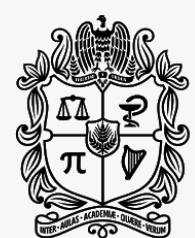


COLOMBIA ROUND 2021



UNIVERSIDAD
NACIONAL
DE COLOMBIA



Uptc
Universidad Pedagógica y
Tecnológica de Colombia



ACOGGP
ASOCIACIÓN COLOMBIANA DE GEÓLOGOS Y GEOFÍSICOS DEL PETRÓLEO



AAPG



EAGE

COLOMBIA ROUND 2021 MIDDLE MAGDALENA VALLEY BASIN EXPLORATORY OPPORTUNITIES E & P s

14/05/2021

Location

Infrastructure

Geological Framework

Database

Well Summary

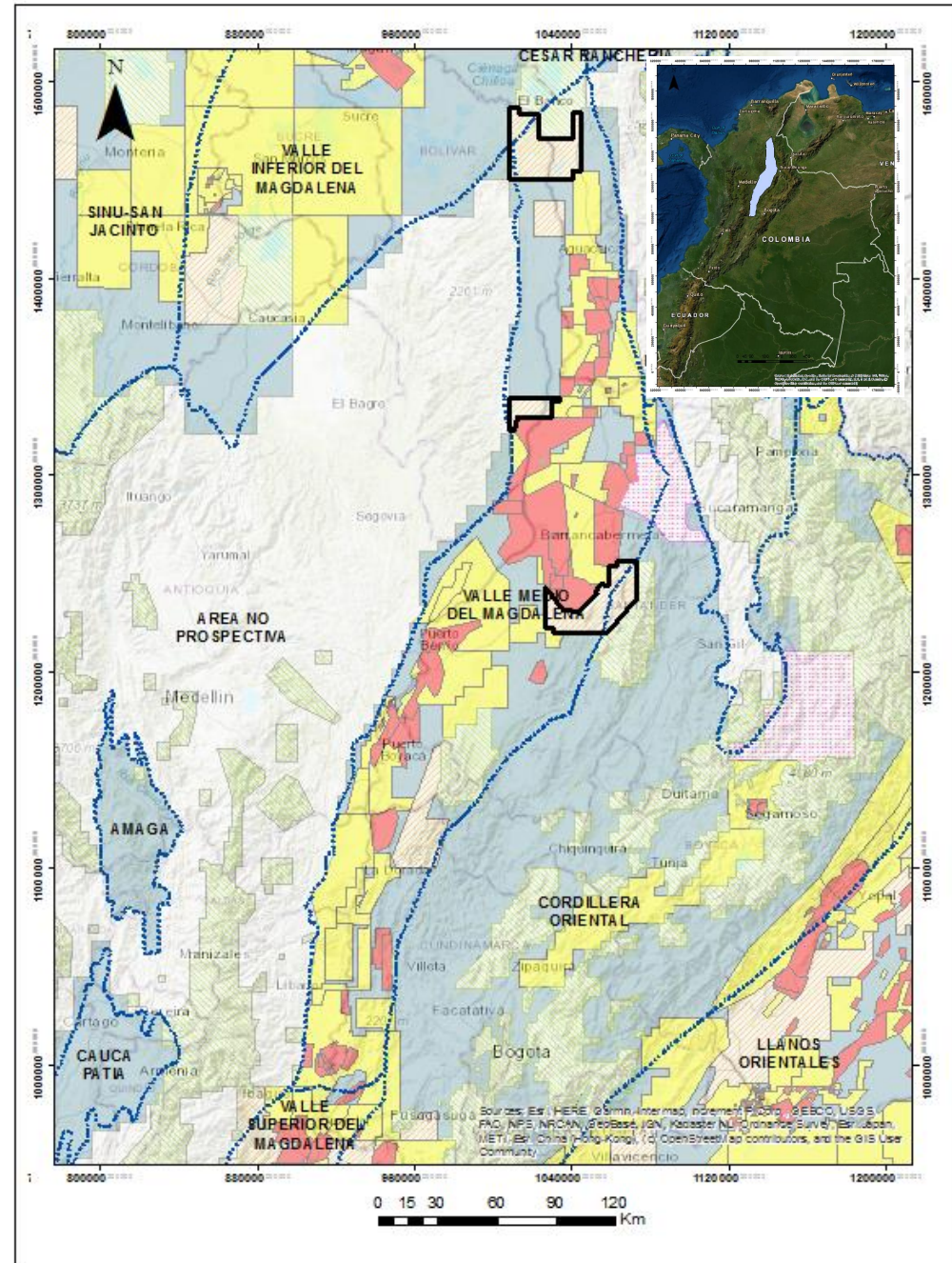
Seismic Interpretation

Prospectivity

Conclusions

INTRODUCTION

LOCATION

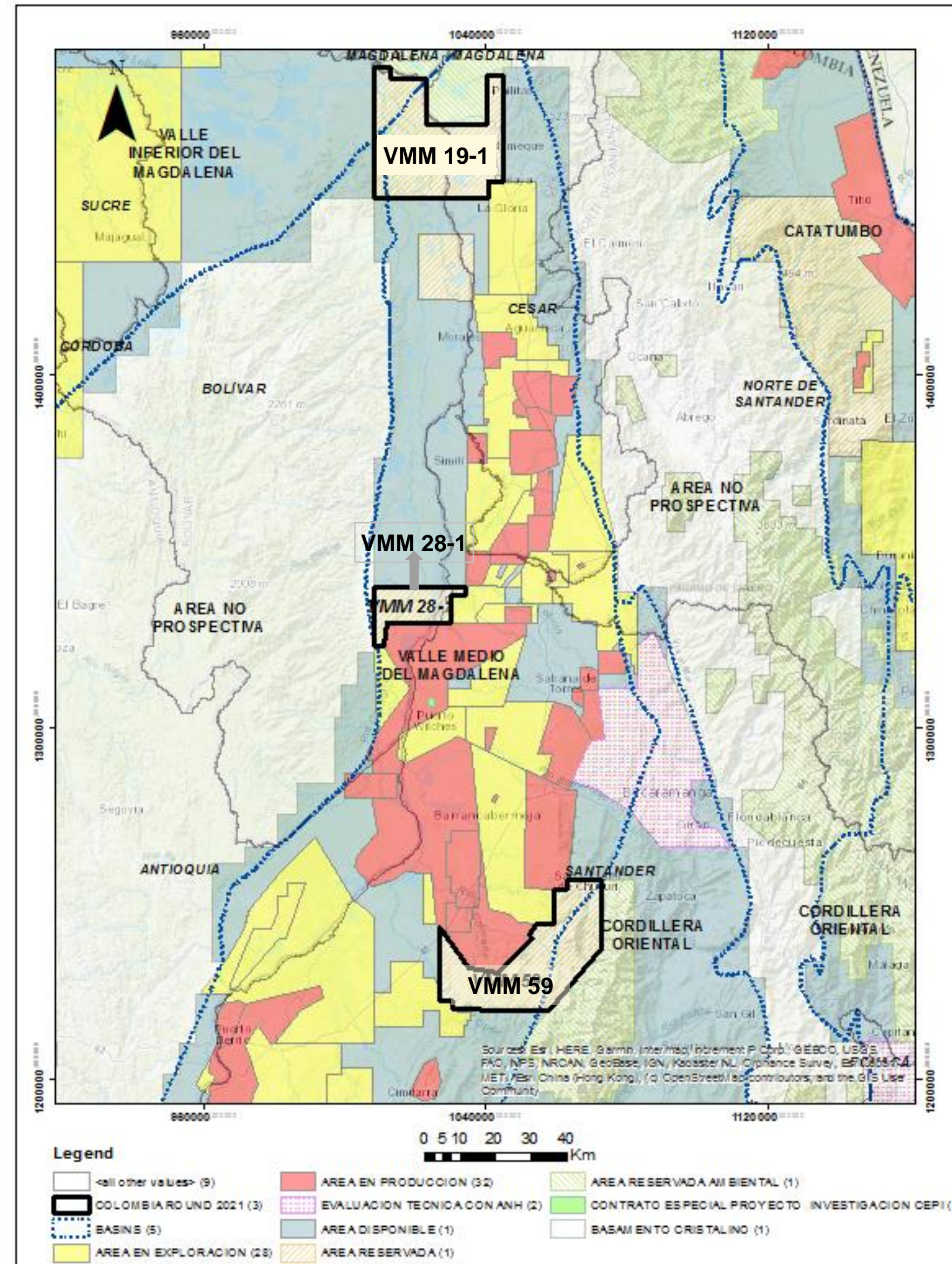


Block Areas

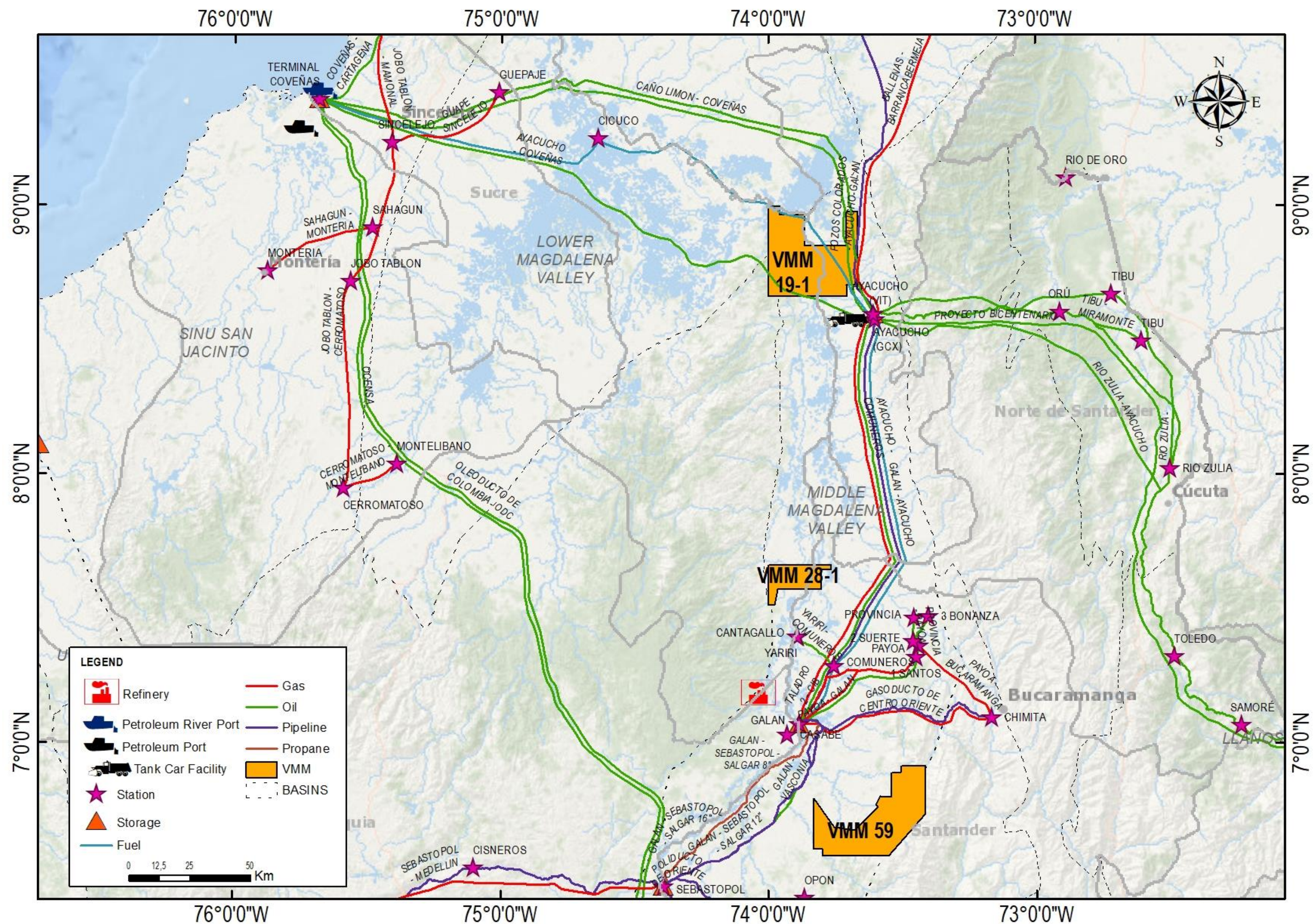
- **VMM 19-1** (100,673 Ha)
- Bolívar, Cesar, Magdalena departments

- **VMM 28-1** (24,600 Ha)
- Bolívar and Santander departments

- **VMM 59** (89,140 Ha)
- Santander department



INFRASTRUCTURE



Main Infrastructure nearby

Oil Pipeline:

- Caño Limón – Coveñas
- Ayacucho – Coveñas
- Proyecto Bicentenario
- Oleoducto de Colombia – ODC
- Galán - Ayacucho

Pipeline:

- Galán - Ayacucho
- Poliducto de Oriente

Gas Pipeline:

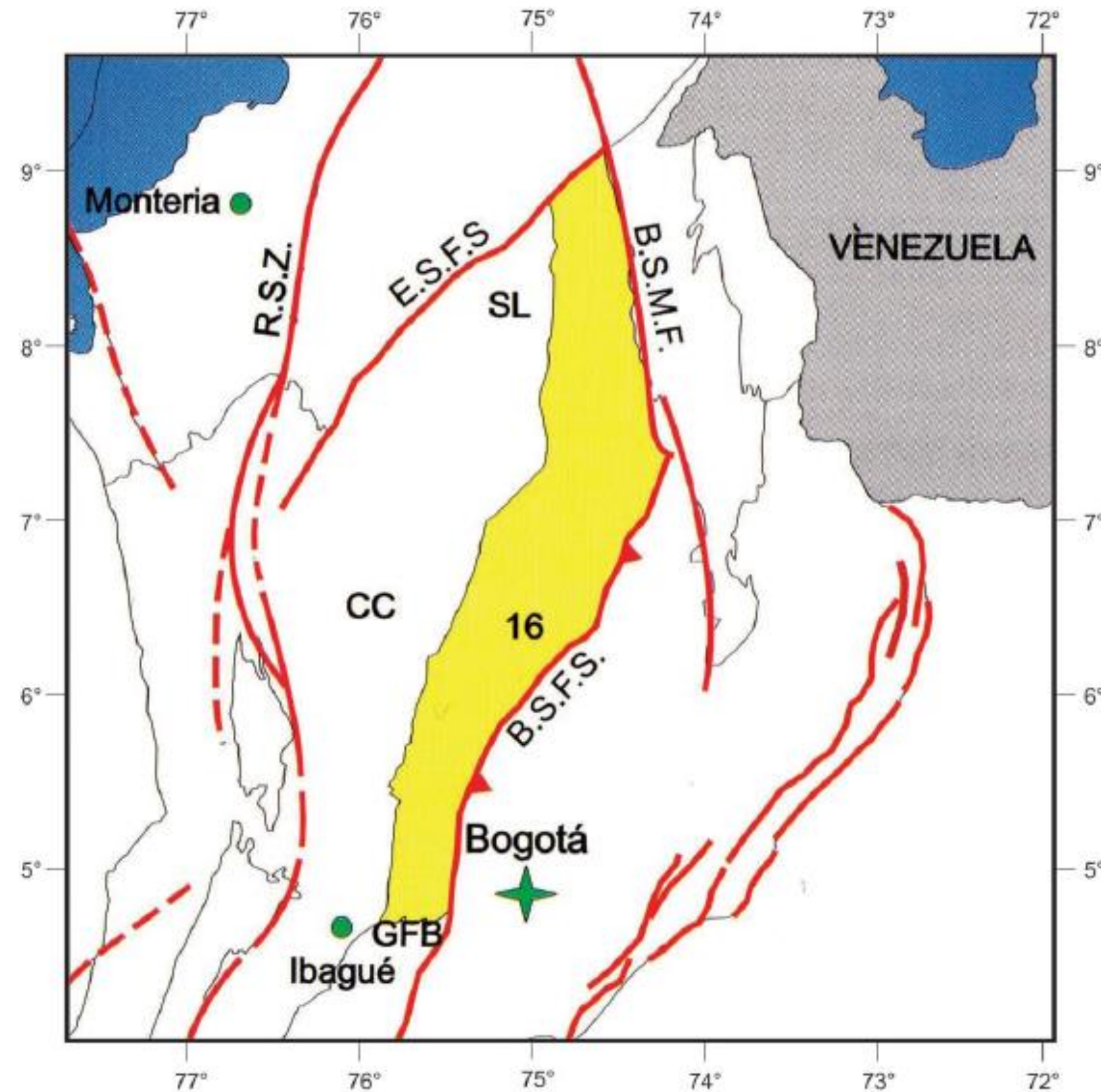
- Galán - Ayacucho
- Gasoducto de Centro Oriente

GEOLOGICAL FRAMEWORK

VMM Basin

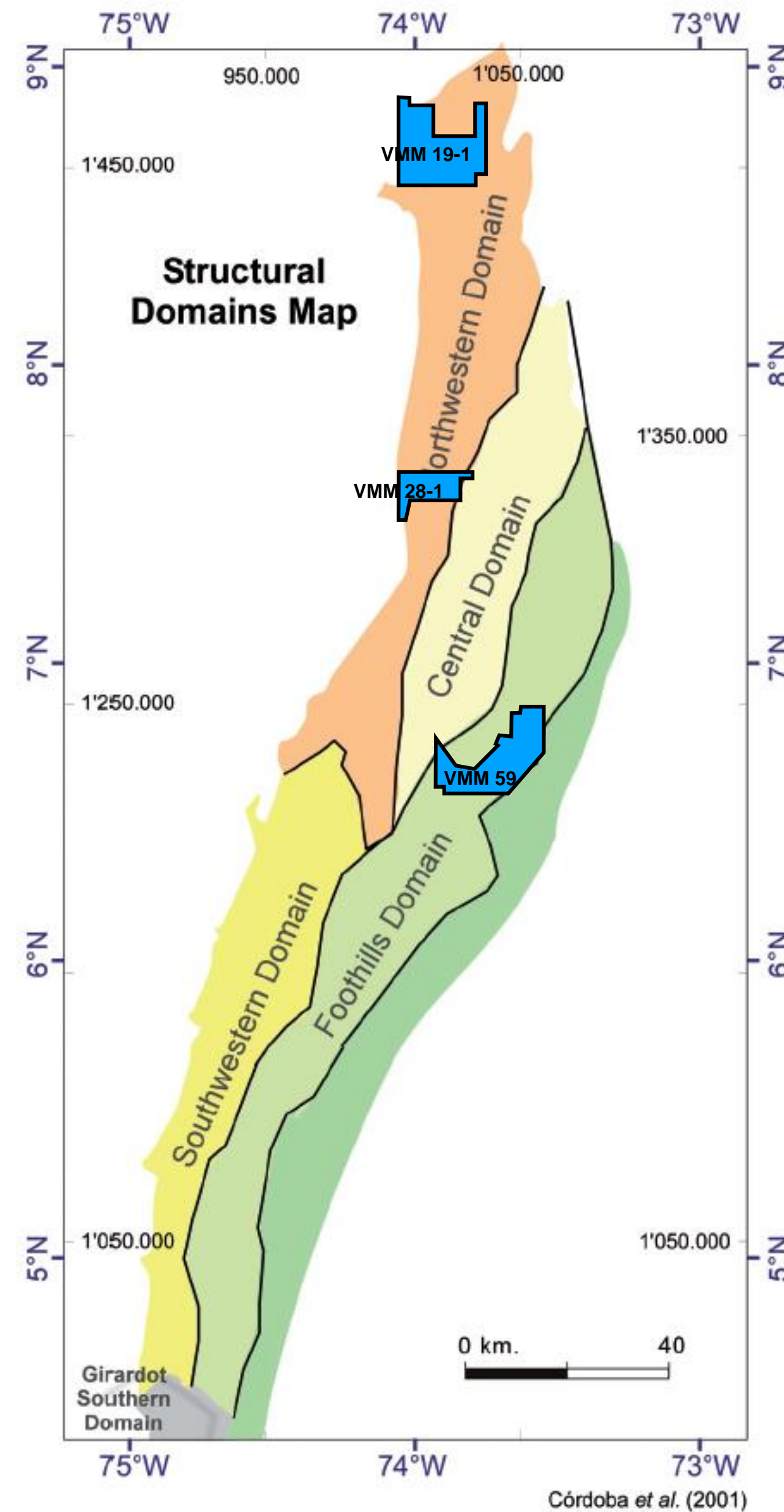
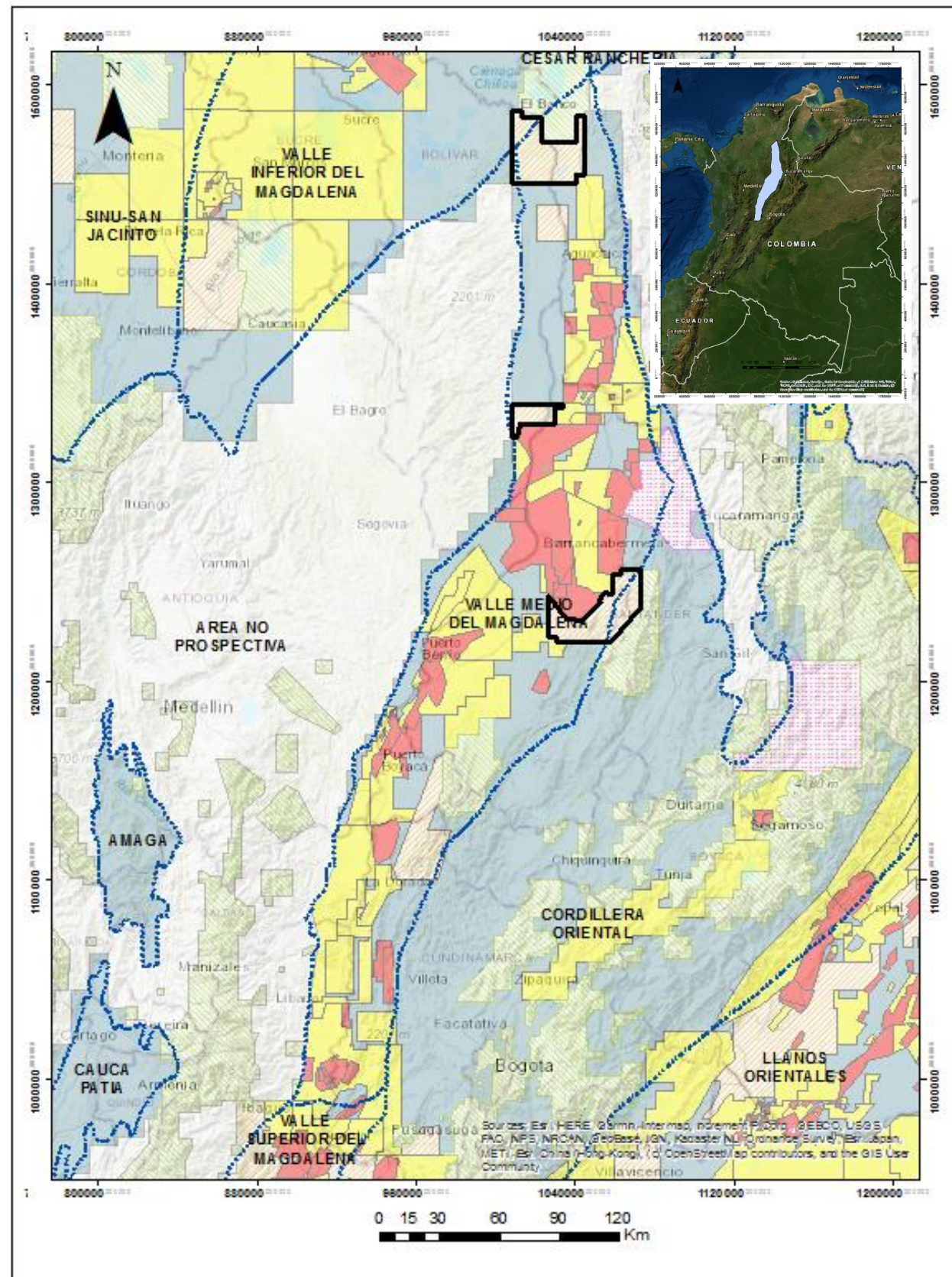


Boundaries



- North: Espiríto Santo Fault System (E.S.F.S.).
- Northeast: Bucaramanga – Santa Marta fault system (B.S.M.F.).
- Southeast: Bituima and La Salina fault systems (B.S.F.S.).
- South: Girardot fold belt (GFB).
- West: Onlap of Neogene sediments over the Serranía de San Lucas (SL) and Central Cordillera (CC) basement.

