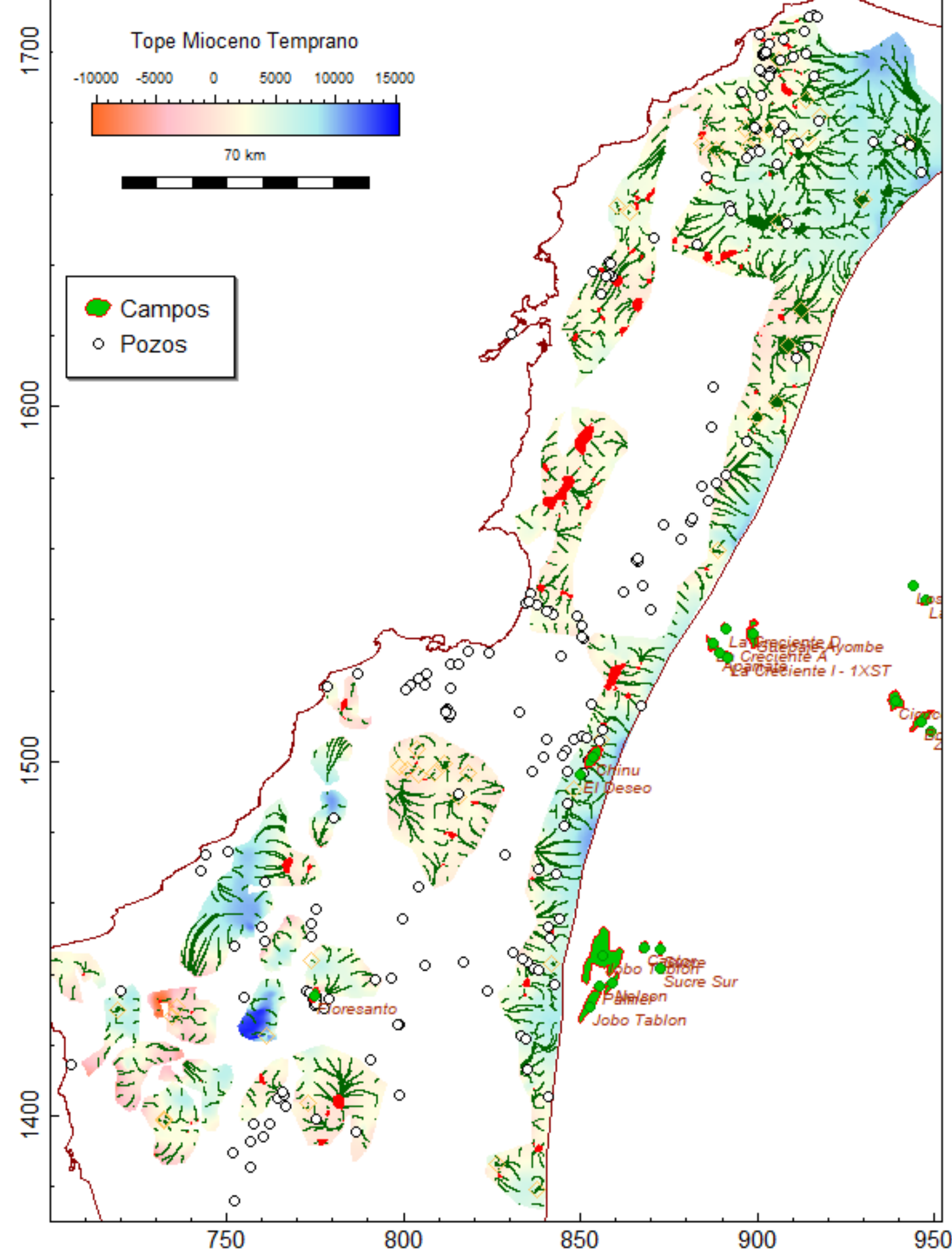
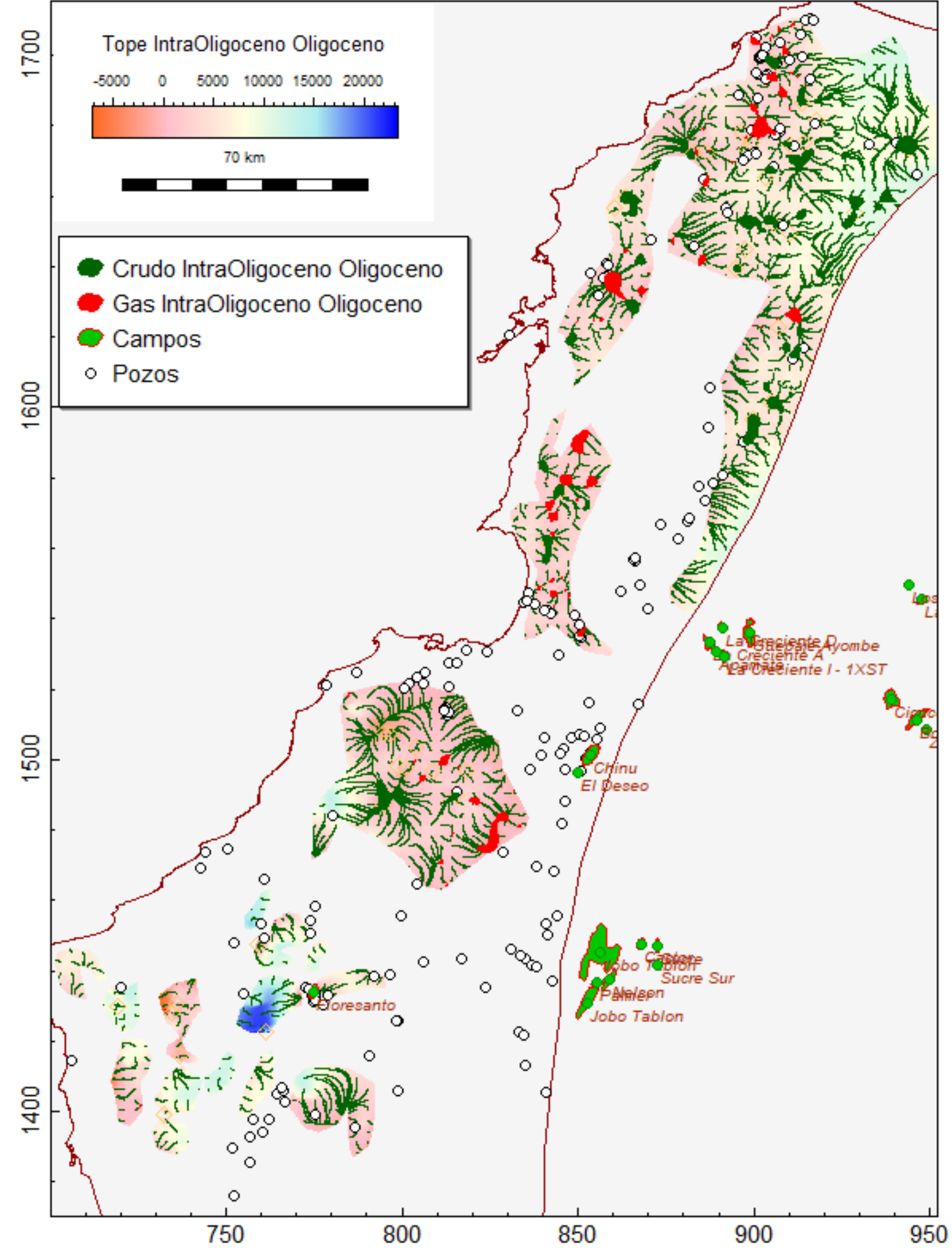