Structural Domains



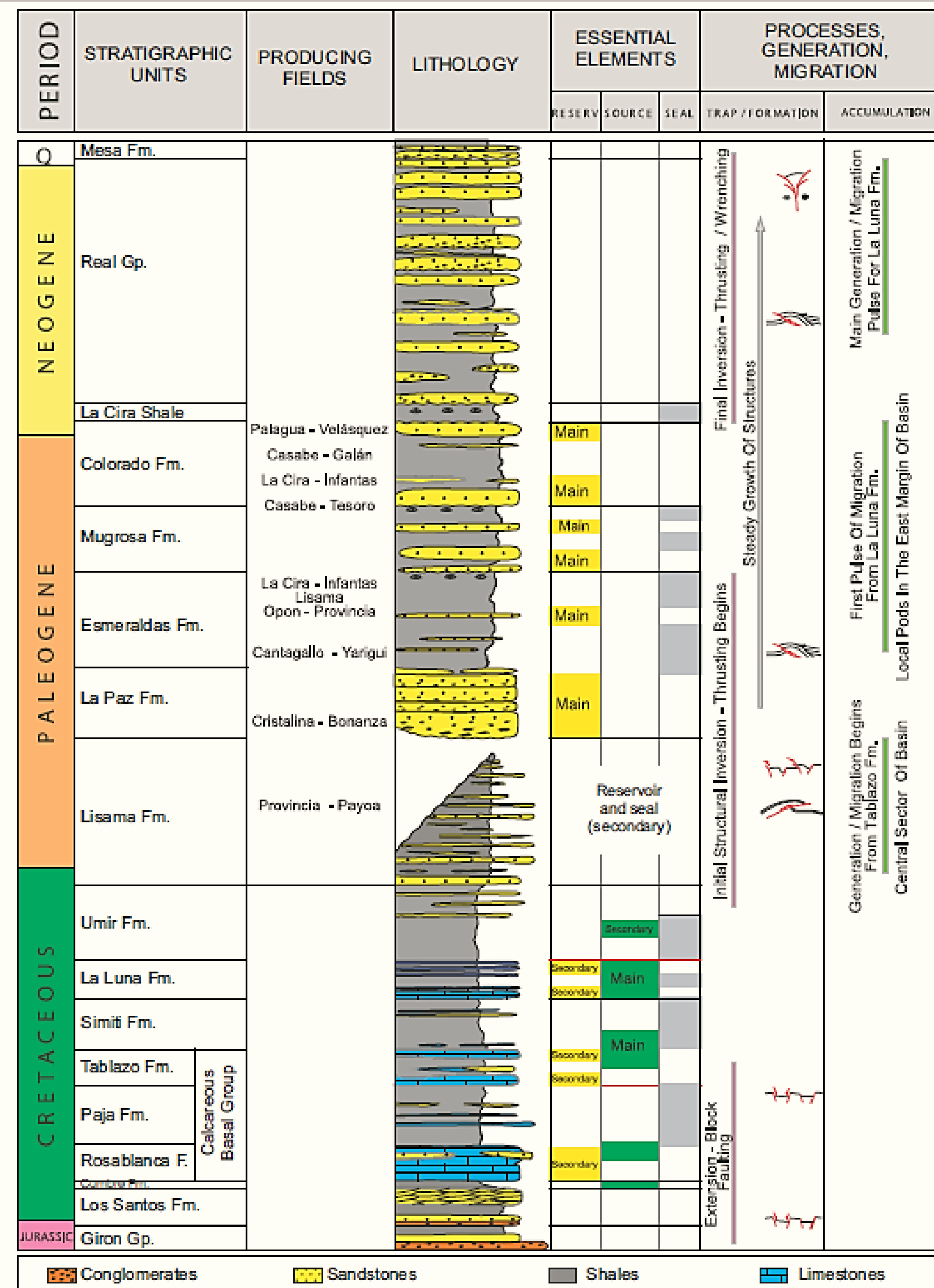
Structural domains of the MMB (From Córdoba et al., 2001 – ANH, 2011):

- **VMM 19-1:** Northwestern domain. Characterized by a wide, east-dipping homocline with NNE-trending transtensional normal faults with dextral oblique displacement and fault planes dipping toward the ESE.
- **VMM 28-1:** North – Western domain.
- **VMM-59:** Central domain and Foothills Domain.

The Central MMB domain is characterized by opposite vergence of thrust and fold belts forming a structural convergence zone.

The Eastern Cordillera foothills domain is characterized by west-vergent thrusts and folds.

STRATIGRAPHY

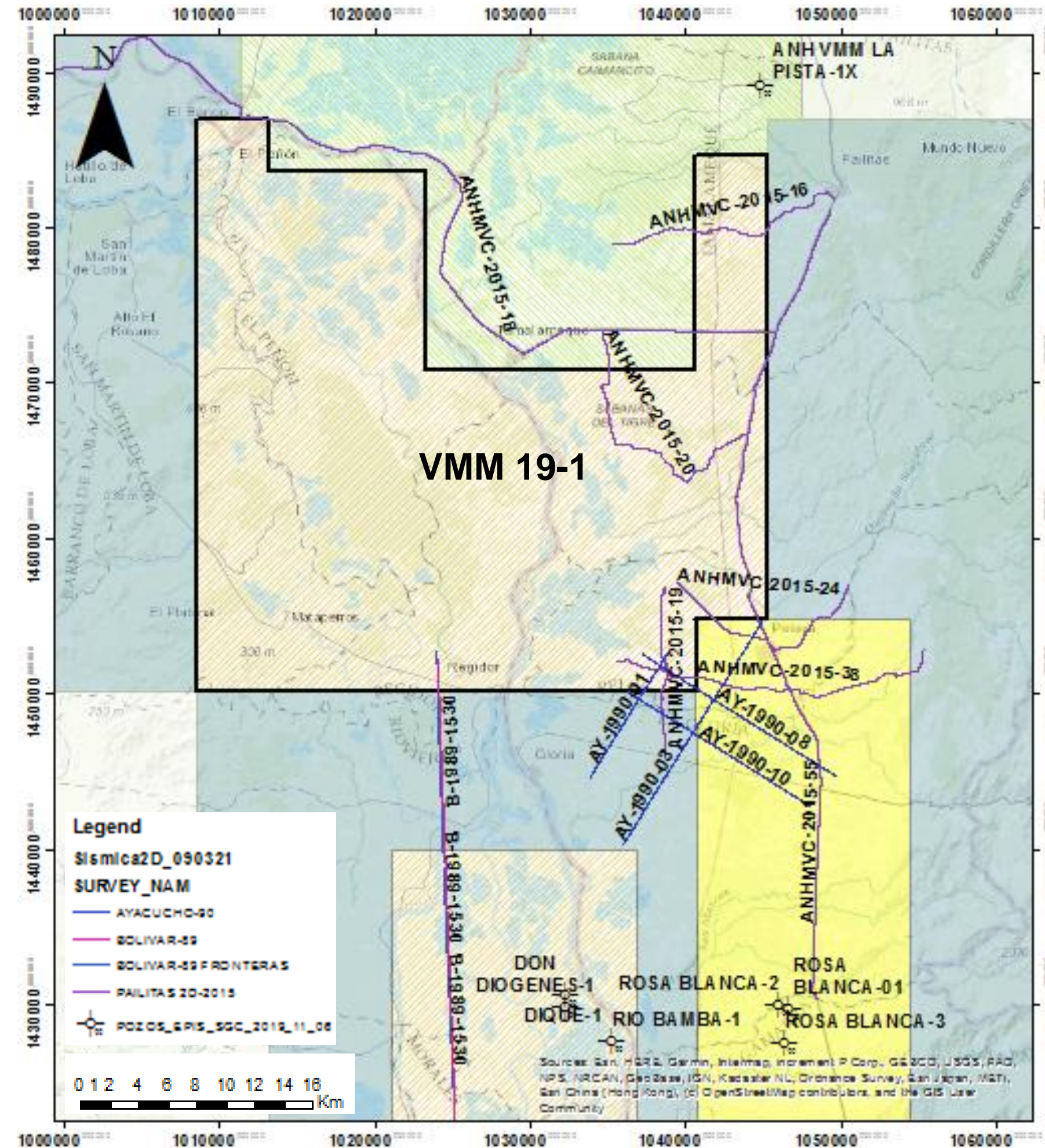
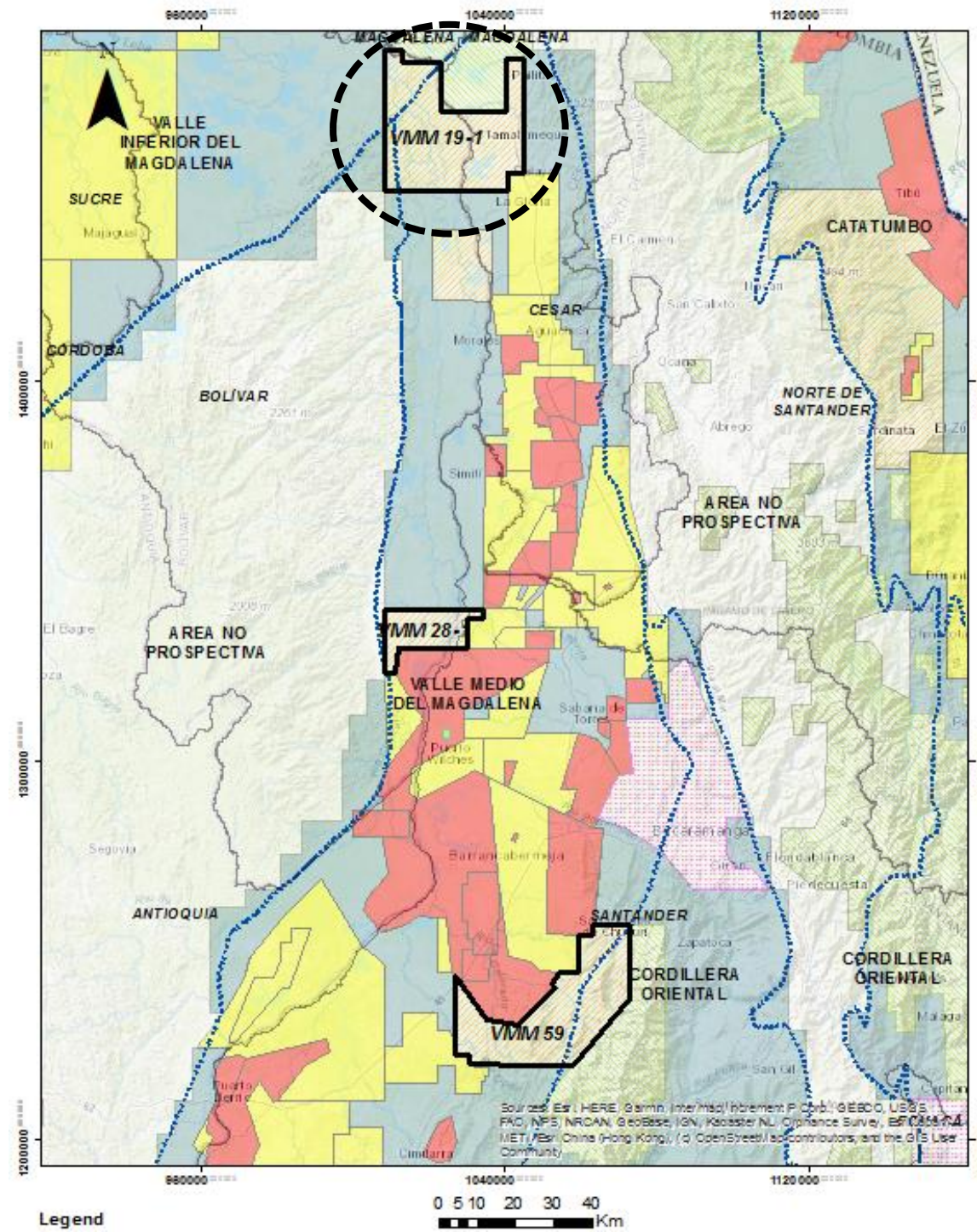


From Barrero et al.. 2007

- Paleogene fluvial channel sandstones of Esmeraldas, La Paz, Mugrosa and Colorado Formations have been identified as the main reservoirs in the area.
- La Luna Formation is the main source in the area, but Cretaceous limestones and shales of the Simití-Tablazo Formations are also source rocks in the basin. TOC are high (1-6%) and organic matter is mainly type II, Ro reaches values of 0.6 -1.2 %.

DATABASE

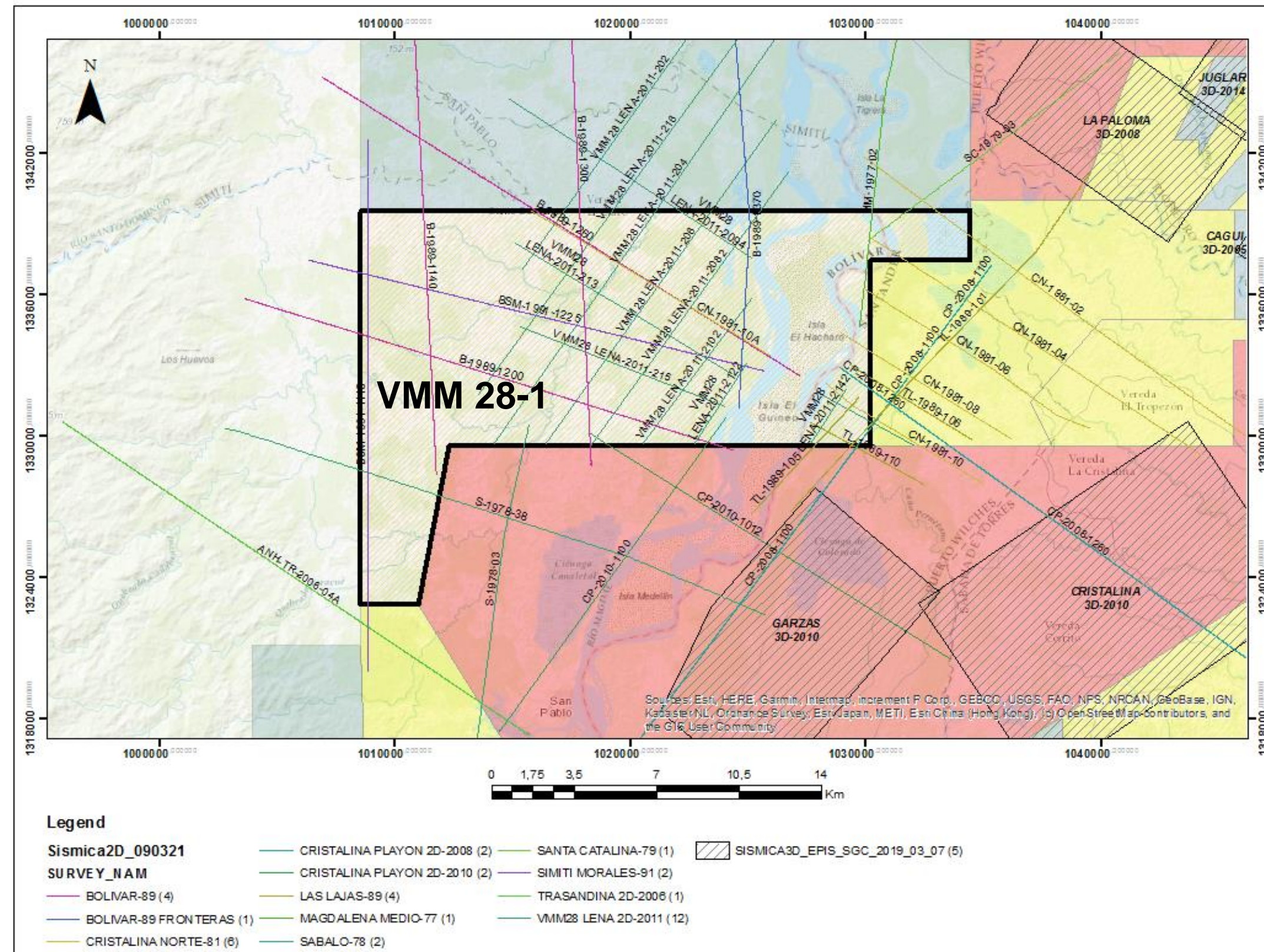
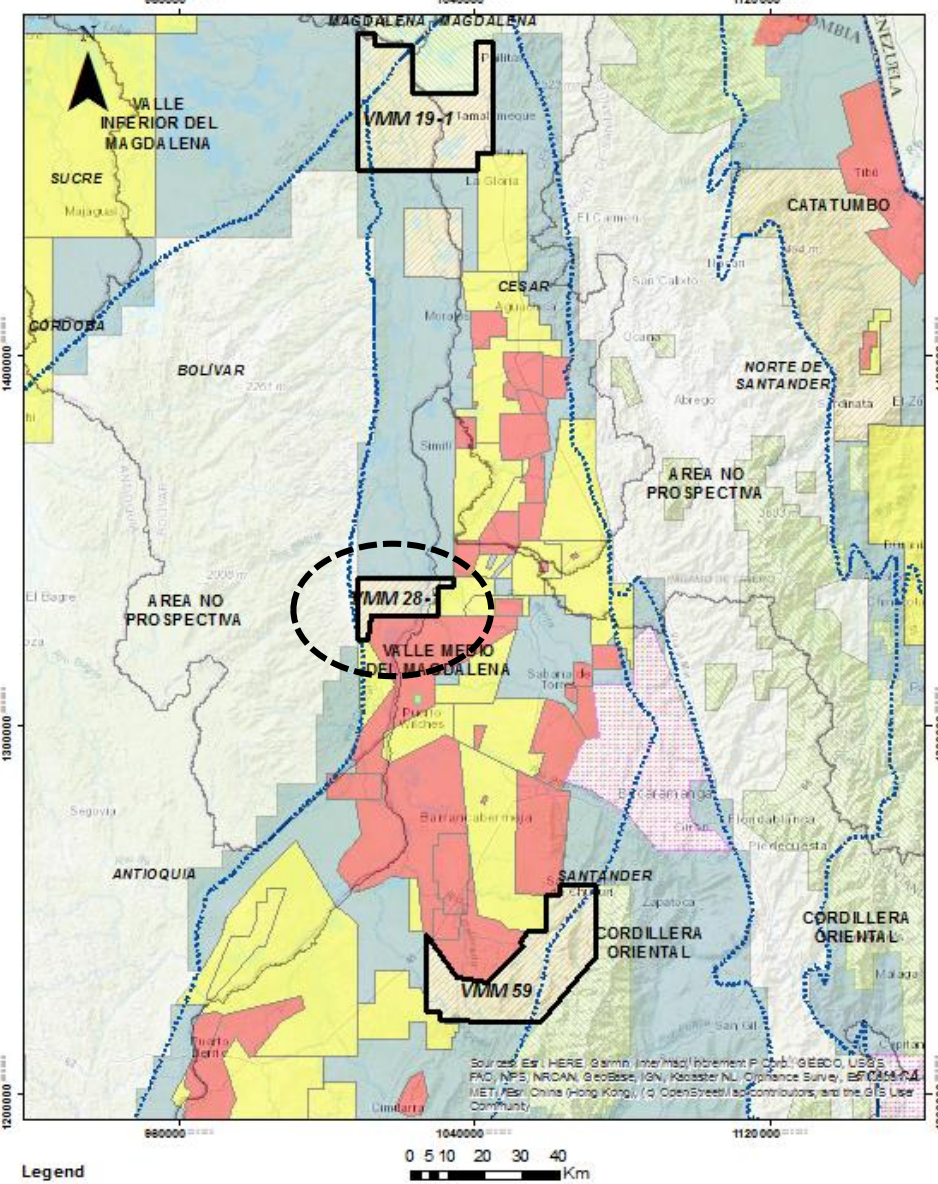
VMM 19-1: Seismic



SEISMIC

- **2D Seismic Surveys: (4 surveys)**
- Pailitas 2D-2015 (60,23 Km)
- Ayacucho-90 (7,26 Km)
- Bolívar-89 Fronteras (2,69 Km)
- Bolívar-89 (2,28 Km)
- **Total length in the area: 72,46 Km**

VMM 28-1: Seismic



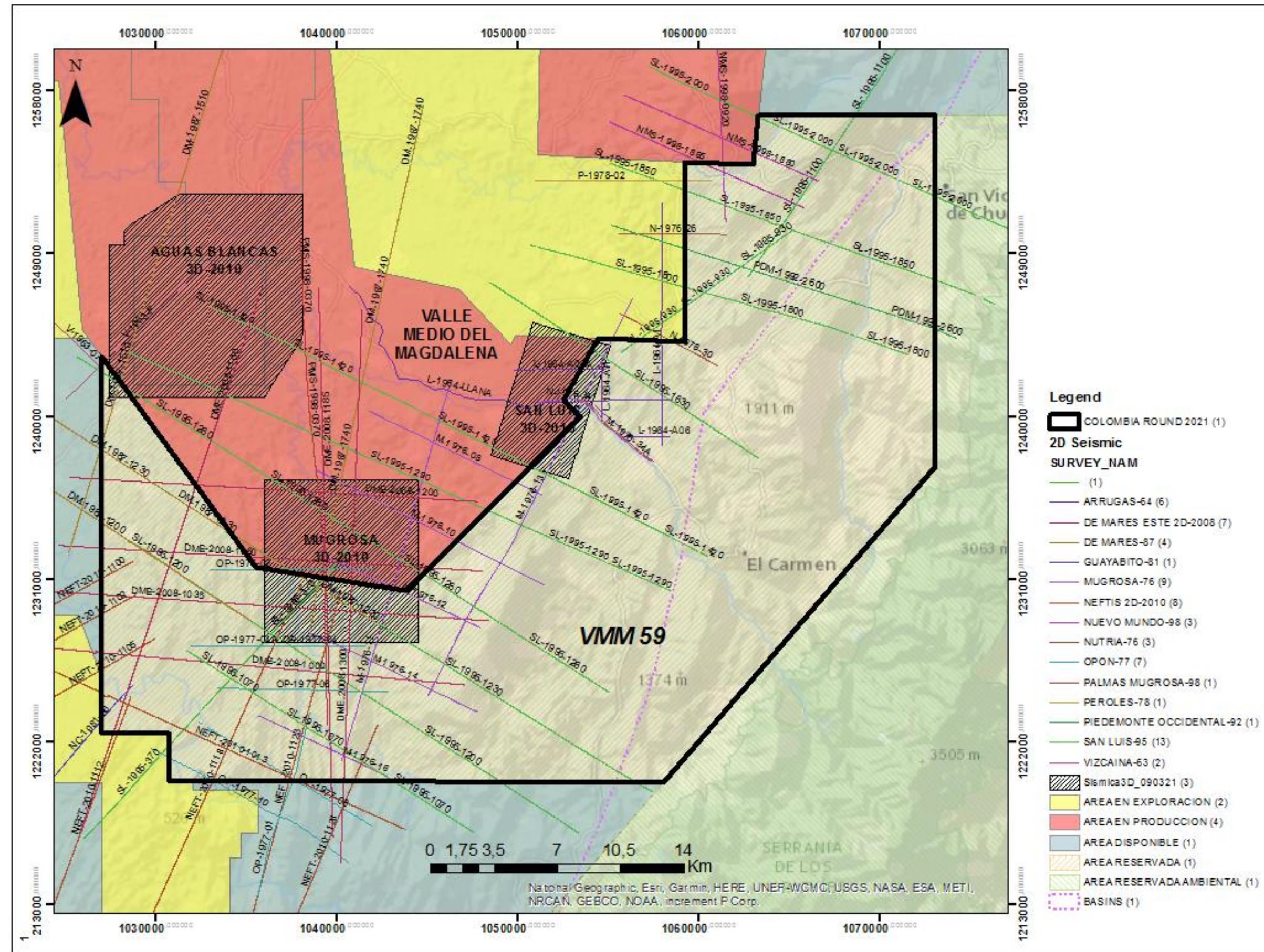
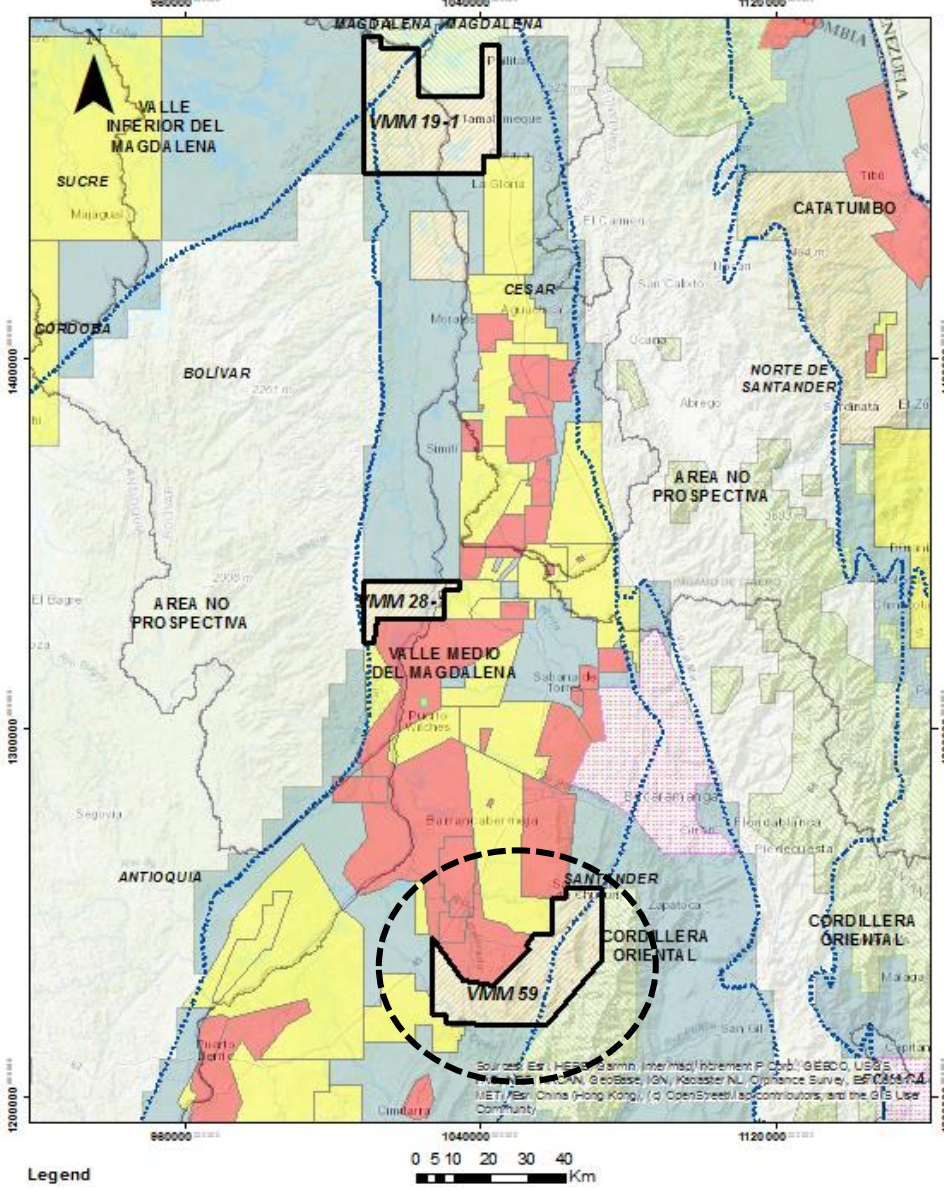
SEISMIC

2D Seismic Surveys (11 surveys):

- Bolívar-89 (50 Km)
- Bolívar-89 Fronteras (8 Km)
- Cristalina Norte-81 (20 Km)
- Cristalina Playón-2008 (3 Km)
- Cristalina Playón-2010 (3 Km)
- Las Lajas-89 (7 Km)
- Magdalena Medio-77 (5 Km)
- Sábalo-78 (4 Km)
- Santa Catalina-79 (2 Km)
- Simití Morales-91 (34 Km)
- VMM28 Lena 2D-2011 (90 Km)

■ **Total Length in the Area:
227 Km**

VMM-59: Seismic

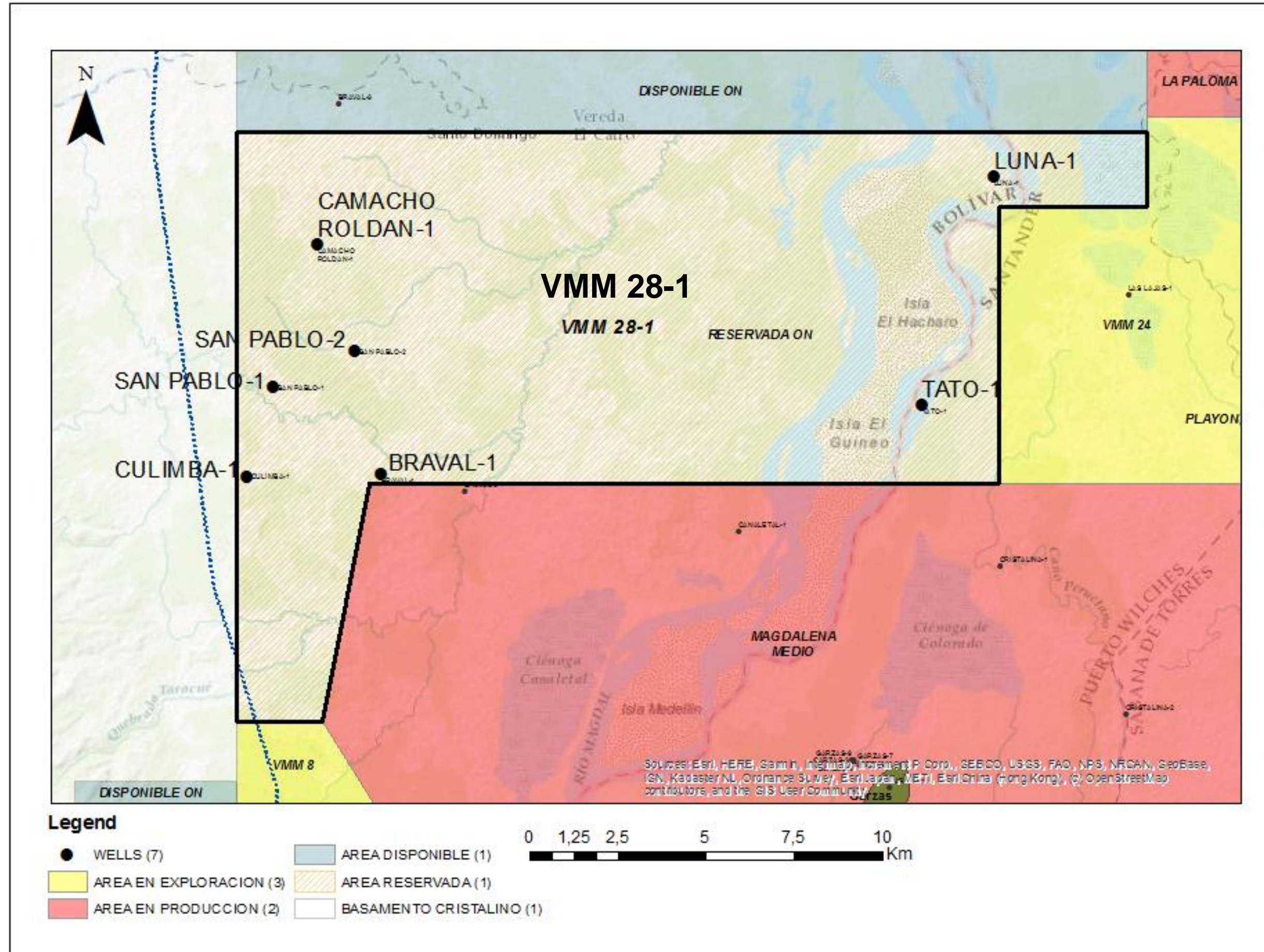
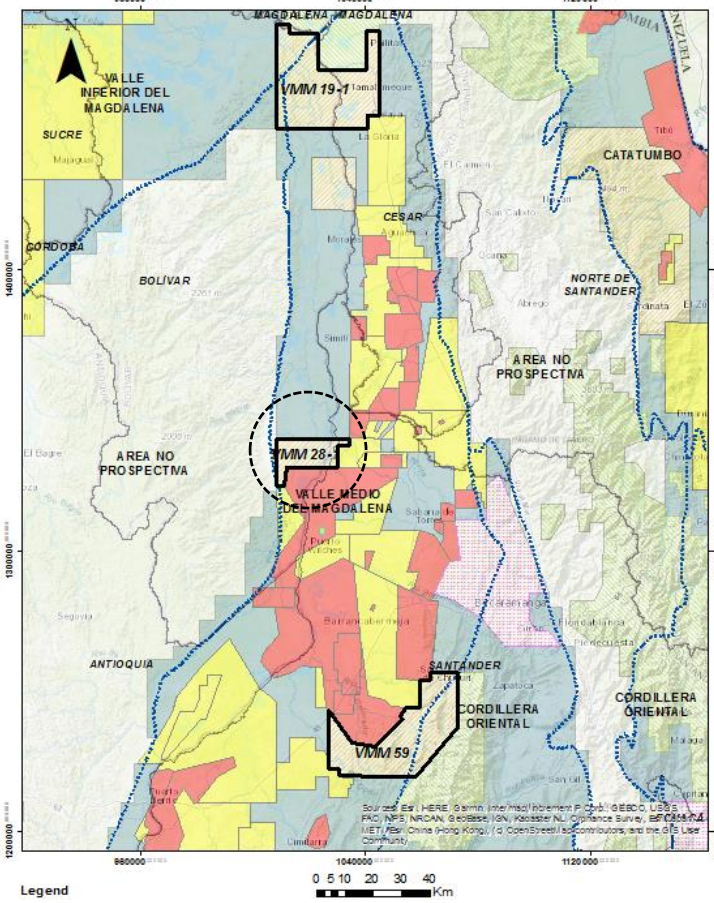


SURVEY	NUMBER OF SEISMIC LINES	LENGTH (Km)	LENGTH IN AREA (Km)
DE MARES ESTE 2D-2008	7	188,5	95
DE MARES-87	4	117,34	29,78
GUAYABITO-81	1	37,79	3
MUGROSA-76	9	110,51	65,89
NEFTIS 2D-2010	8	198,78	48,9
NUEVO MUNDO-98	3	42,1	13,23
NUTRIA-76	3	19,78	11,52
PALMAS MUGROSA-98	1	26,78	8
PEROLES-78	1	9,80	2
PIEDEMONT OCCIDENTAL-92	1	19,88	14
SAN LUIS-95	13	308,43	175,78
TOTAL	156	1151	510

3D Seismic:

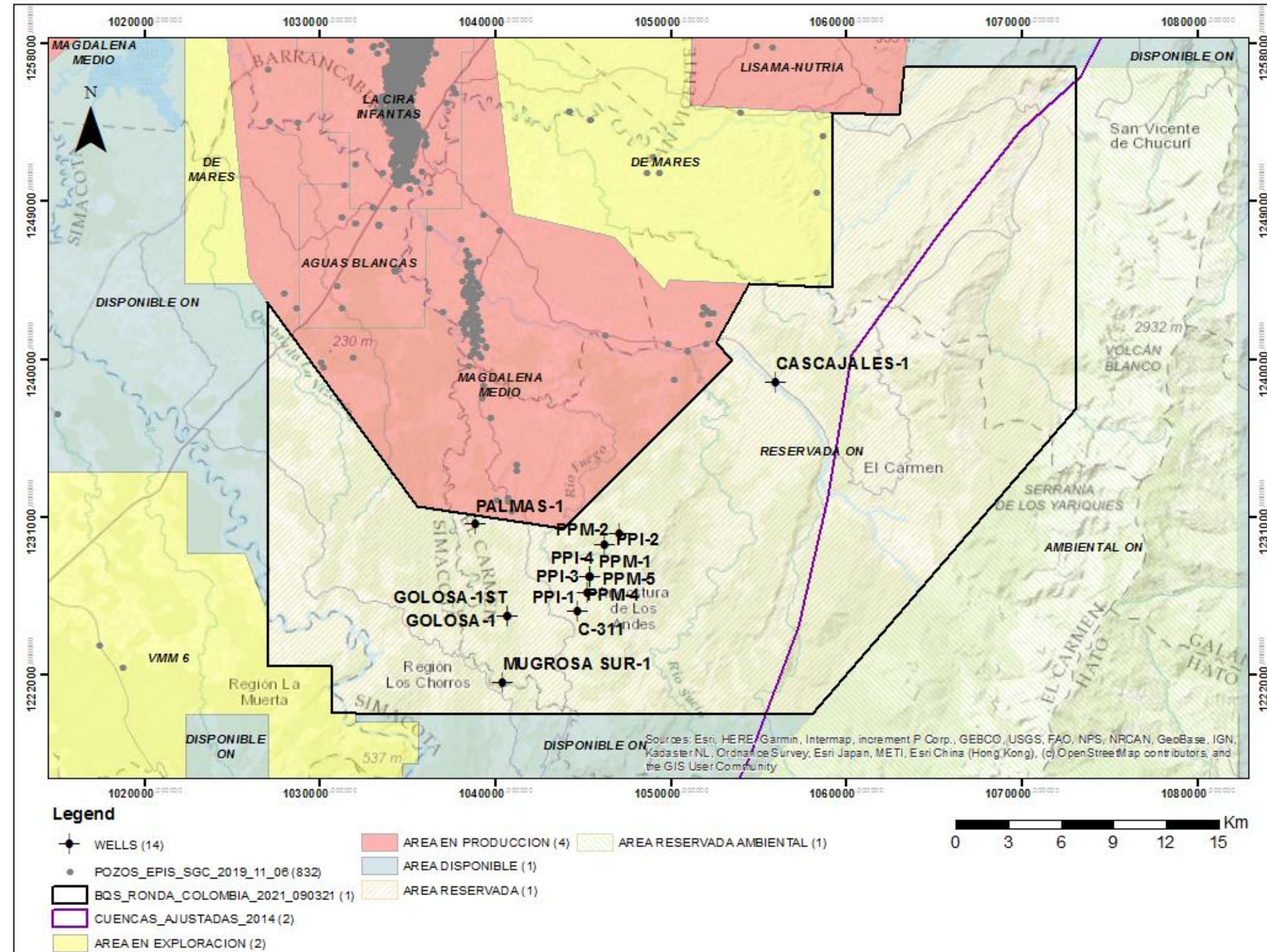
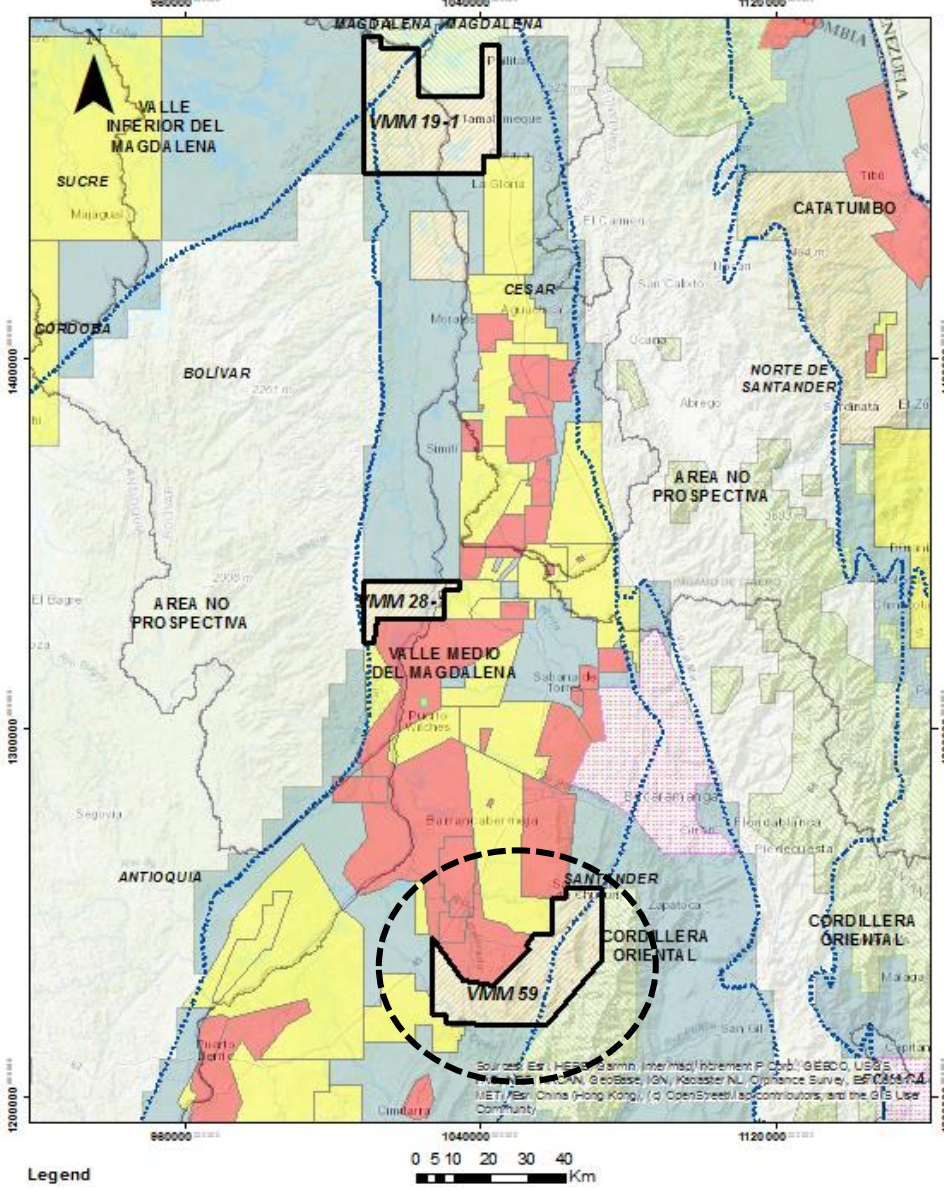
SURVEY	AREA (Km ²)	AREA IN BLOCK (Km ²)
MUGROSA 3D-2010	76,44	29
SAN LUIS 3D-2010	34,62	9

VMM 28-1: Wells



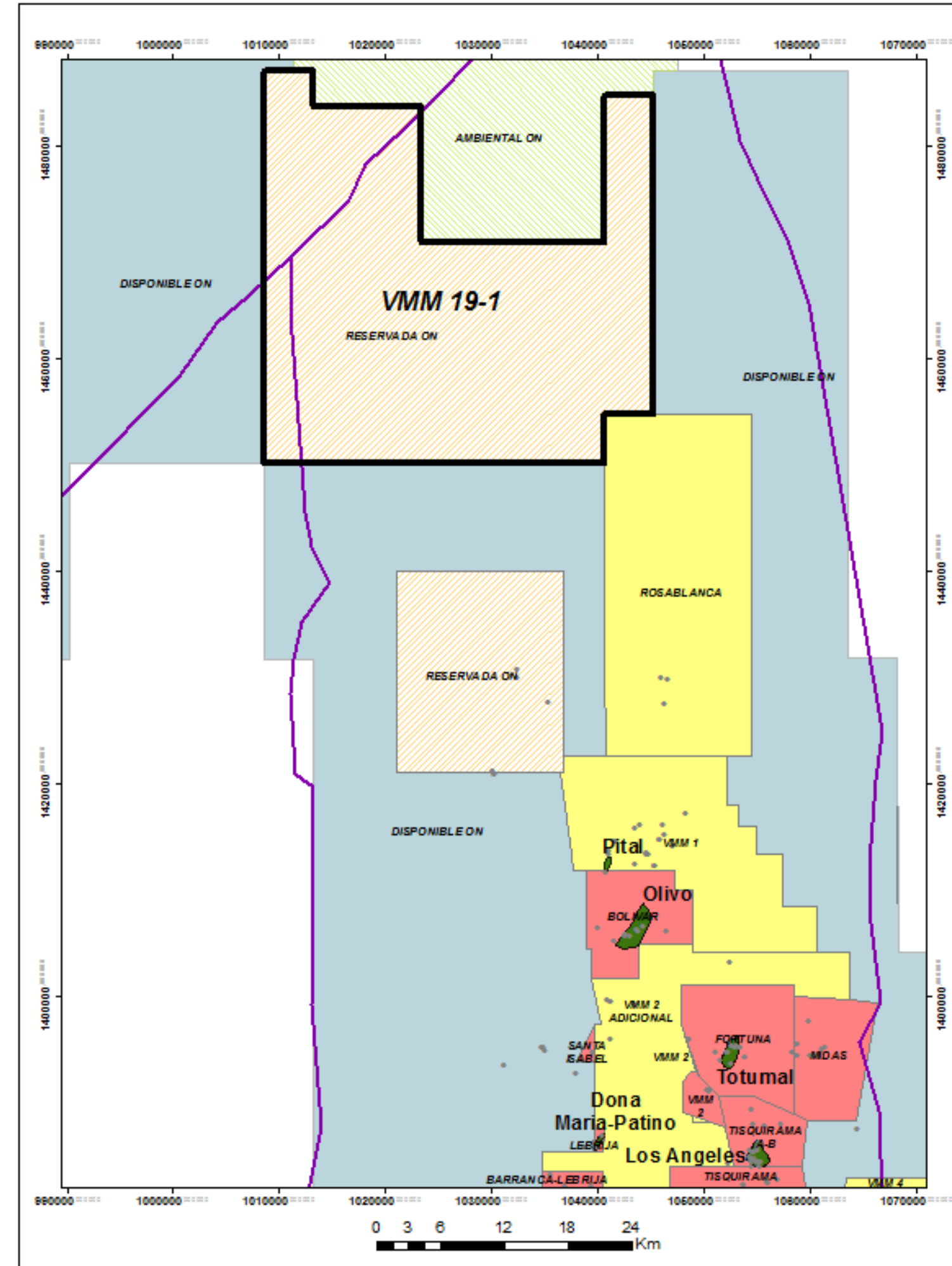
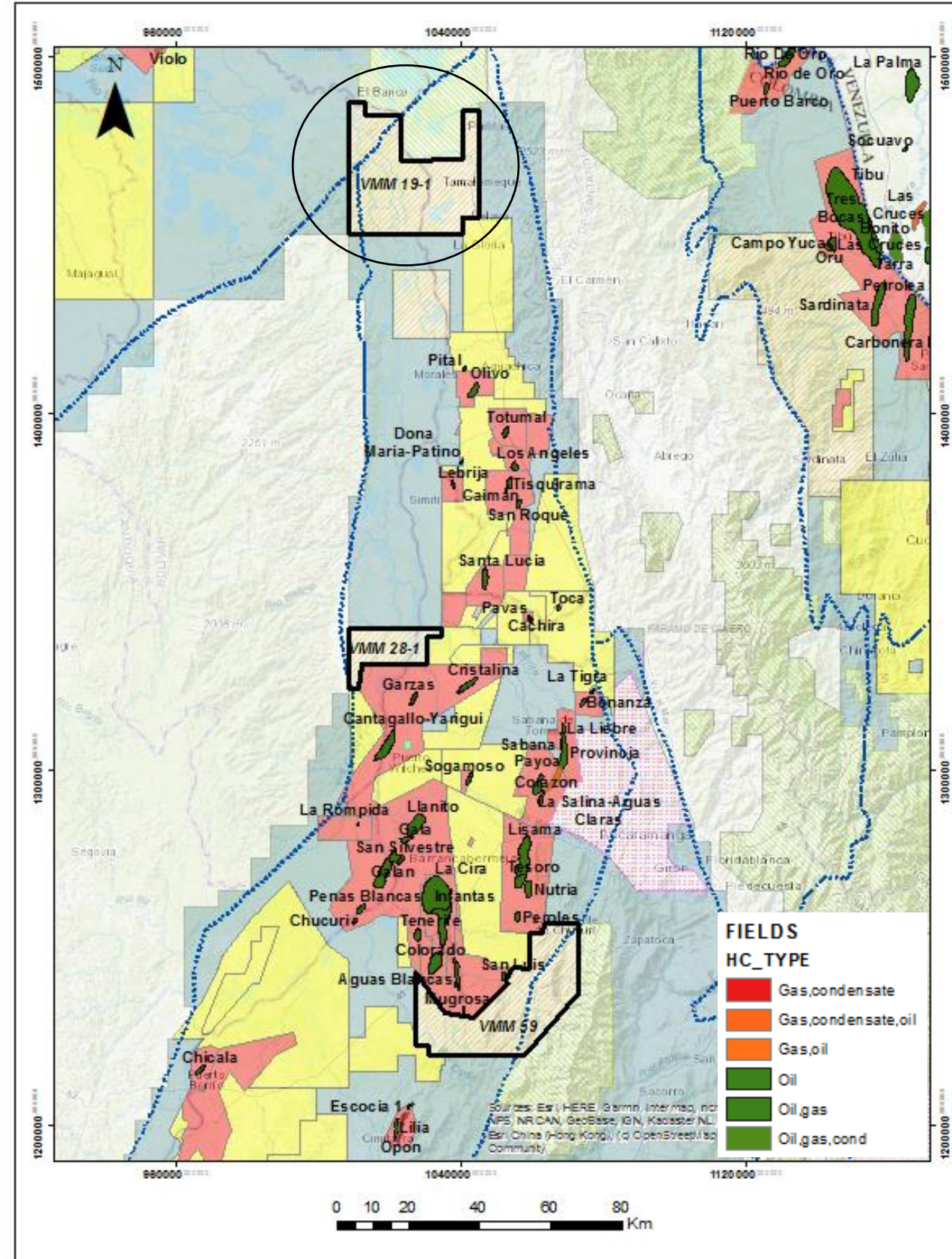
WELL NAME	MD (ft)	DATE	OPERATING COMPANY
BRAVAL-1	2812	1941	SIERRA NEVADA S.A.
CAMACHO ROLDAN-1	1457	1942	RICHMOND COLOMBIAN COMPANY
CULIMBA-1	2069	1942	SHELL CONDOR S.A.
SAN PABLO-1	467	1942	SHELL CONDOR S.A.
SAN PABLO-2	1464	1942	RICHMOND COLOMBIAN COMPANY
LUNA-1	8500	1957	INTERCOL
TATO-1	7892	1962	INTERCOL

VMM 59: Wells



WELL NAME	MD (ft)	DATE	COMPANY
CASCAJALES-1	11400	1976	ECOPETROL S.A.
MUGROSA SUR-1	5407	1977	ECOPETROL S.A.
PALMAS-1	11564	1977	ECOPETROL S.A.
GOLOSA-1	3530	2013	ECOPETROL S.A.
GOLOSA-1ST	3265	2014	ECOPETROL S.A.
PPI-1	695	1996	ECOCARBON
PPI-2	492	1996	ECOCARBON
PPI-3	774	1996	ECOCARBON
PPI-4	433	1996	ECOCARBON
PPM-1	544,6	1996	ECOCARBON
PPM-2	941,6	1996	ECOCARBON
PPM-5	922	1996	ECOCARBON
C-311	580,7	1988	CARBOCOL