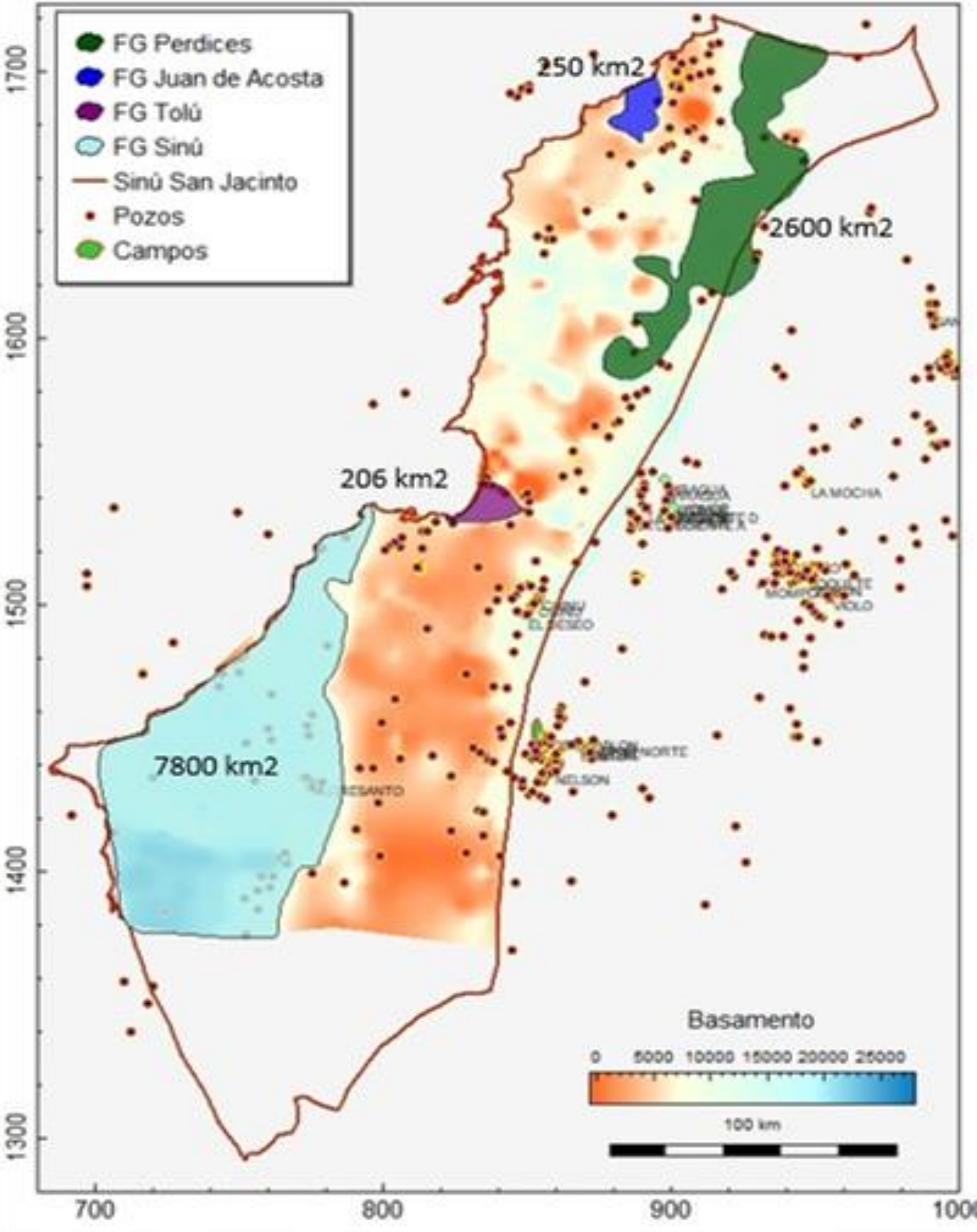
Basin Modeling 1D / Tierra Alta – 2XP