VMM 19-1 - NEAR FIELDS



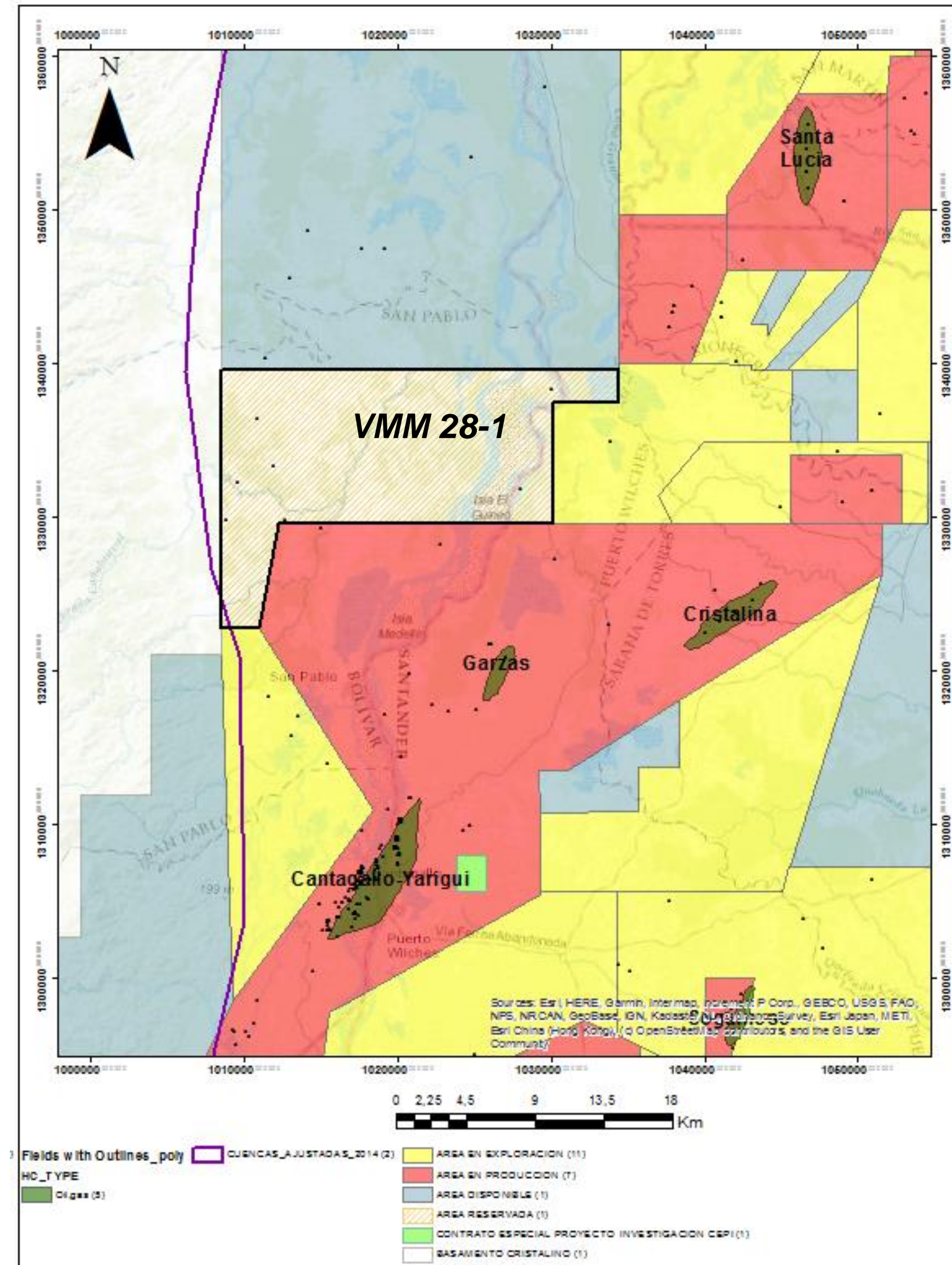
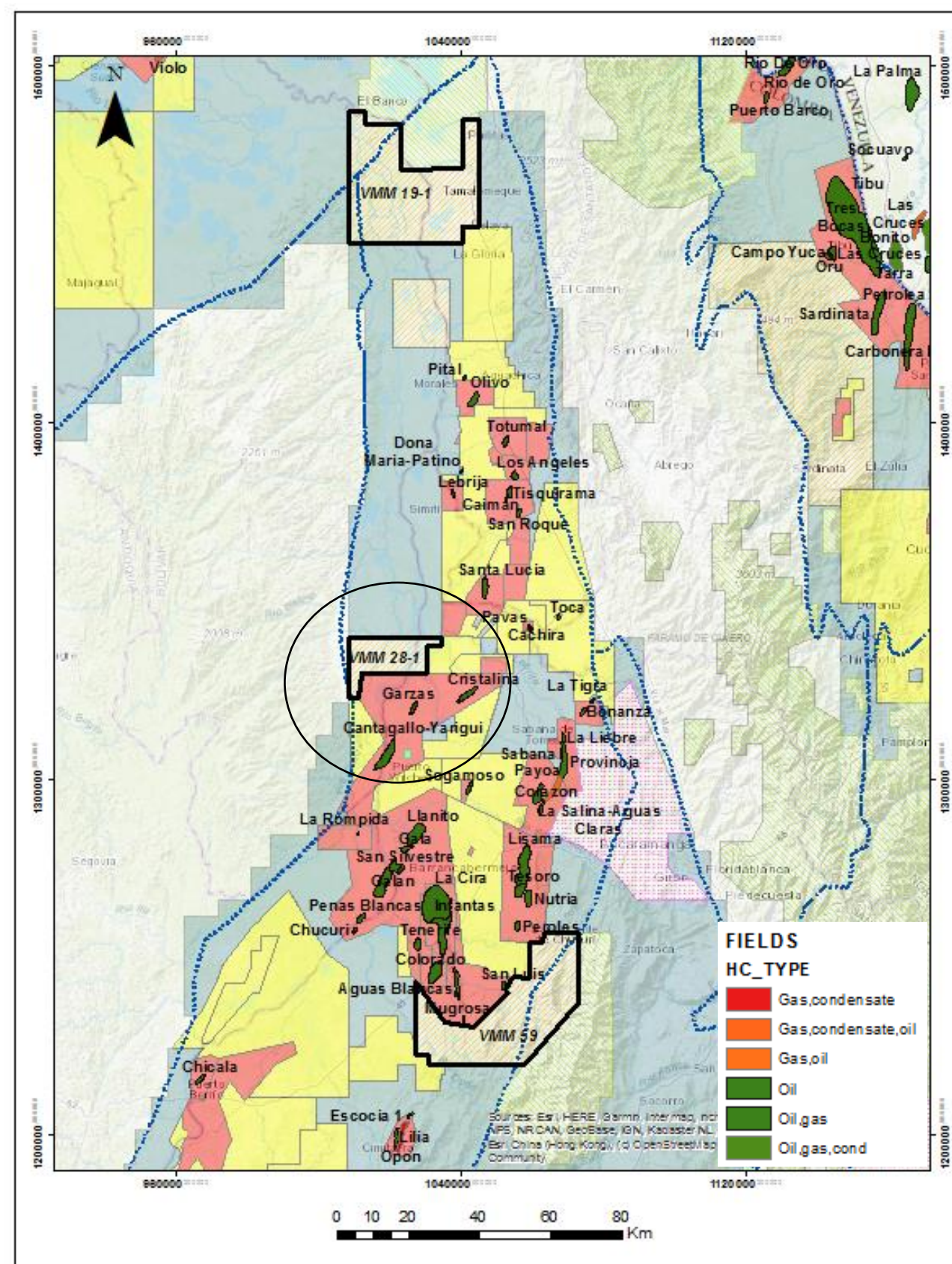
Producing Fields

FIELD	CONTRACT	DISCOVERY YEAR	DISC COMPANY	PROD_STAT	OIL_IN_PLC mmbo (2014)	OIL_CP mmbo (2014)	C_GAS MMSCF (2014)
Pital	VMM 1	1953	Tropical Oil Co	Abd, no improved recv	0,2	0	0
Olivo (Buturama wells)	Bolívar	1953	Int'l Petroleum Co (Intercol)	Prod, improved recov	60	1,864	3798
Totumal	Fortuna	1951	Int'l Petroleum Co (Intercol)	Producing	7,5	0,926	304

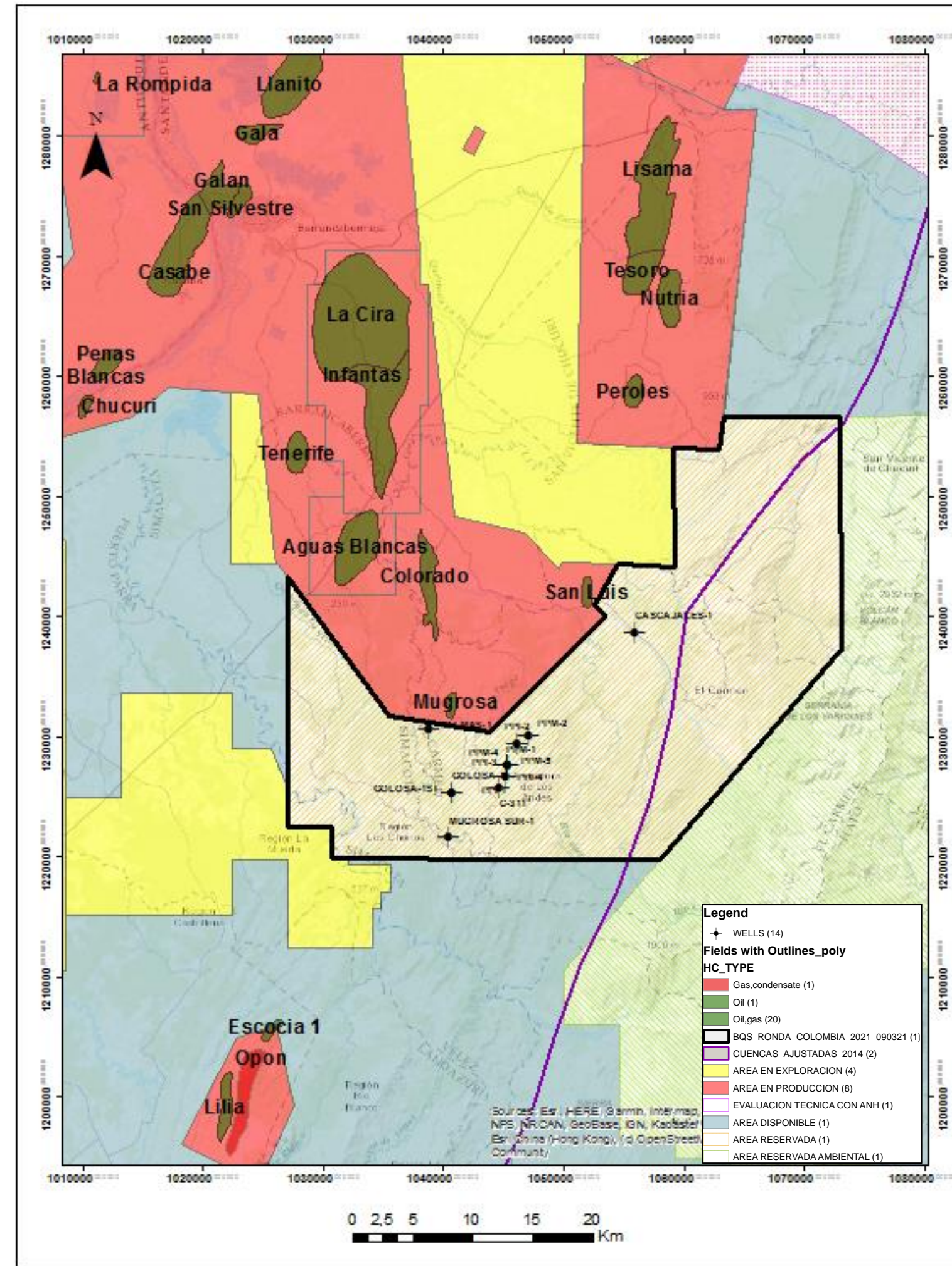
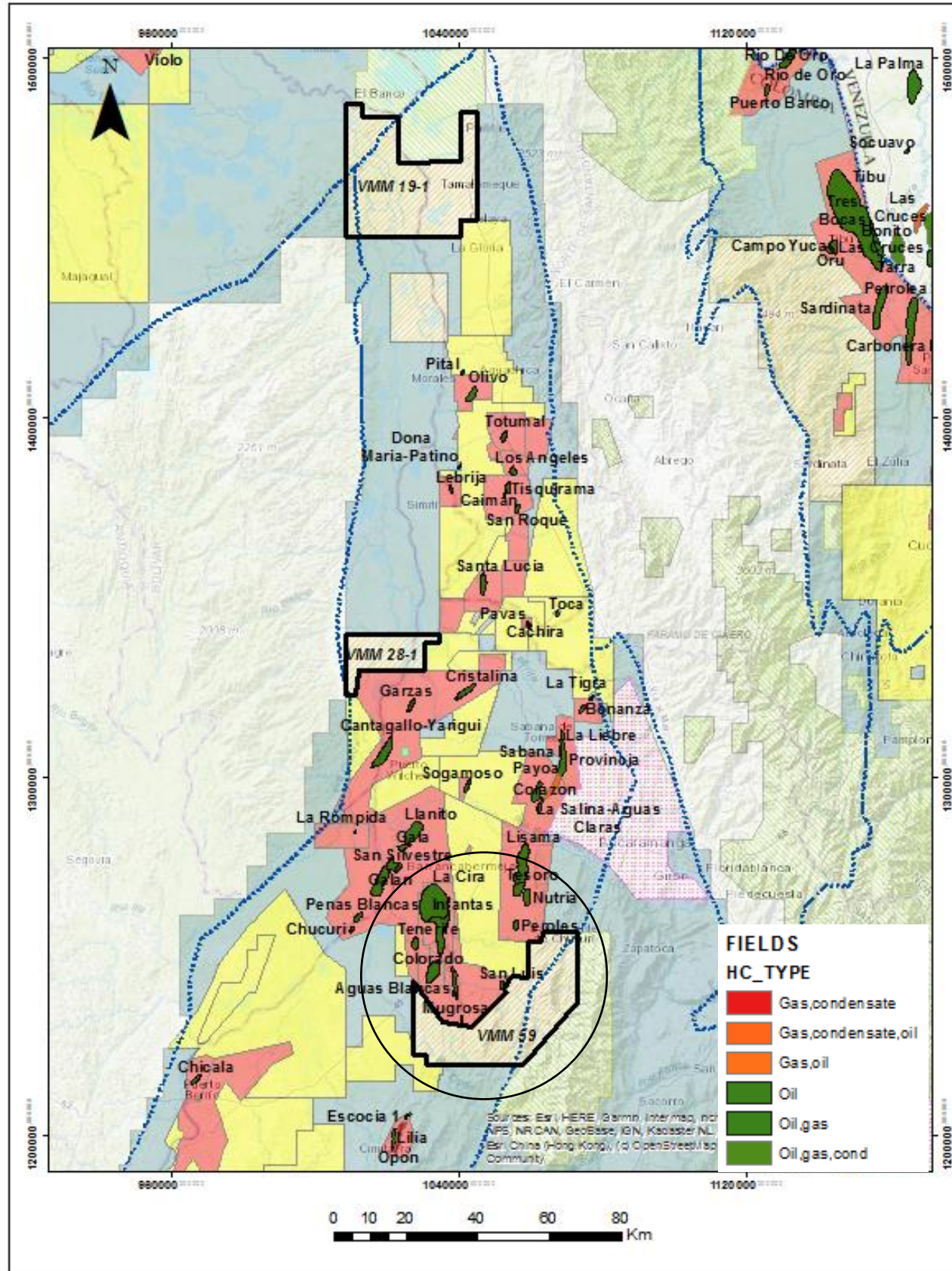
VMM 28-1 - NEAR FIELDS

Producing Fields

FIELD	CONTRACT	DISCOVERY YEAR	OOIP mmo	OIL_CP mmo (2015)	C_GAS MMSCF (2015)	Reservoir Name
Cantagallo -Yarigui	Magdalena Medio	1943	580	218,8	109105,0	La Paz – Mugrosa.
Garzas	Magdalena Medio	1957	10	2,4	535,6	La Paz
Cristalina	Magdalena Medio	1959	27,6	7,3	2651,0	Lisama Fm.
Santa Lucía	Tisquirama A-B	1988	15	3,4	671,1	Esmeraldas – La Paz



VMM 59 - NEAR FIELDS



FIELD	CONTRACT	PRODUCTION FORMATIONS	DISCOVERY YEAR	RECOVERABLE RESERVES (mmboe)	OOIP MMBO	OGIP MMSCF
Opón	Opón	Lisama, La Paz (Cumulative gas: 45,542 MMSCFD - 2015)	1966	36 (IHS, 2009)		1000
Lilia	Opón	Mugrosa 30°API	1982		0,25	0
Mugrosa	De Mares	Mugrosa 38,2°API	1929		0,5	0
San Luis	De Mares	Mugrosa 46°API	1927		3,5	0
Colorado	Magdalena Medio	Mugrosa 40°API	1925		100	0
Aguas Blancas			1962		35	0
Infantas	La Cira-Infantas	Colorado, Mugrosa, Esmeralda-La Paz (20-27°API)	1918	259	1849	288
La Cira	La Cira-Infantas	Colorado, Mugrosa, Esmeralda-La Paz (25-30°API)	1926	645	2150	960
Casabe	Magdalena Medio	21°-24° API Colorado Mugrosa	1941		1670	555
Lisama	Lisama-Nutria	Colorado, Mugrosa, Esmeraldas- La Paz (19-34° API). Production: 45,3 MMBO (2011)	1965		183	182

SUMMARY WELLS

VMM 28-1 Wells

Braval-1 (1941) (TD 2812')

- Drilled by Sierra Nevada S.A.
- In tests showed gas with light oil. In different intervals Braval-1 recovered muddy with sweet water with heavy oil.

Camacho Roldán-1 (1942) (TD 1457')

- Drilled by Richmond Colombian Company. It reached the Lisama Formation.

San Pablo-1 (1942) (TD 467')

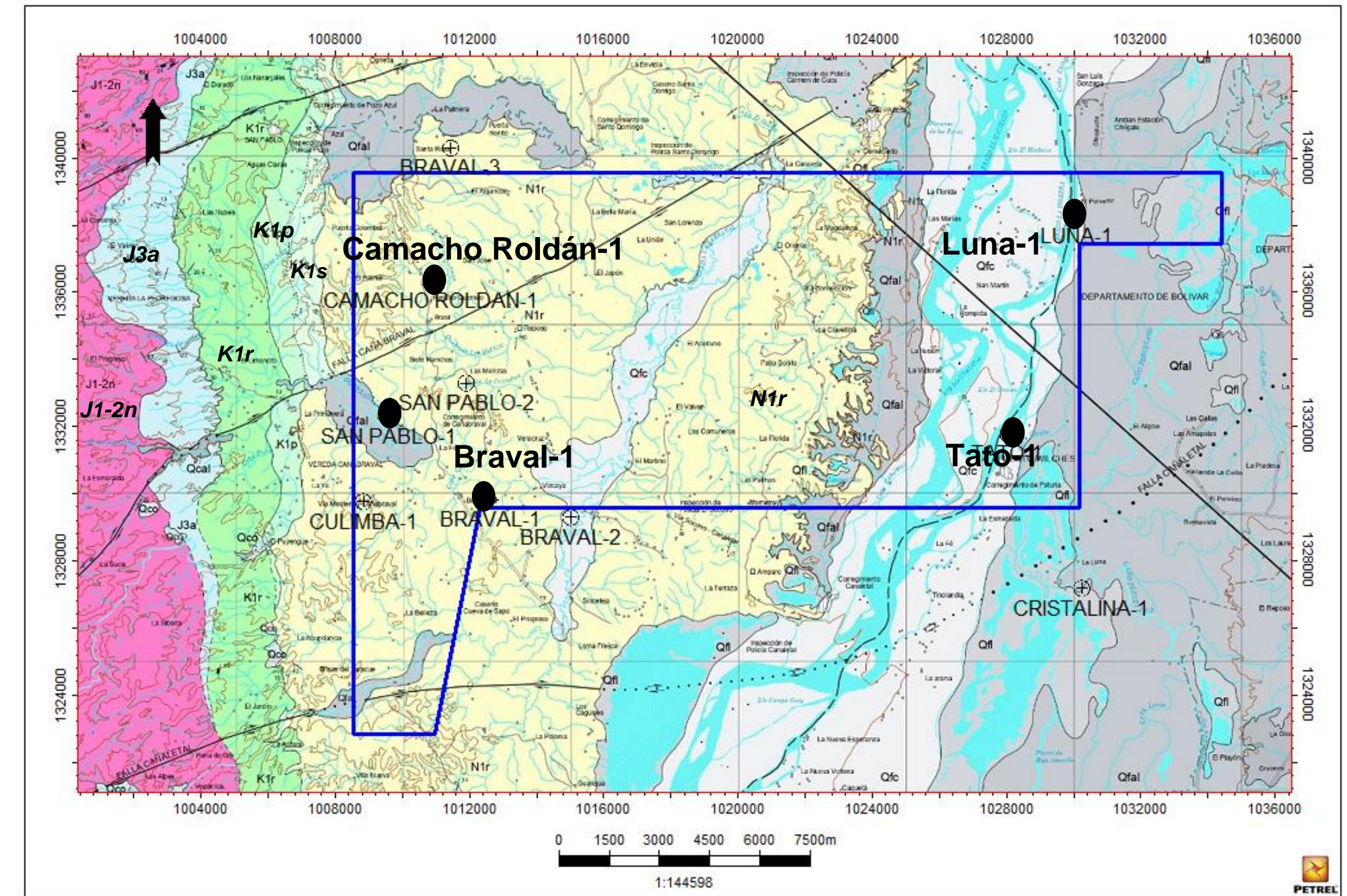
- Drilled by Shell Condor S.A. Oil and gas shows in the Lower Eocene.

Luna-1 (1957) (TD 8500')

- Drilled by Intercol. The Real Fm. had sands with sweet water, Chuspas Fm.: Sands with shales until 6930', 6930'-7867': massive sandstones interlayered with shales.

Tato-1 (1962) (TD 7892')

- Drilled by Intercol. The well reached The Umir Formation. La Paz Fm consisted of massive sands interlayered with shales.



VMM 59 Wells

Cascajales-1 (1976) (TD 11,400')

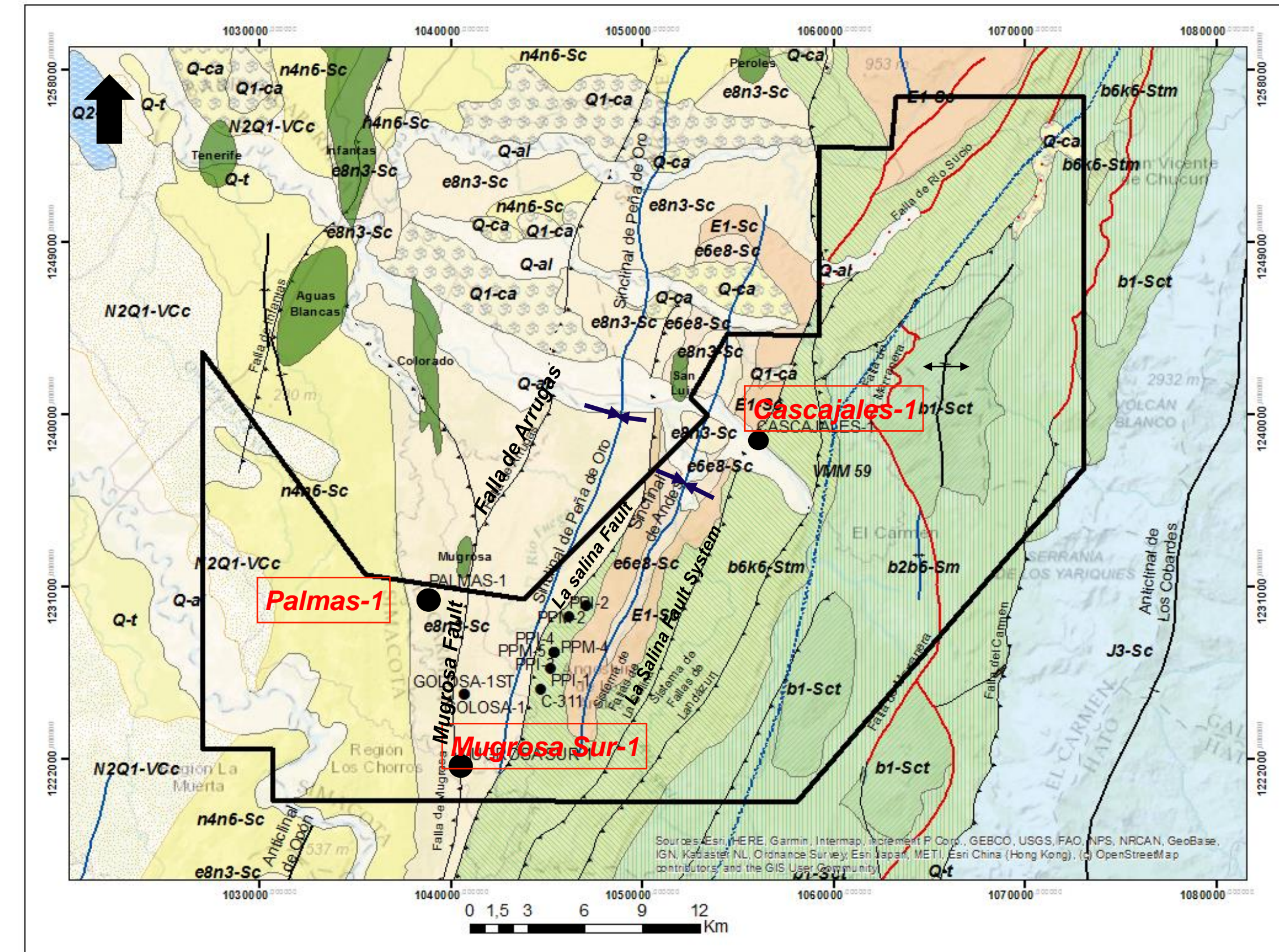
- Drilled by Ecopetrol. Target: Rosablanca, Paja and Tablazo Formations in the Cascajal Anticline. This well drilled all the Cretaceous sequence up to Tambor Formation.
- Six tests were carried out in Rosablanca, Paja, Tablazo and La Paz Formations. In the Cretaceous Units showed gas, but were considered non-commercial. Due to the high compaction, the sediments had low porosity and permeability.
- The sandstones of La Paz Fm. showed good permeability and TAR. The test showed fresh water.
- It was abandoned as a non-commercial gas producer (B3).