Generation and Expulsion



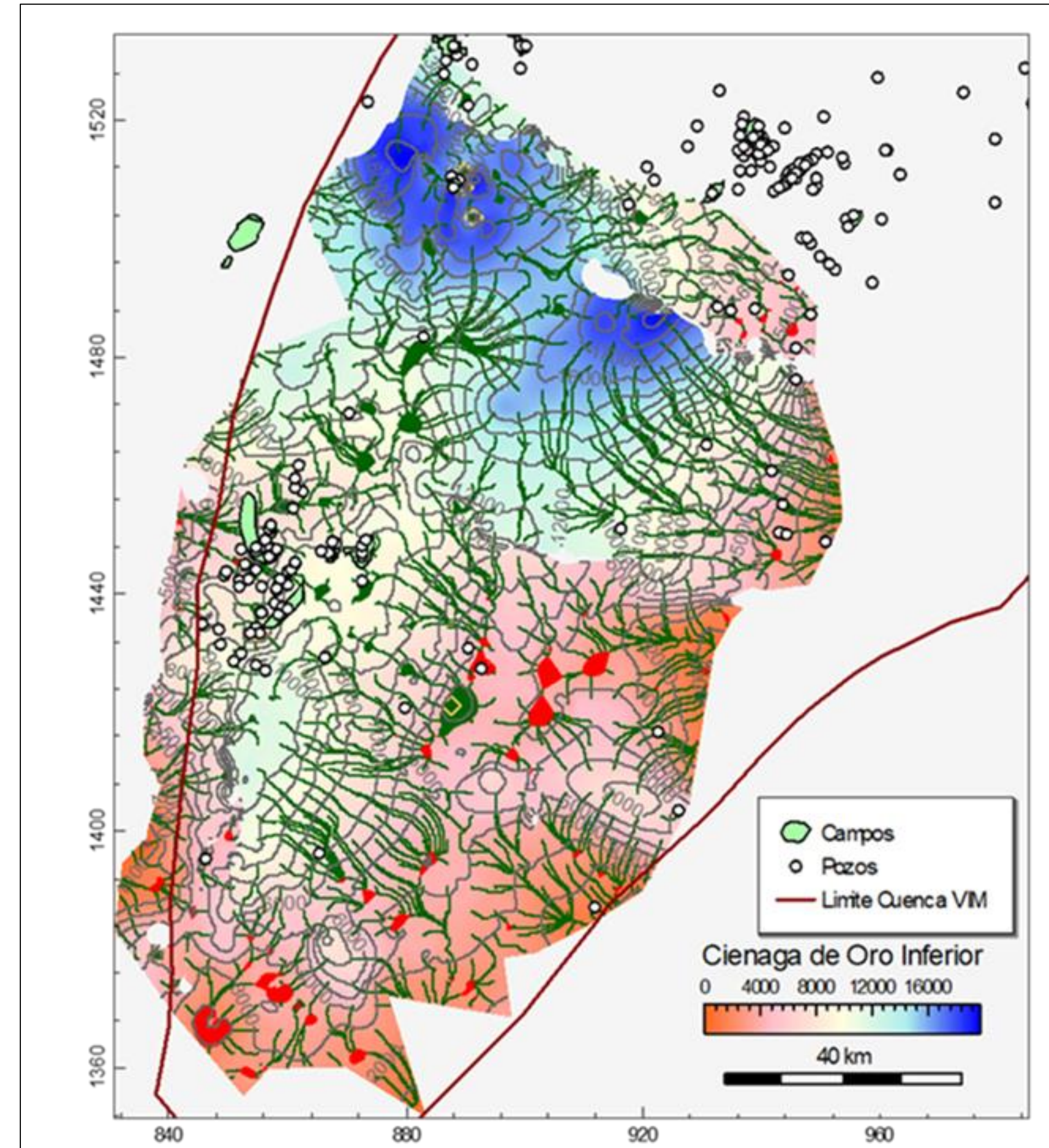