Mugrosa Sur-1 (1977) (TD 5407')

- Drilled by Ecopetrol. Tests in la Luna Formation, results: salt water, Tests in Chorro Group: salt water, gas shows, where the gas burned with a 10 feet high flame.

Palmas-1 (1977) (TD 11564')

- Drilled by Ecopetrol. Trap: Structural closure against reverse fault. Targets: Mugrosa (C zone) and La Paz Formations. The well was in the lower part of Chorro Group, without being able to define the presence of Eocene basal sands.
- The well had gas shows in the intervals 9330', 9570' and 11380 ft during the drilling. In the formation tests in Chorro Group (9318-9308 ft, and 9302-9278 ft) there was oil production (1,6bls/8h, 40,6°API to 88°F).
- It was considered non-commercial.



GEOLOGICAL UNITS

Q-al	Mesa Fm.
Q-ca	Real Group
Q-t	Chuspas Group
Q1-ca	Chorro Group
Q2-l	Lisama Fm.
N2Q1-VCc	La Luna
n4n6-Sc	Simiti Fm.
e8n3-Sc	Tambor Fm.
e6e8-Sc	
E1-Sc	
b6k6-Stm	
b2b6-Sm	
b1-Sct	

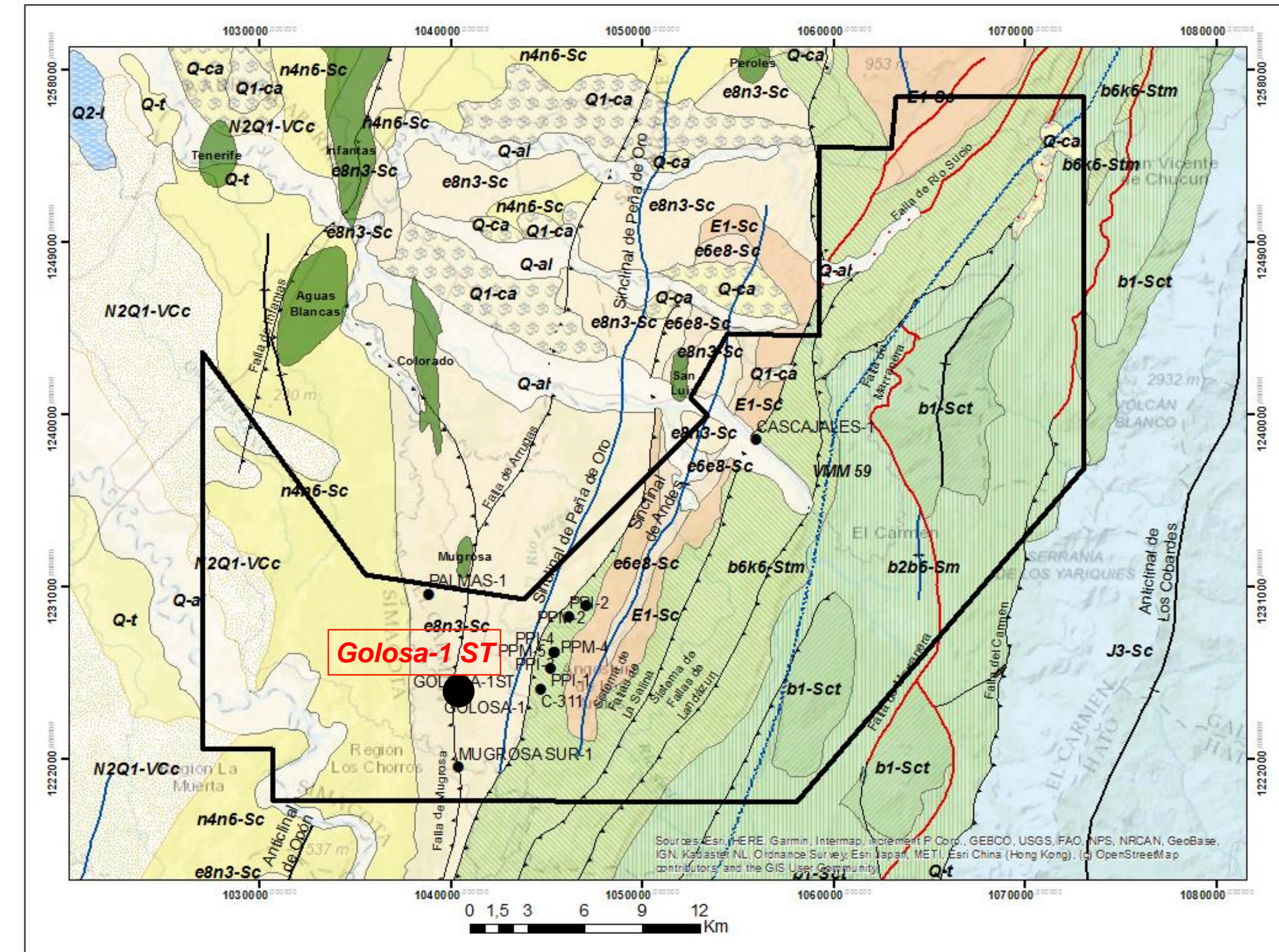
VMM 59 Wells

Golosa-1 (2013) (TD 3530')

- Drilled by Ecopetrol. Trap: Mugrosa faulted anticline. Target: Basal sands of the Chorro Group
- Regular gas shows in Mugrosa and Esmeraldas Formations, poor oil shows.
- Golosa well was drilled structurally low.

Golosa-1ST (2014) (TD 3265')

- Drilled by Ecopetrol. Trap: Closure in a faulted inverted anticline. Target: Basal sands of the Chorro Group.
- The main oil shows are associated to Chorro Group (2008-2590'), that were very poor.
- Esmeraldas Formation had low production of oil. Tests: DST 2 : 13 bls light oil (33°API) and 5 Bbls of water formation with salinity of 21000 ppm, DST 3: 27 Bbls water formation with 21700 ppm Cl- and 4 Bls of oil (31°API), and DST 1: La Luna Formation, (secondary target), and the result was water.



GEOLOGICAL UNITS

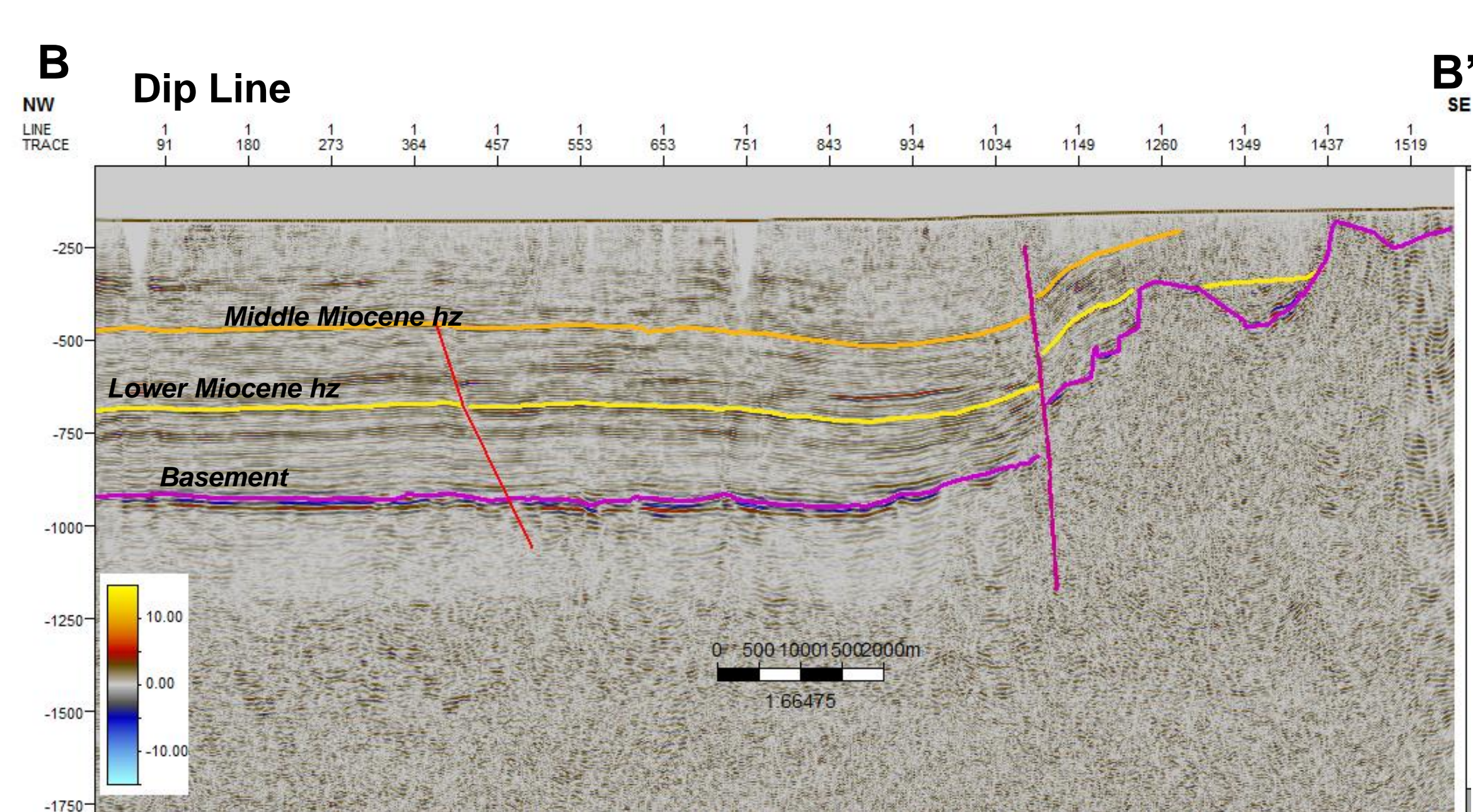
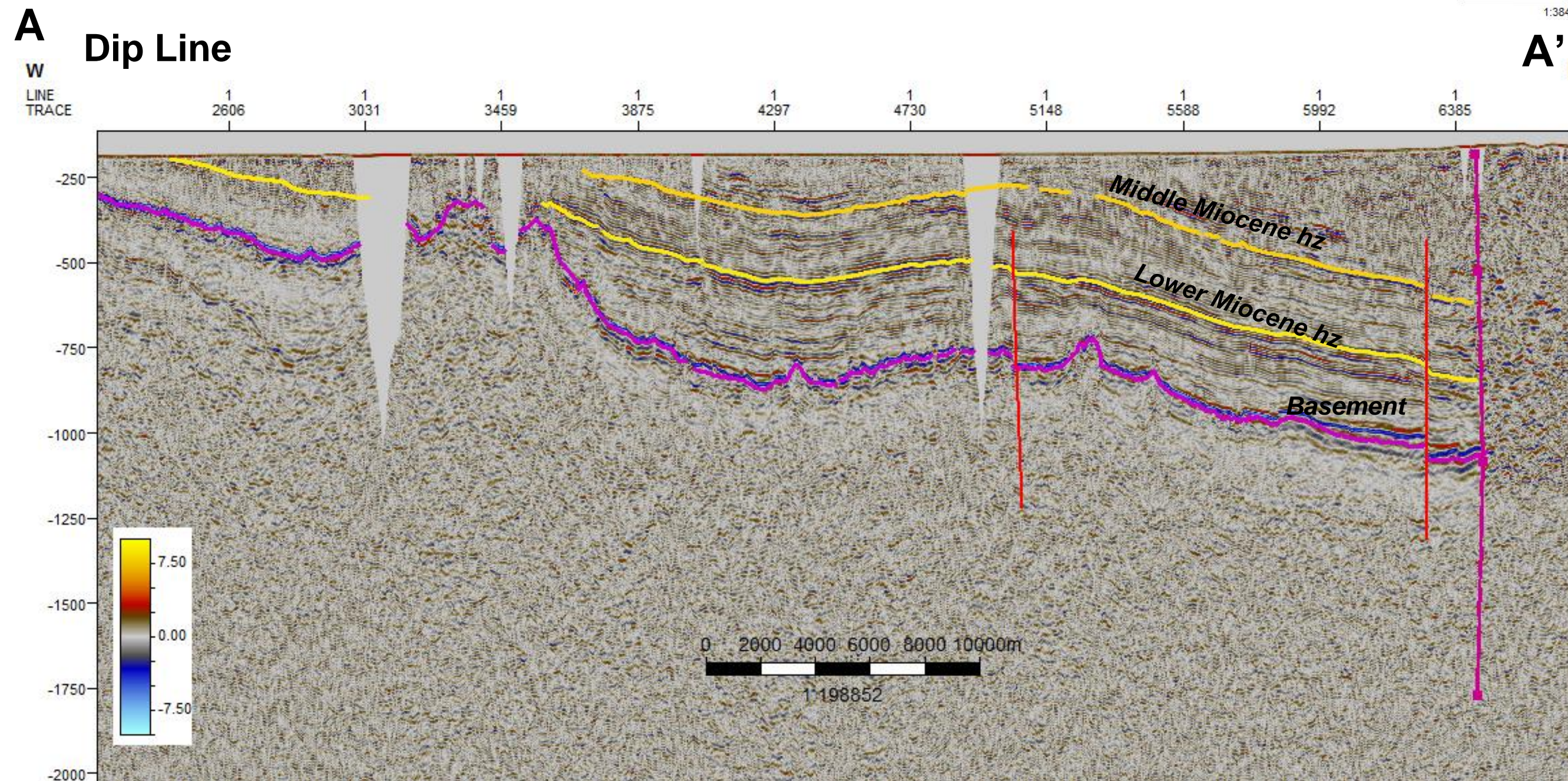
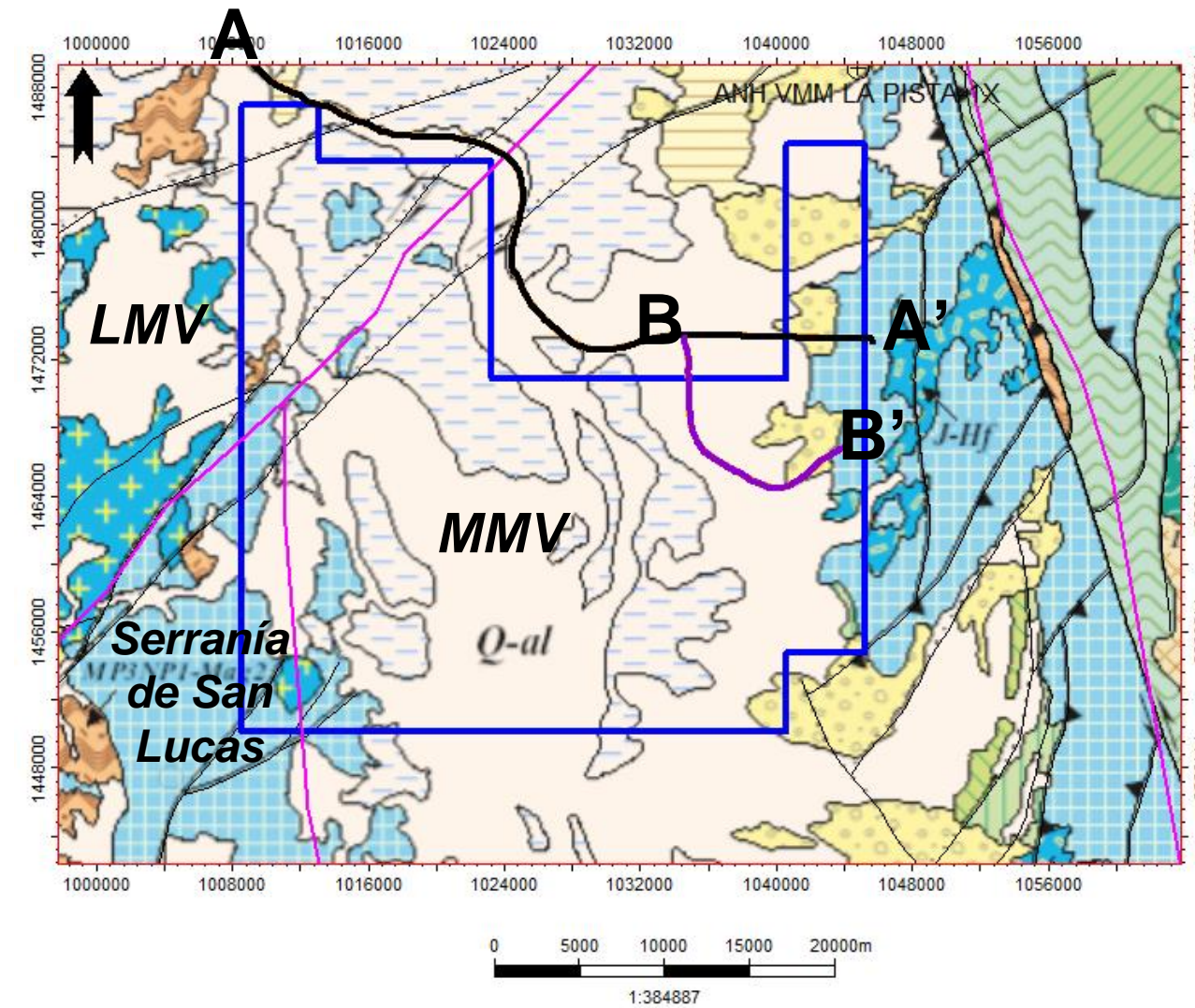
Q-al	
Q-ca	
Q-t	
Q1-ca	
Q2-1	
N2Q1-VCc	Mesa Fm.
n4n6-Sc	Real Group
e8n3-Sc	Chuspas Group
e6e8-Sc	Chorro Group
E1-Sc	Lisama Fm.
b6k6-STM	La Luna
b2b6-Sm	Simiti Fm.
b1-Sct	Tambor Fm.

SEISMIC INTERPRETATION

VMM 19-1 AREA

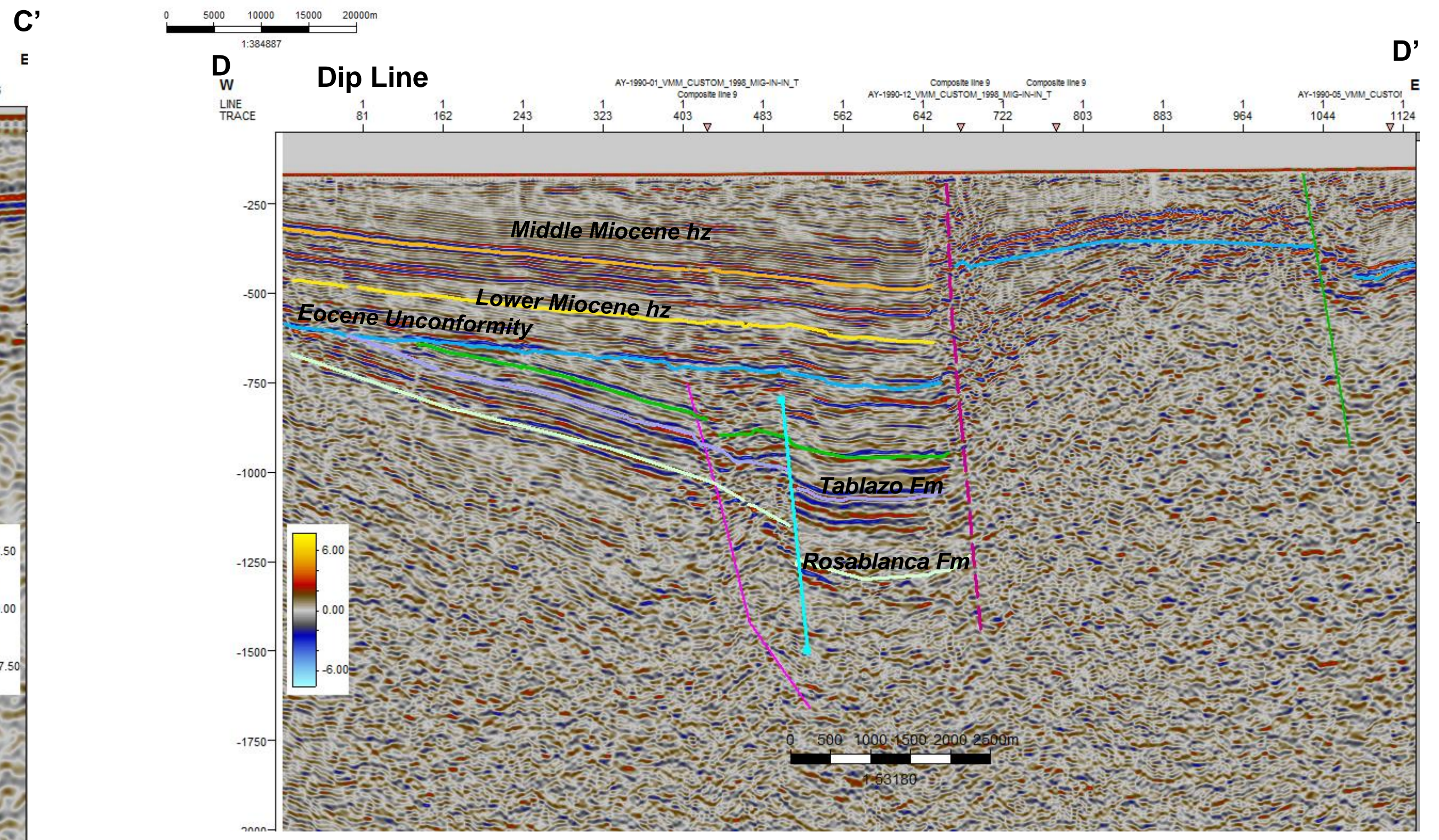
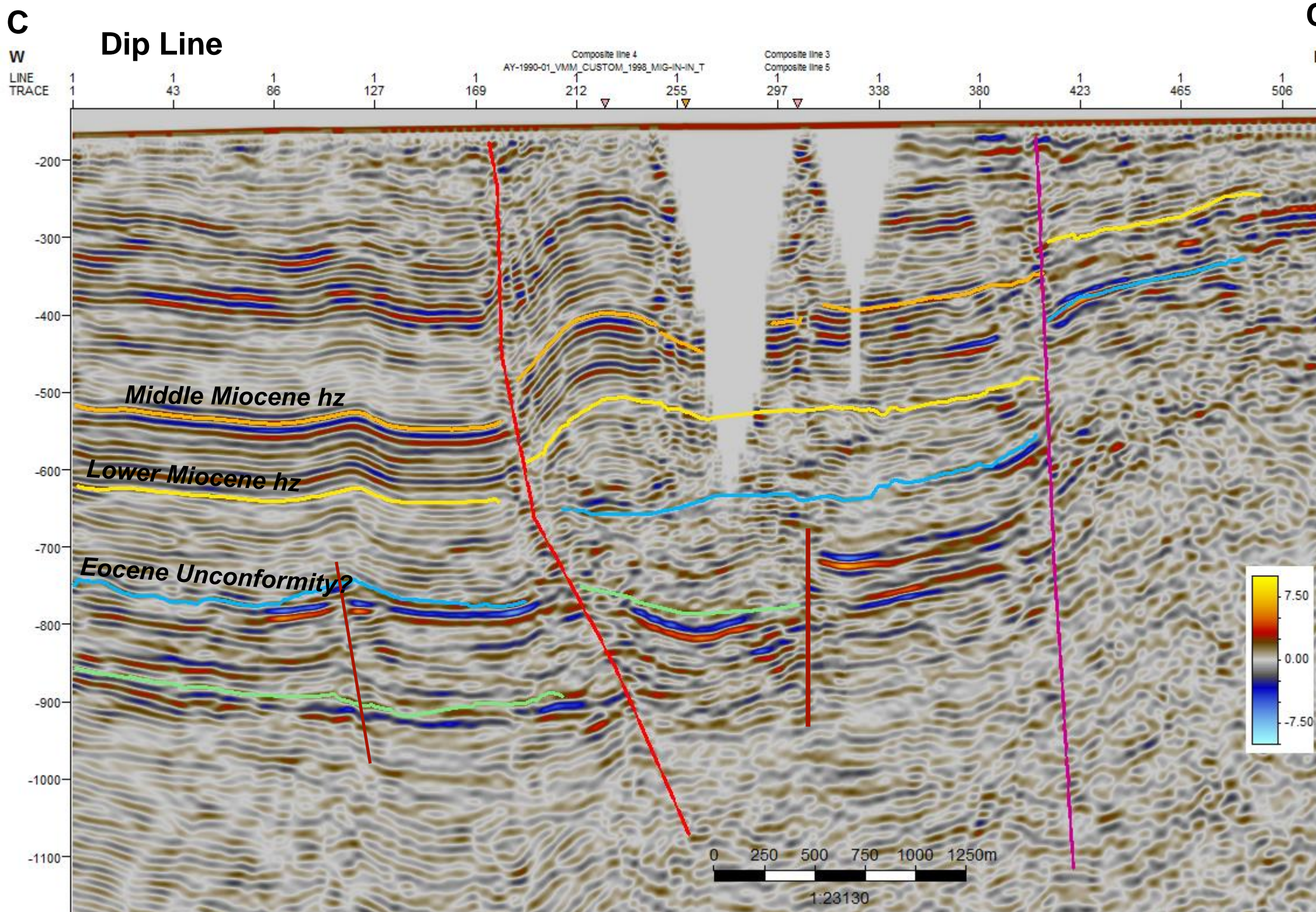
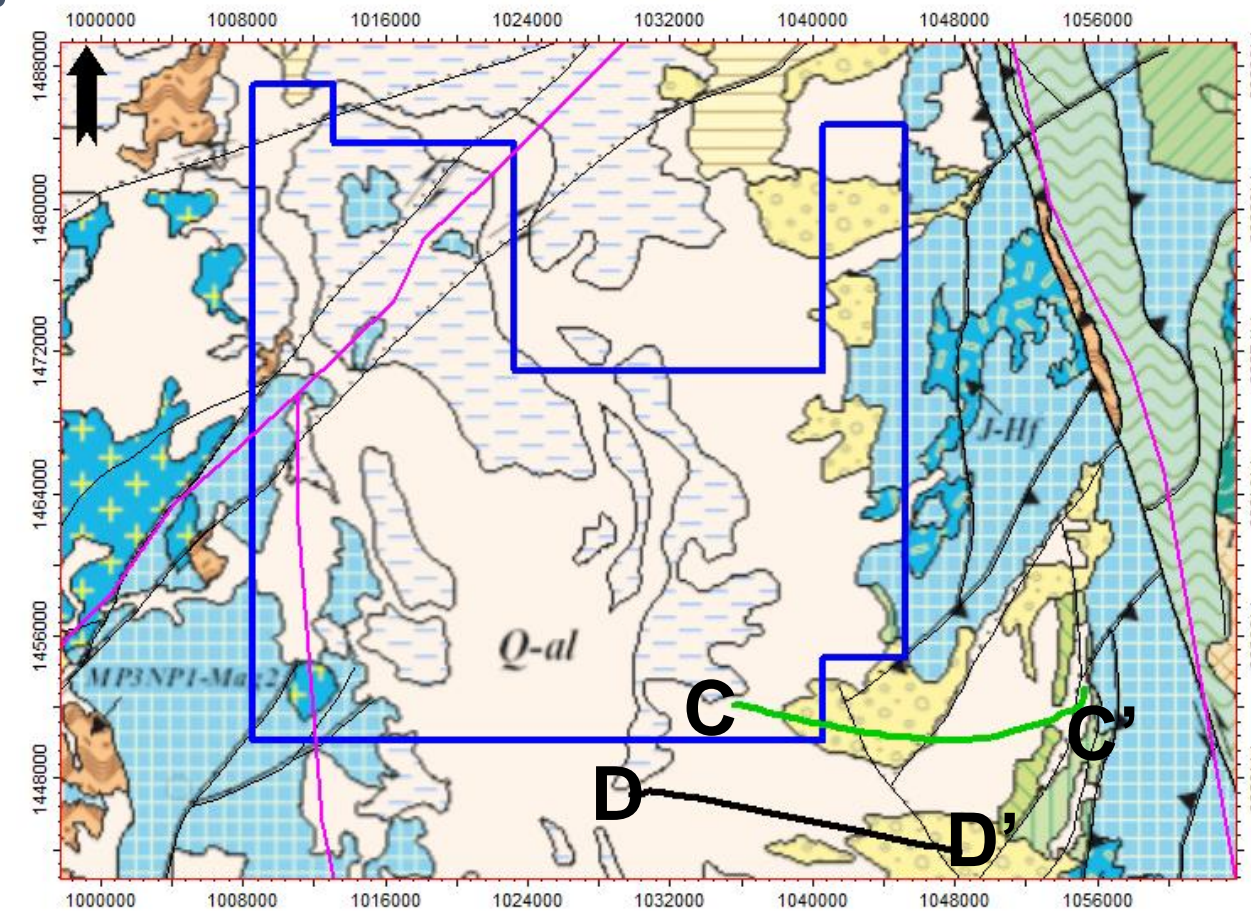
SEISMIC INTERPRETATION VMM 19-1:

- PLAYS
- Structural: Wide Anticline (Lower Miocene)
- Truncation of Tertiary sediments against a high angle fault and basement.