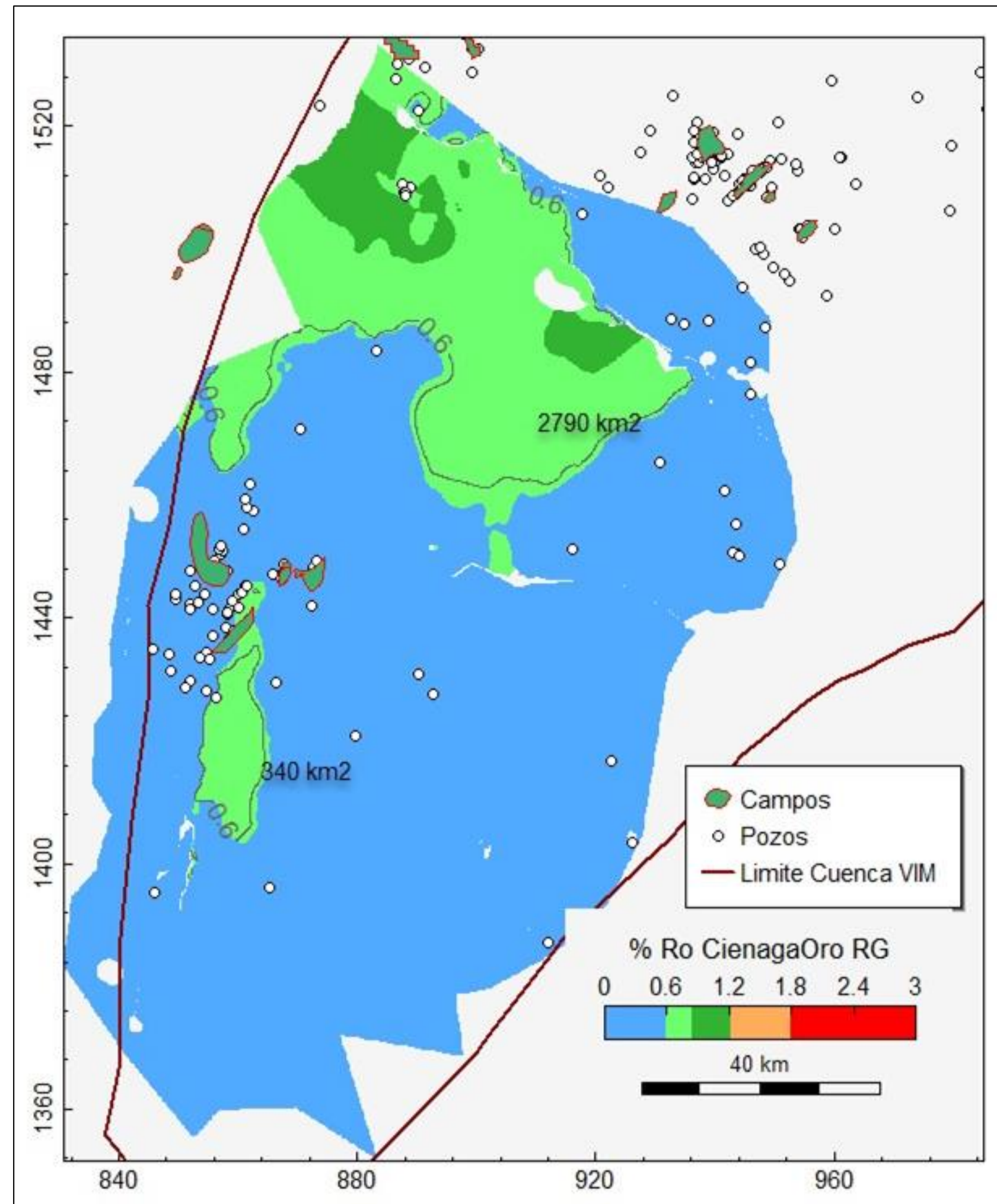
Burial history and thermal maturity

Transformación Ratio and expulsion efficiency



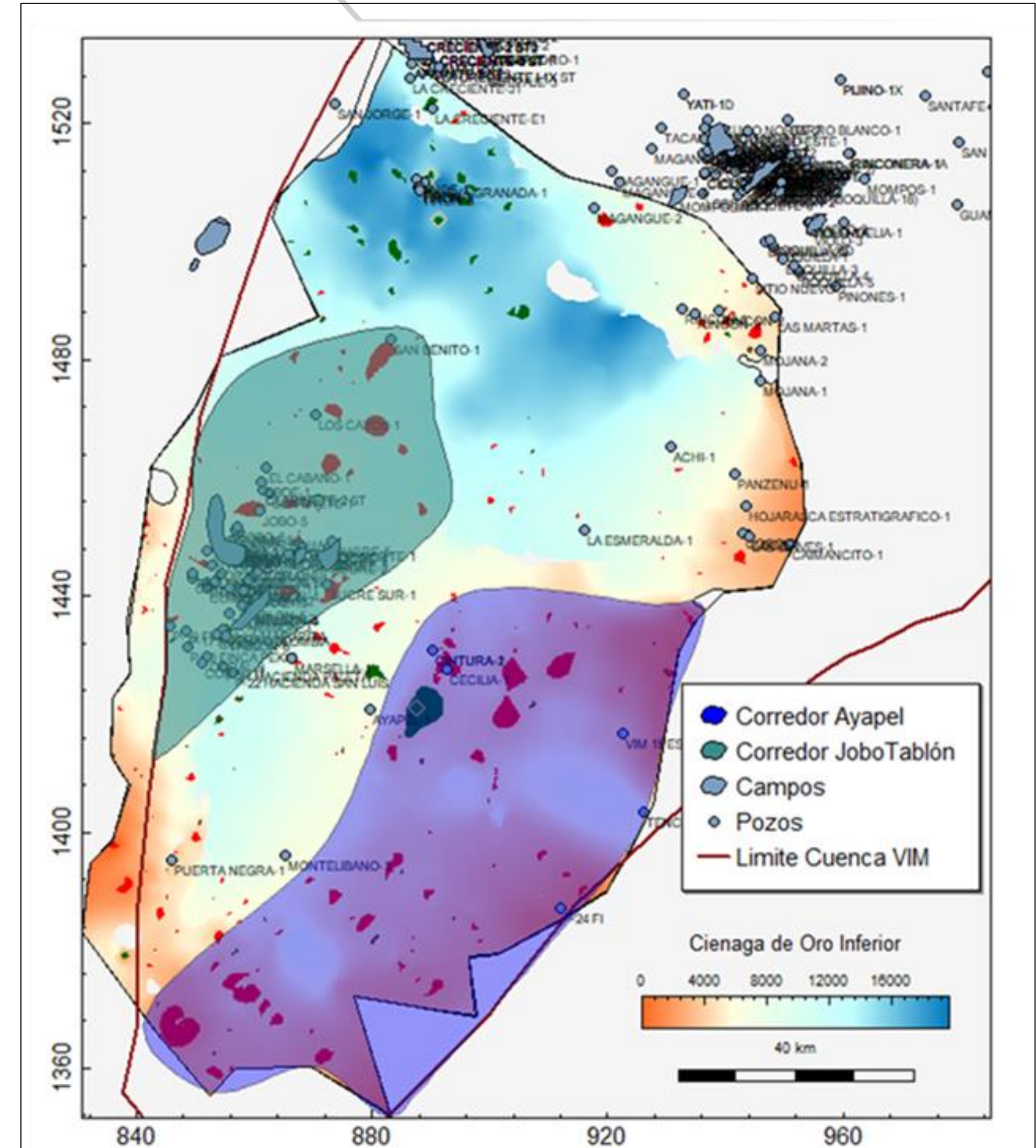