SEISMIC INTERPRETATION VMM 19-1:

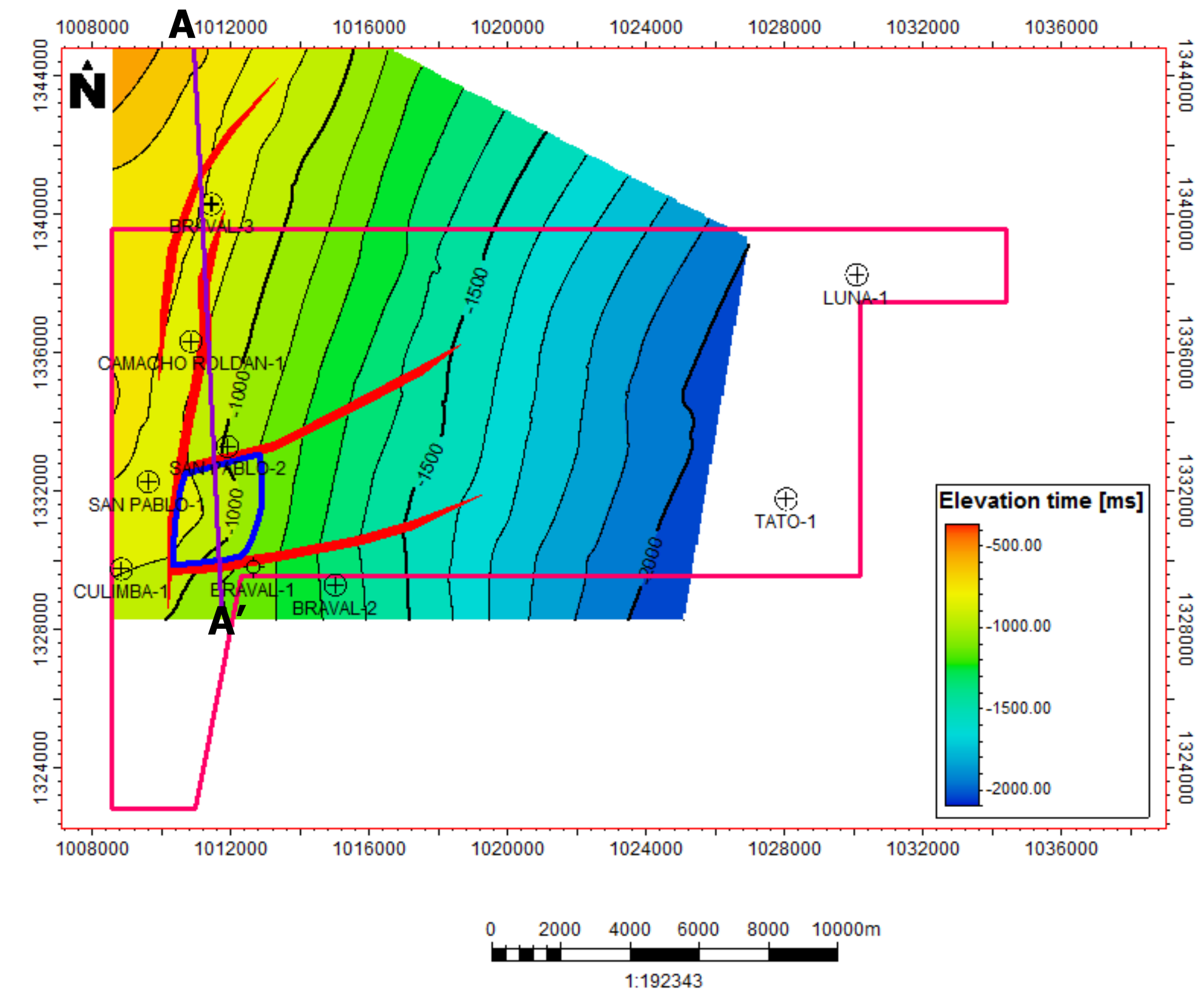
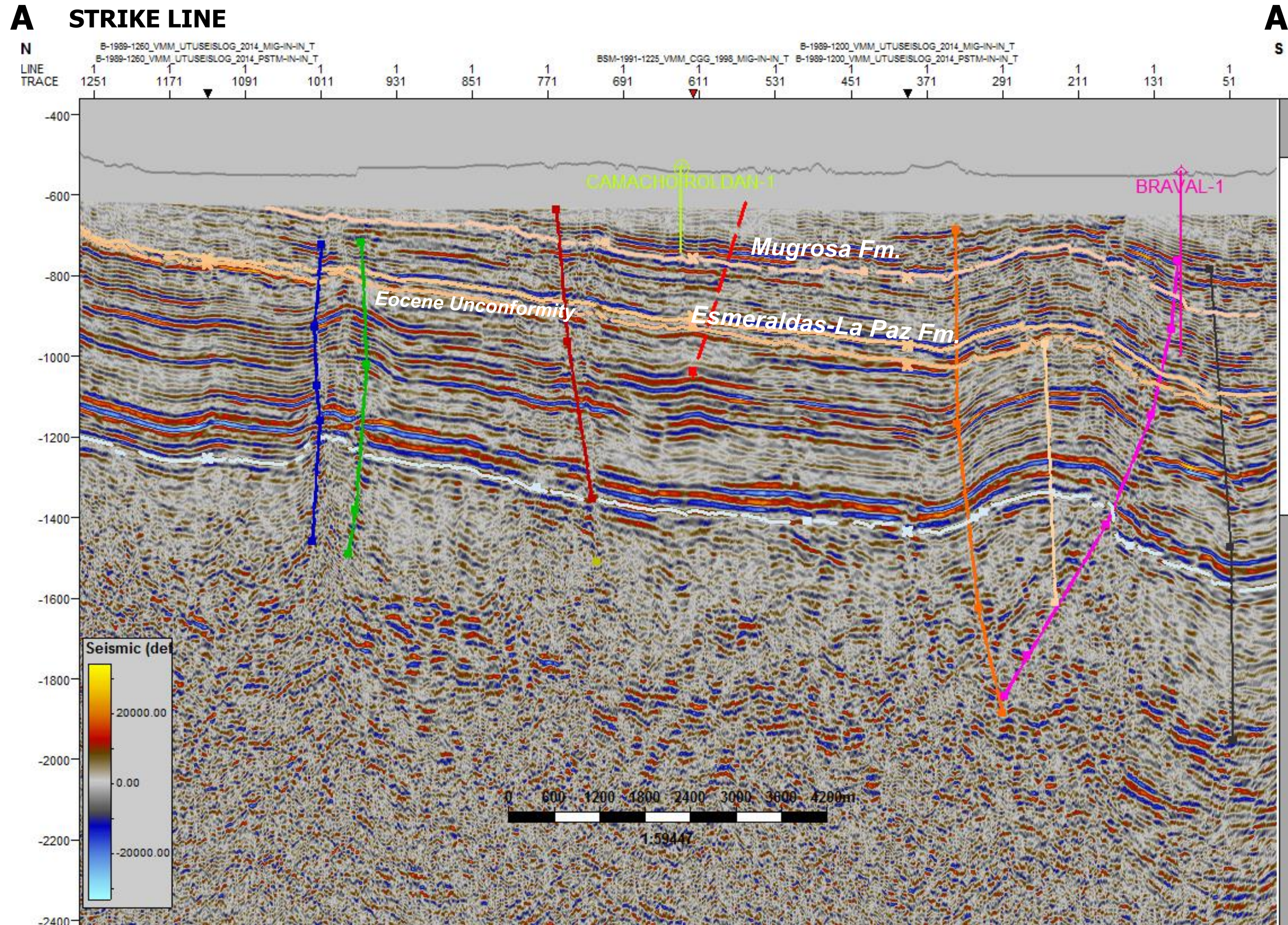
- PLAYS
- Structural: Wide Anticline (Lower Miocene)
- Miocene sequences truncates against the high angle fault.



VMM 28-1 AREA

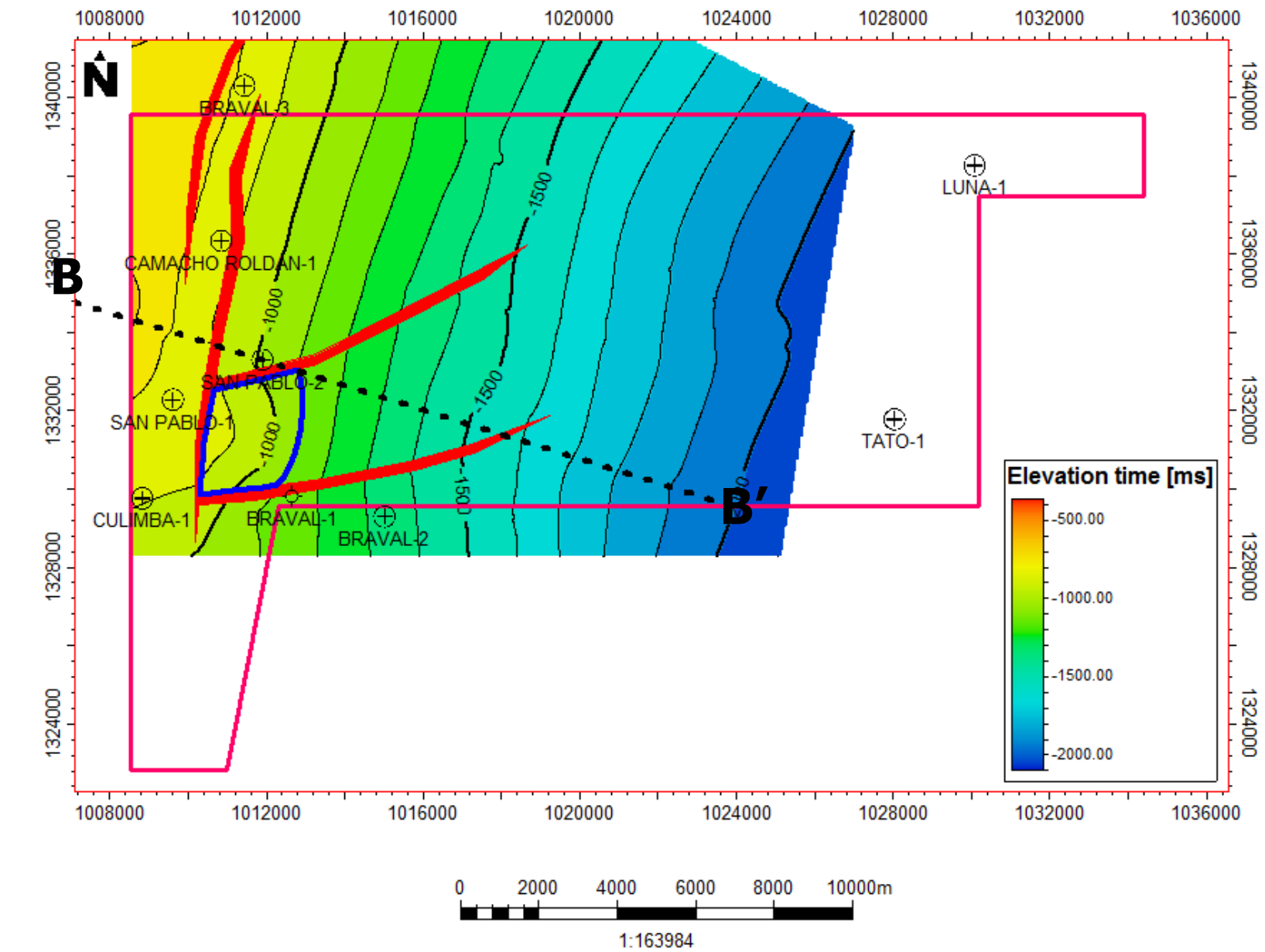
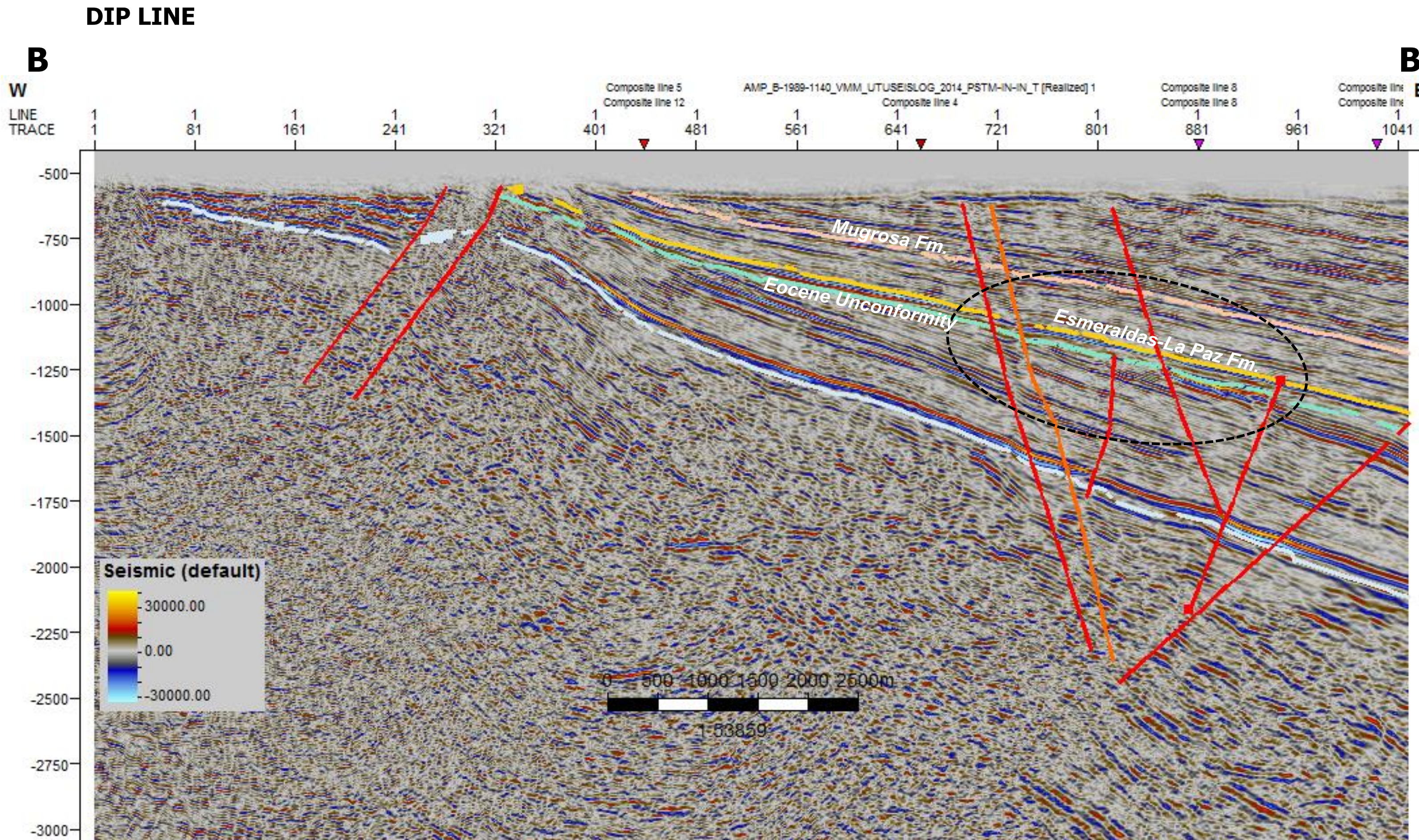
SEISMIC INTERPRETATION VMM 28-1:

- PLAYS
- Structural: Anticline with three way dip closure against fault (Esmeraldas – La Paz Fm.)



SEISMIC INTERPRETATION VMM 28-1:

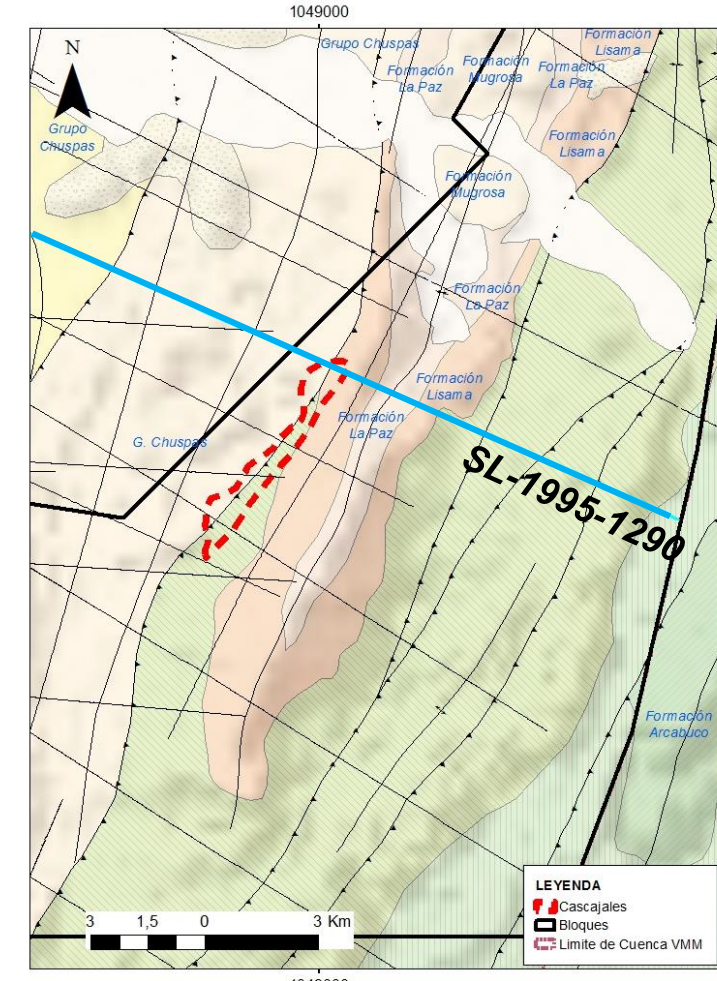
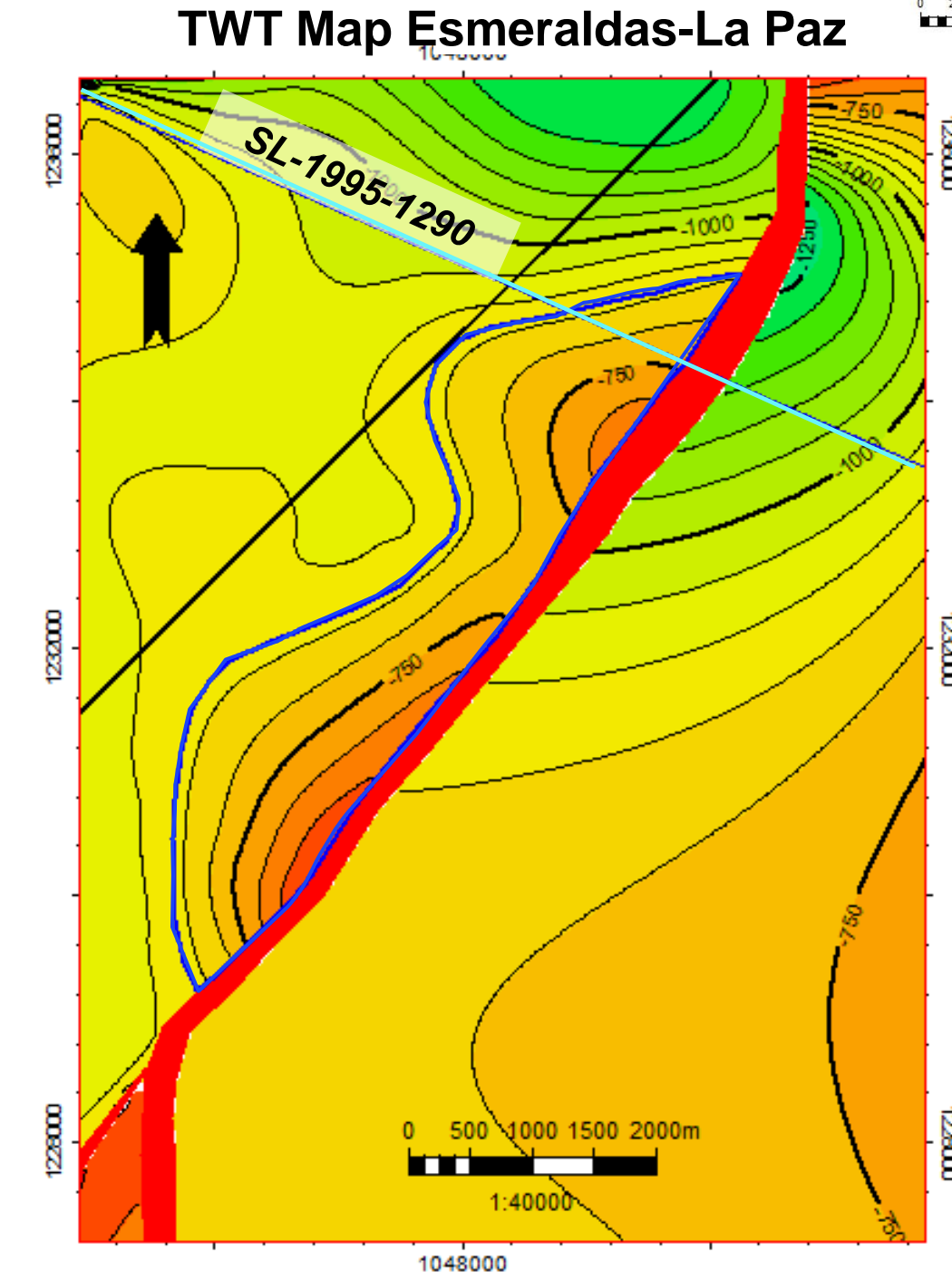
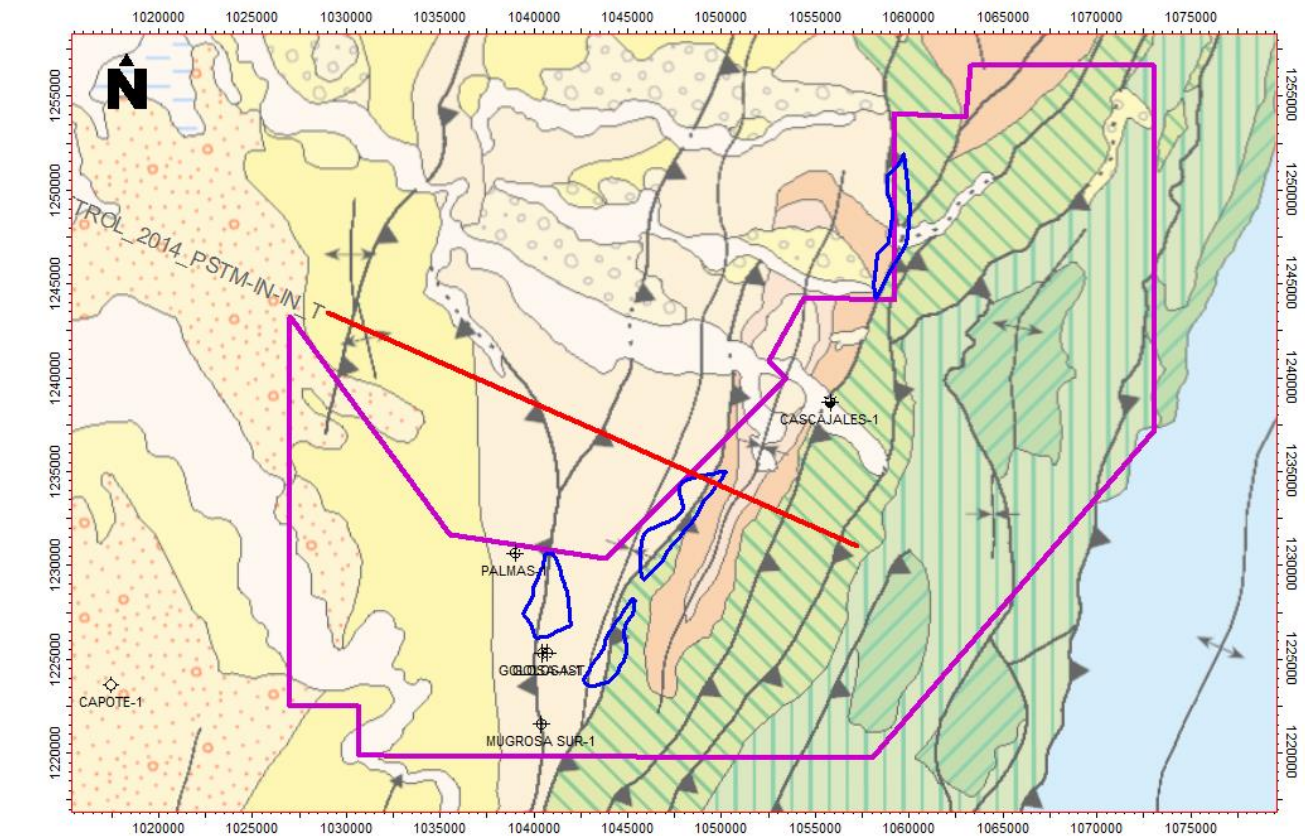
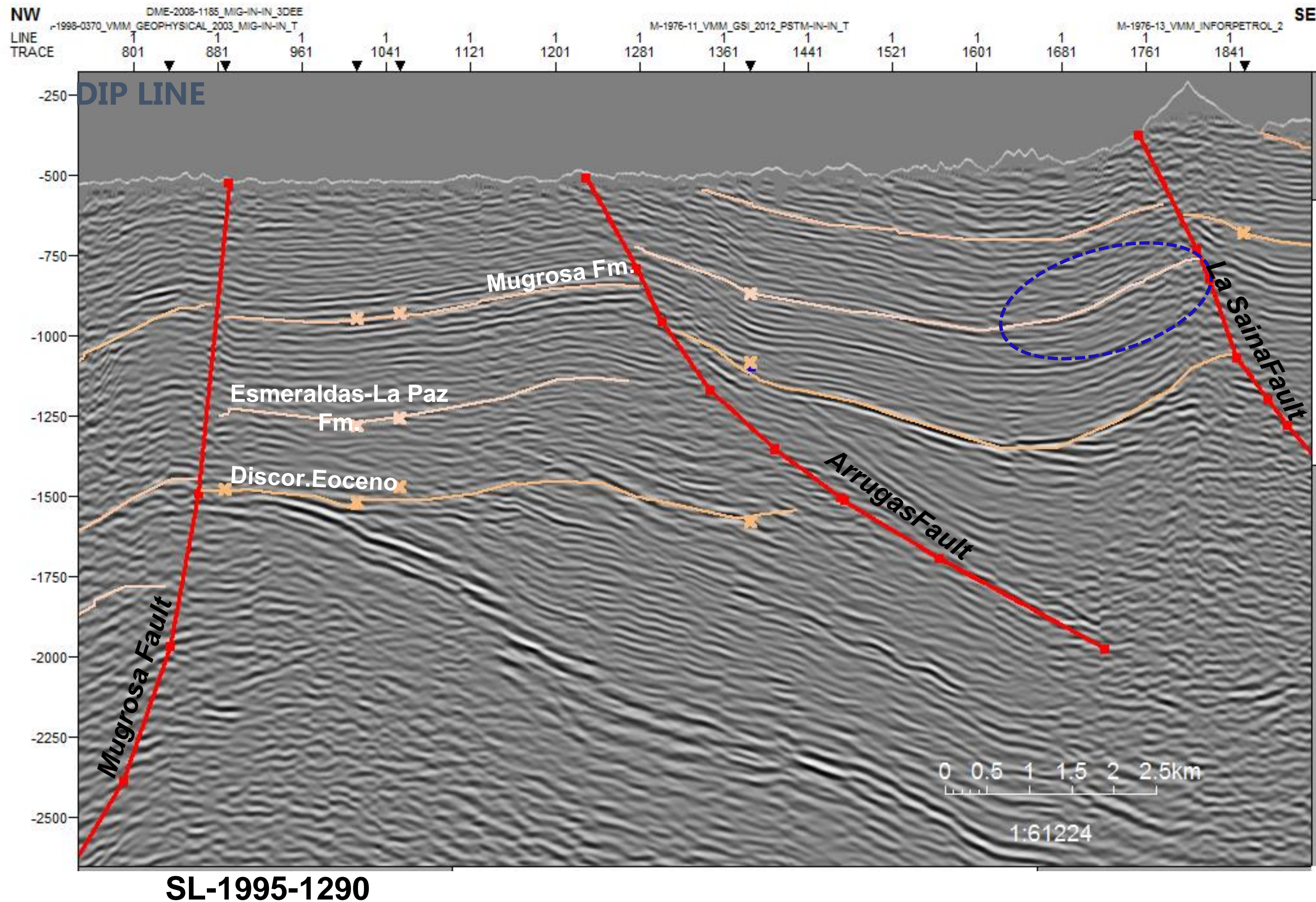
- PLAYS
- Structural: Anticline with three way dip closure against fault (Esmeraldas – La Paz Fm.)