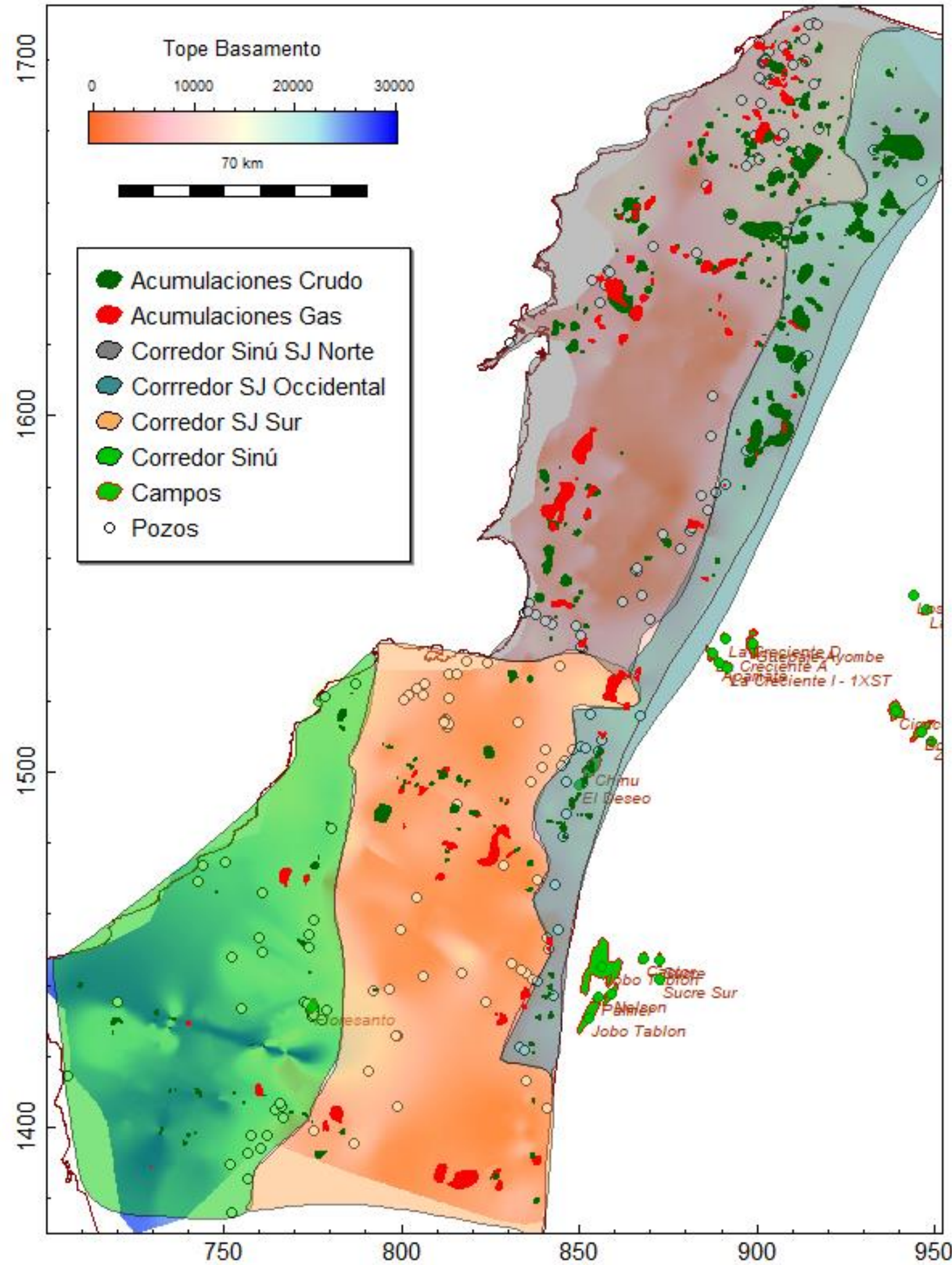
VIM Basin- San Jorge

Basin Modeling 3D

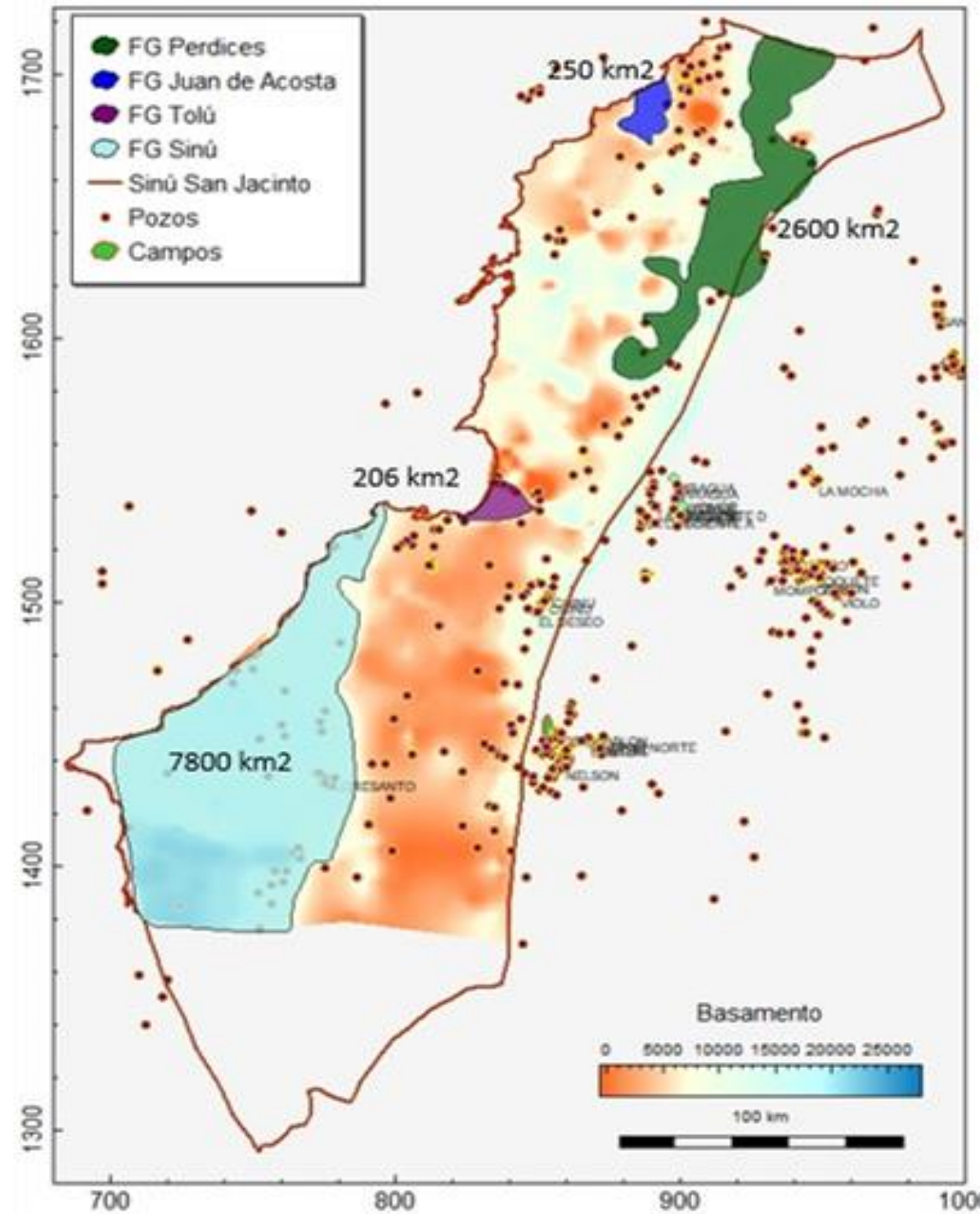


Sinú – San Jacinto & San Jorge Basin

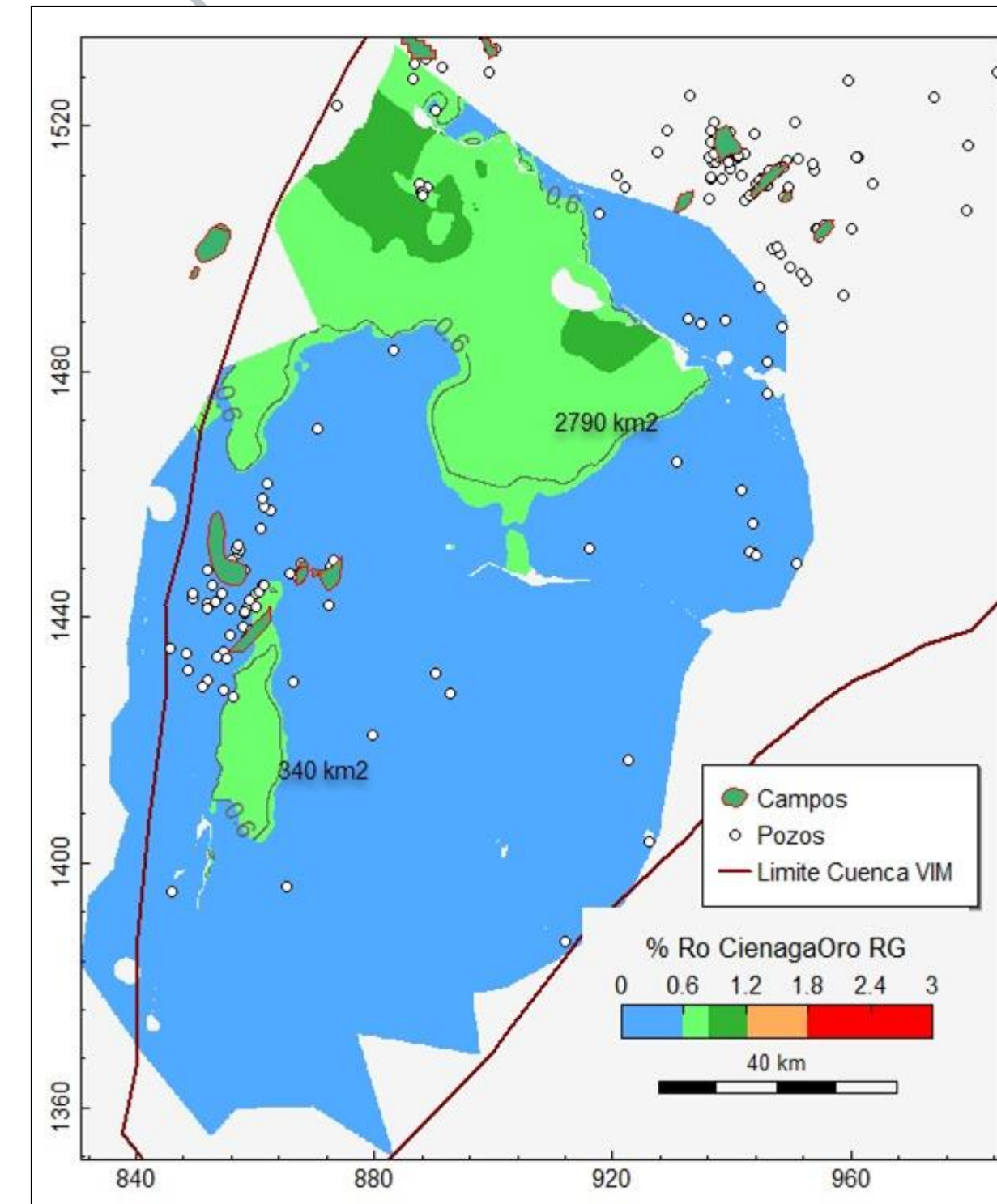
Play Fairway Maps



Sinú – San Jacinto & San Jorge Basin



YET TO FIND



El futuro es de todos

Minenergía

PARÁMETROS	UNIDADES	Sinu Onshore				TOTAL
		Perdices	Juan de Acosta	Tolu	Sinu	
HC's Generados por la Fm San Jacinto	MBPE	33.540	3.218	2.645	100.554	139.956
HC's Disponibles por la Fm San Jacinto	MBPE	2.694	258	212	8.077	11.242
HC's Generados por la Fm Cansona	MBPE	78.192	7.645	6.802	238.920	331.559
HC's Disponibles por la Fm Cansona	MBPE	6.281	614	546	19.191	26.632
Total HC's Generados	MBPE	111.731	10.863	9.447	339.474	471.515
Recursos Disponibles	MBPE	8.975	873	759	27.268	37.874
Recursos Descubiertos (OOIP)	MBPE	0	0	0	16	16
Recursos No Descubiertos	MBPE	8.975	873	759	27.252	37.858
Probabilidad de Hallazgo	%	13%	13%	13%	13%	13%
Recursos Prospectivos (OOIP)	MBPE	1167	113	99	3543	4.922
Factor de Recobro	%	25%	25%	25%	25%	25%
Recursos Prospectivos Recuperables	MBPE	292	28	25	886	1.230

*FG= Foco Generador

Prospective Resources (OOIP) = 4.9 Bboe

PARÁMETROS	UNIDADES	San Jorge		TOTAL
		SJ Prof	Jobo-Tablon	
HC's Generados por la Fm Ciénaga de Oro	MBPE	31.499	4.044	35.543
HC's Disponibles por la Fm Ciénaga de Oro	MBPE	1.339	172	1.511
Total HC's Generados	MBPE	31.670		31.670
Recursos Disponibles	MBPE	1.511		1.511
Recursos Descubiertos (OOIP)	MBPE	134		134
Recursos No Descubiertos	MBPE	1.377		1.377
Probabilidad de Hallazgo	%	13%		13%
Recursos Prospectivos (OOIP)	MBPE	179	179	179
Factor de Recobro	%	25%		25%
Recursos Prospectivos Recuperables	MBPE	45		45

*FG= Foco Generador

Prospective Resources (OOIP) = 0.17 Bboe

Conclusions



Thanks

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