VMM 59 AREA

SEISMIC INTERPRETATION VMM 59:

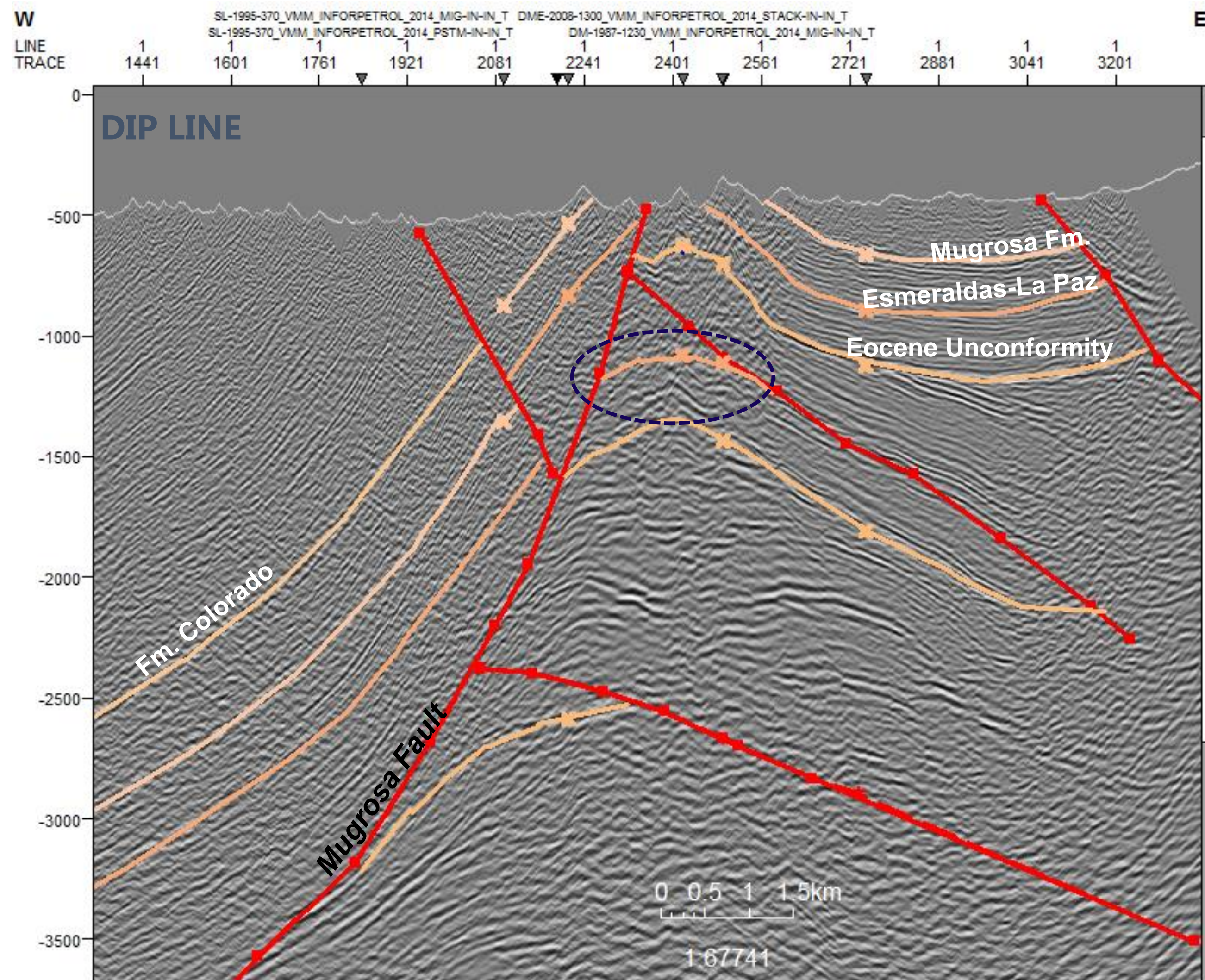
- PLAYS
- Closure associated to thrusts and subthrusts, shallows structures.



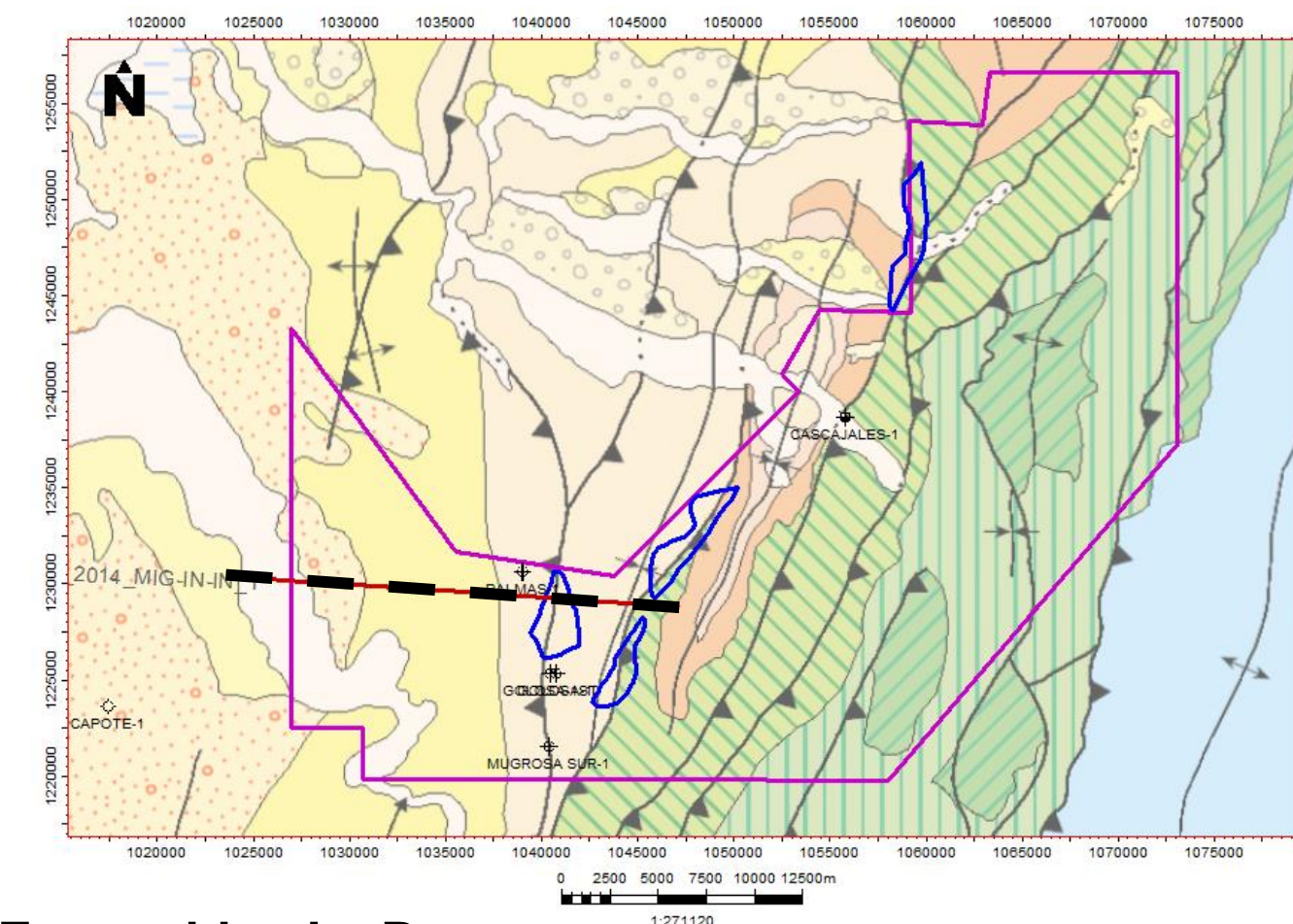
Area: 1893 Acres

SEISMIC INTERPRETATION VMM 59:

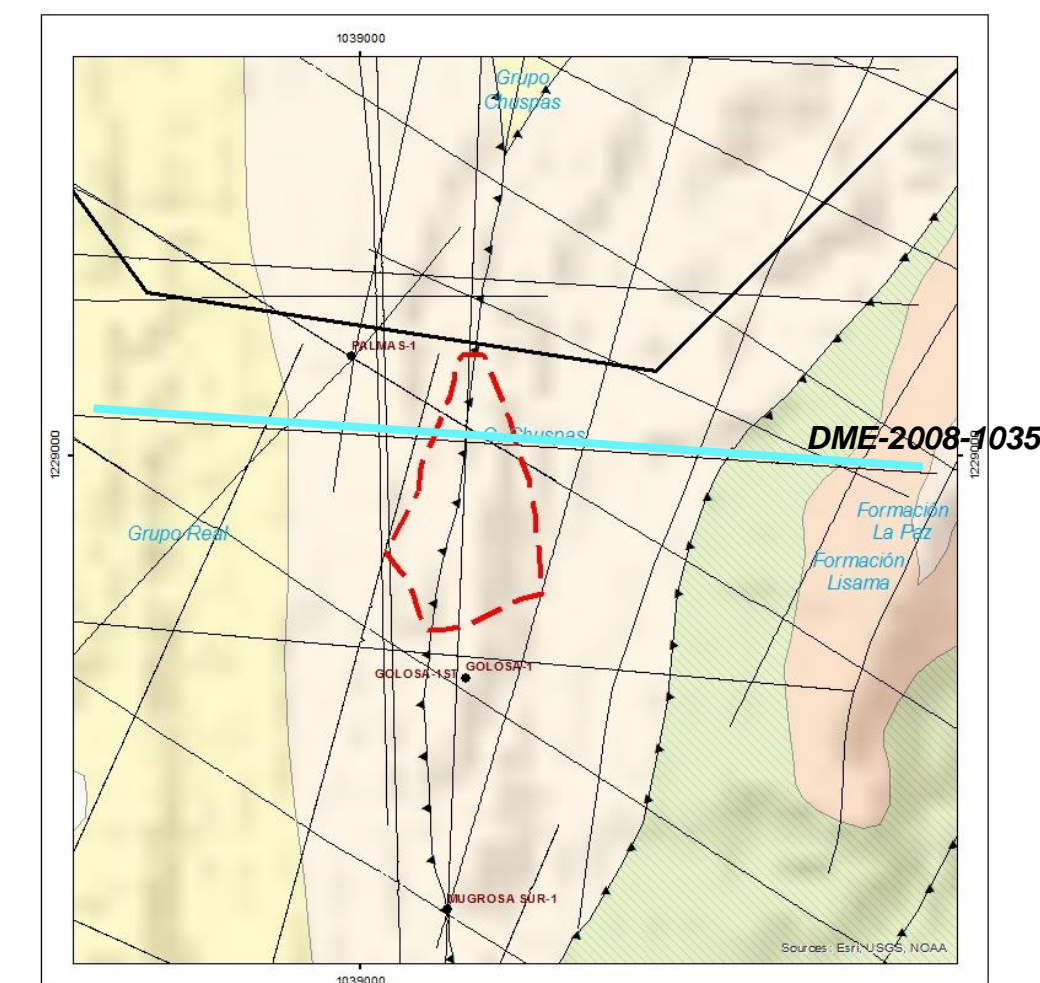
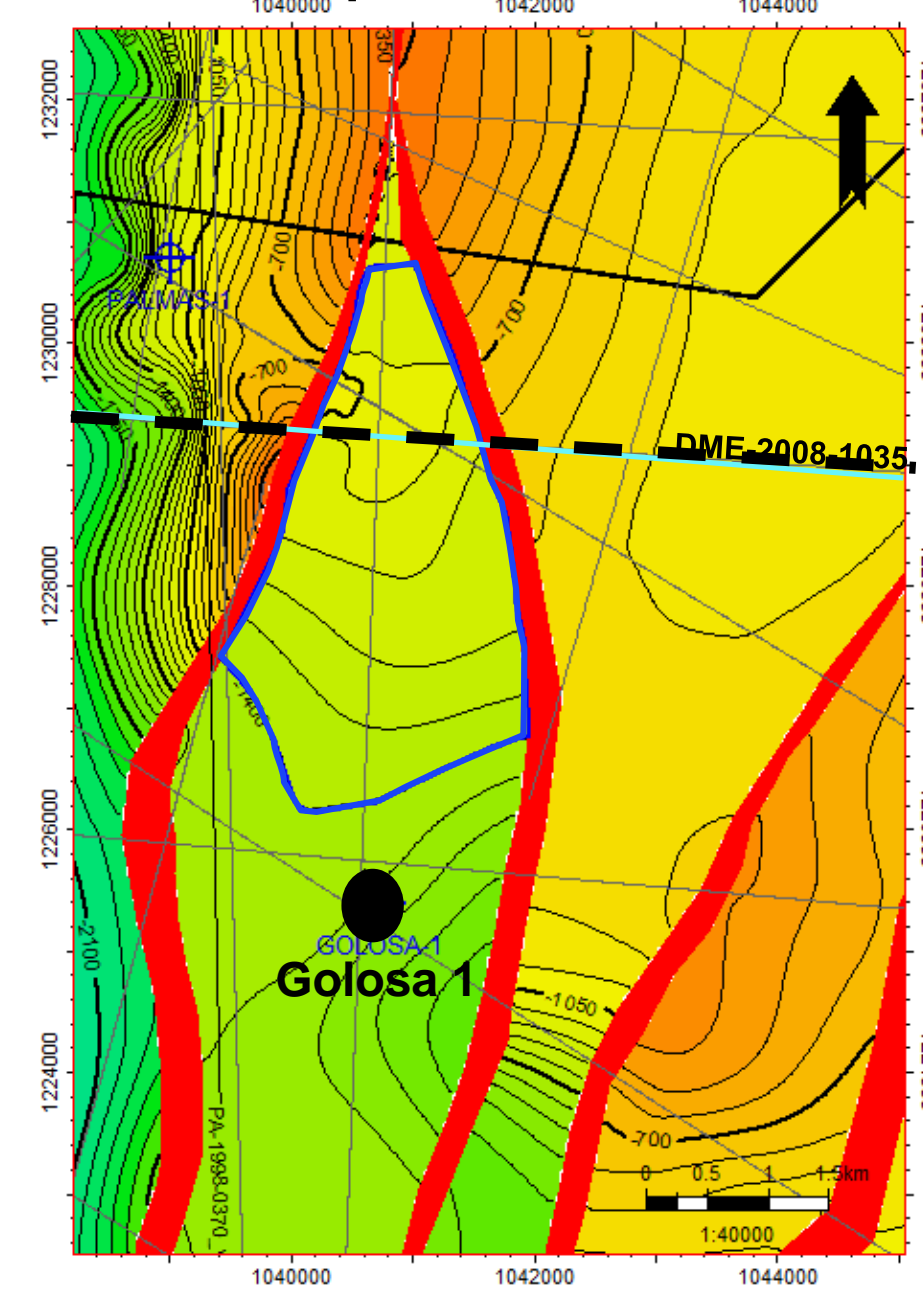
- PLAYS
- Deep Subthrust



DME-2008-1035

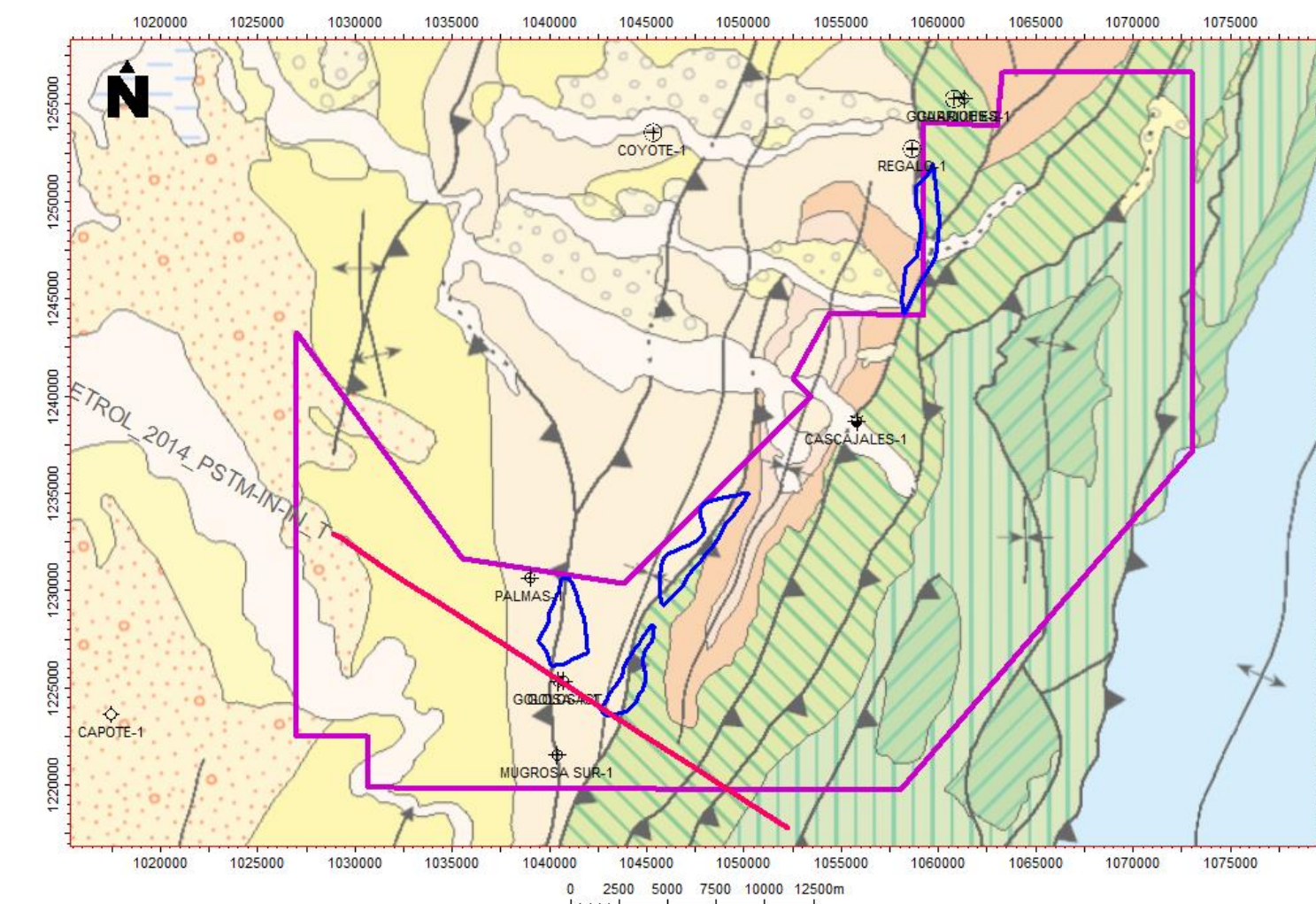
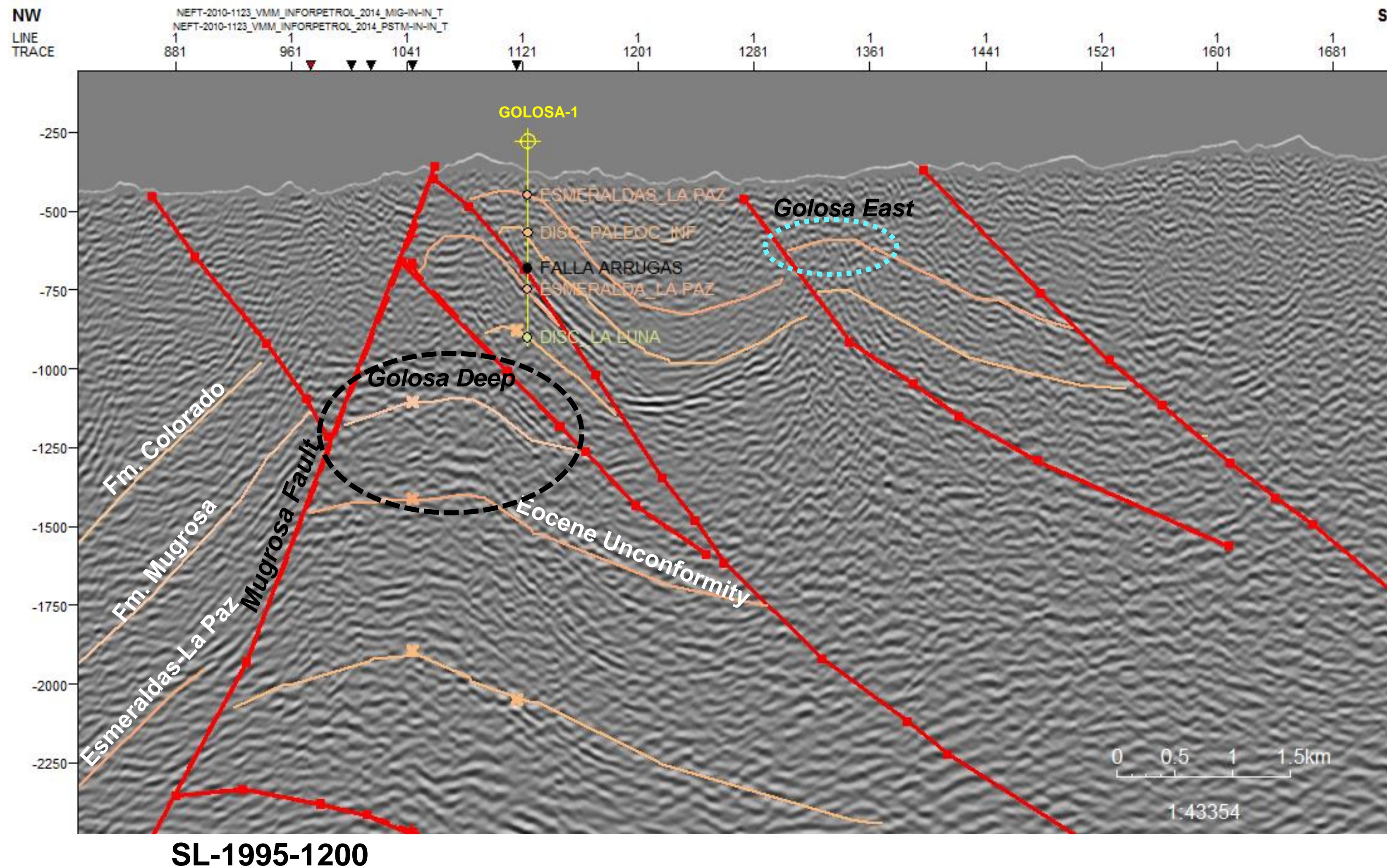


TWT Map Esmeraldas-La Paz

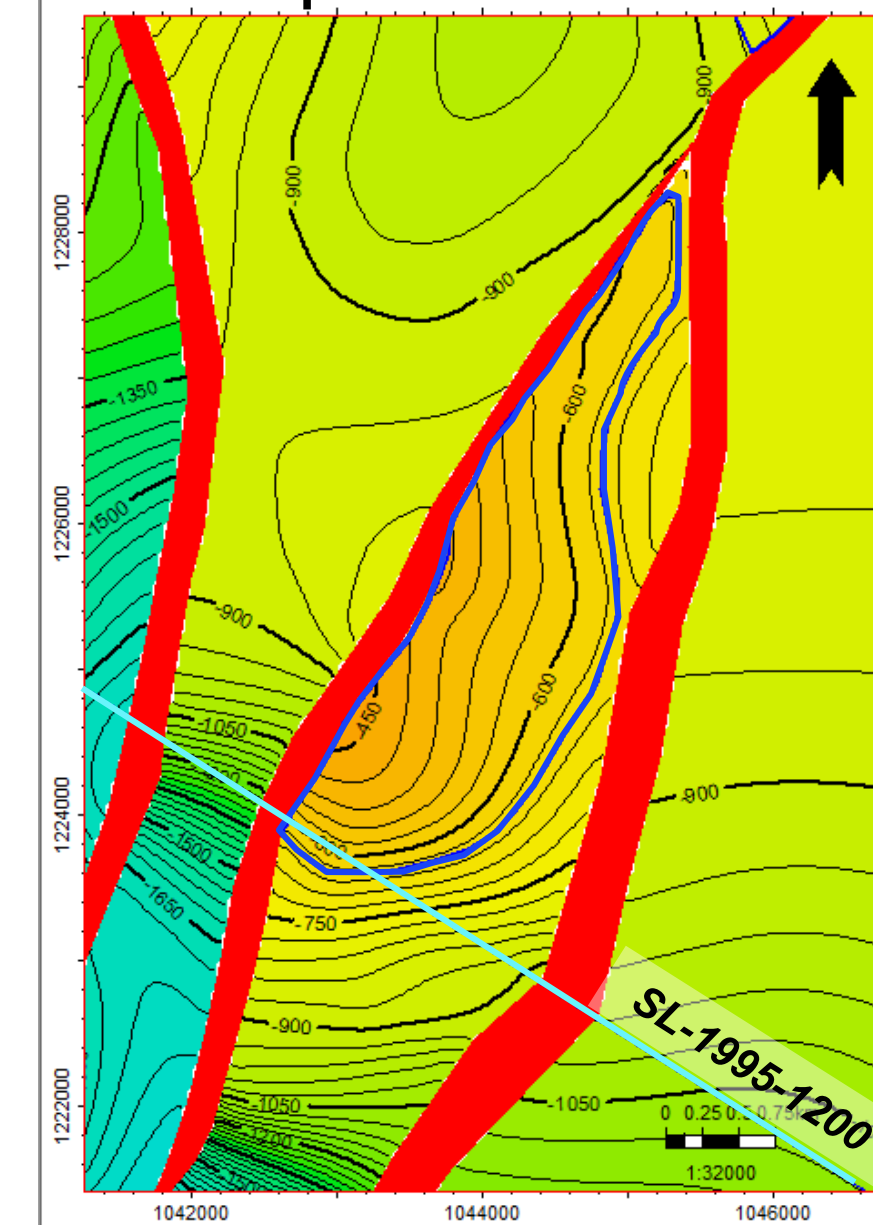


SEISMIC INTERPRETATION VMM 59:

- PLAYS
- Golosa East Thrust – Shallow Structure
- Golosa Deep Subthrust – Deepest Imbrication

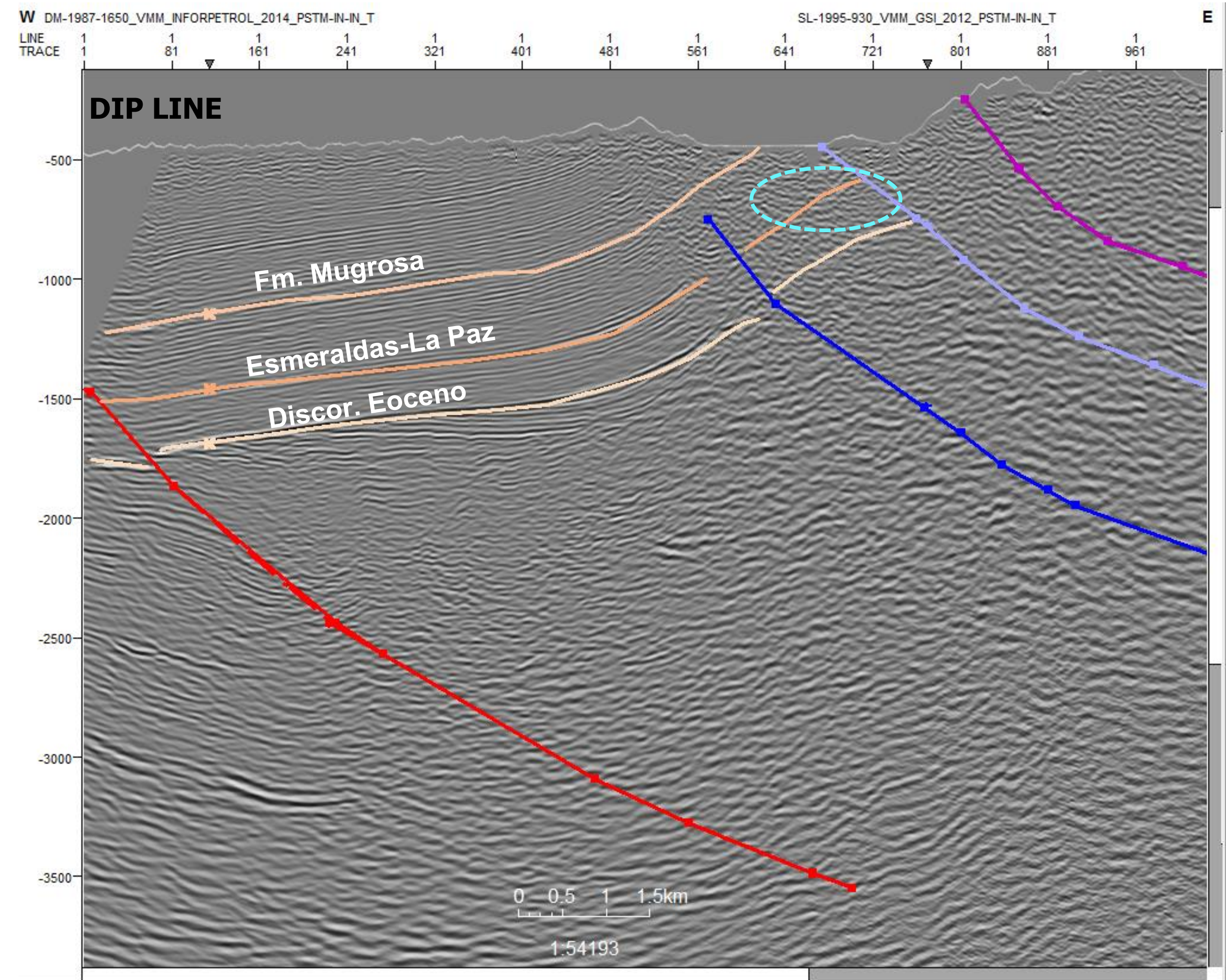


TWT Map Esmeraldas-La Paz

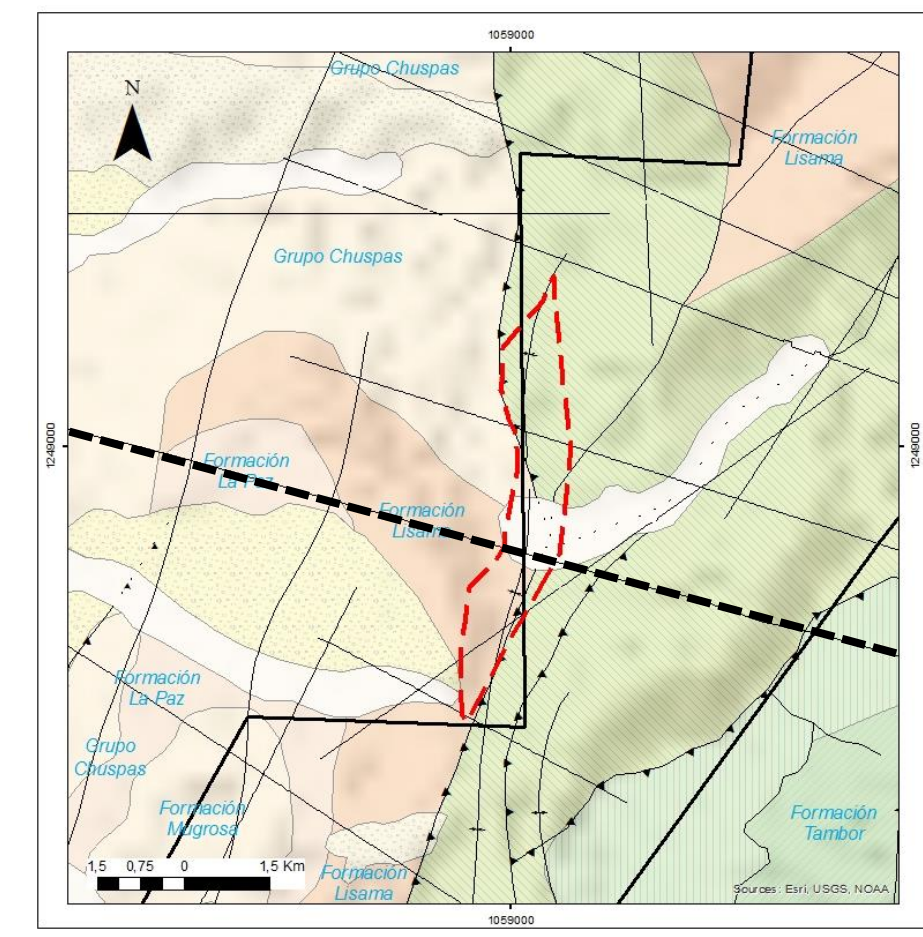
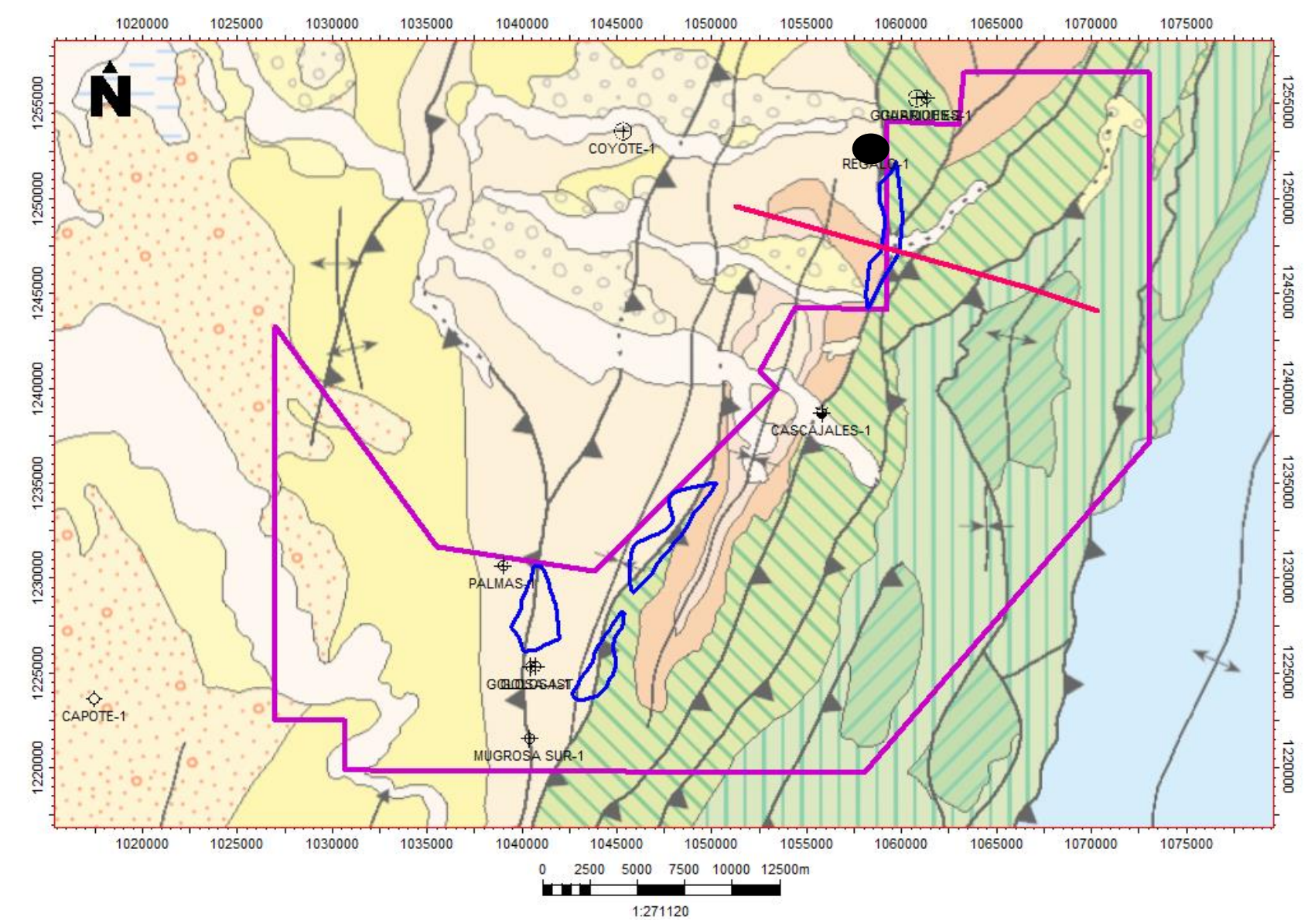


SEISMIC INTERPRETATION VMM 59:

- PLAYS
- Shallow subthrust structure

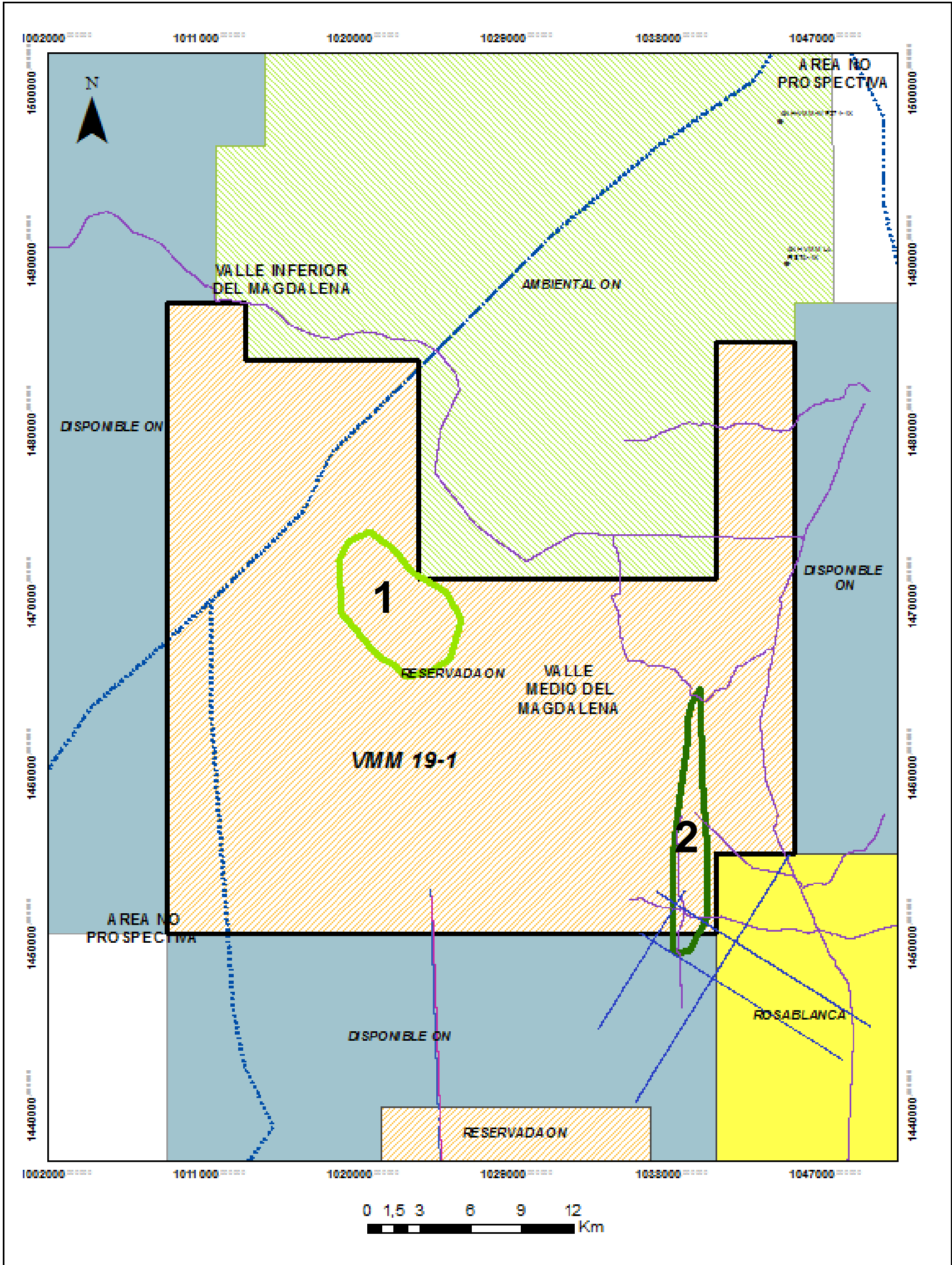


SL-1995-1800



PROSPECTIVE RESOURCES

VOLUMETRICS VMM 19-1:



PROSPECTIVE RESOURCES

2 LEADS

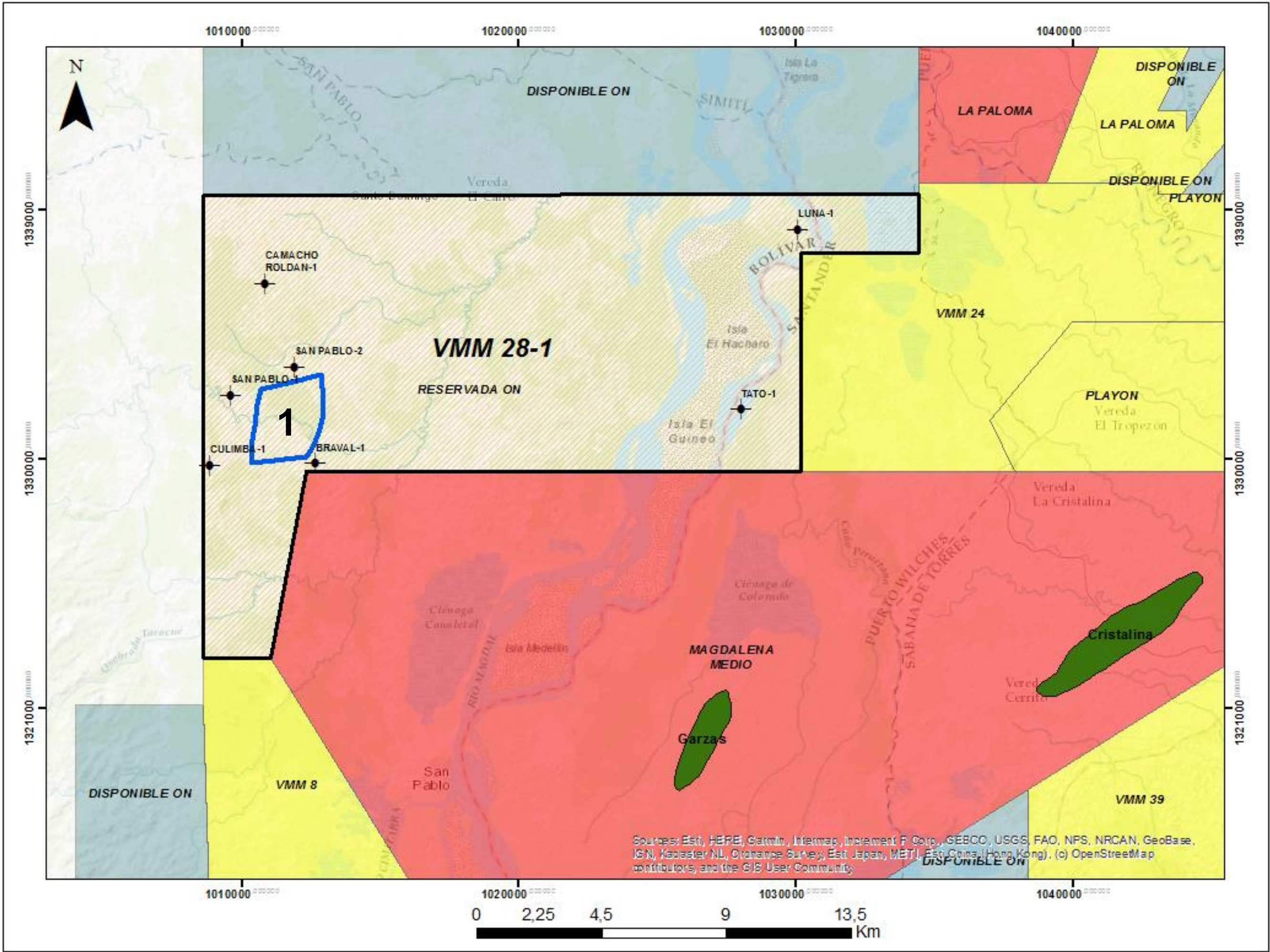
Prospective Resources

Lead No	AREA (Acres)	OGIP (Bcf)	Prospective Resources (Bcf)
1	9321	256,44	64,11
2	5214	143,45	35,86

OGIP: 399,88 BCF

PROSPECTIVE RESOURCES: 99,97 BCF

VOLUMETRICS VMM 28-1:



PROSPECTIVE RESOURCES

1 LEAD

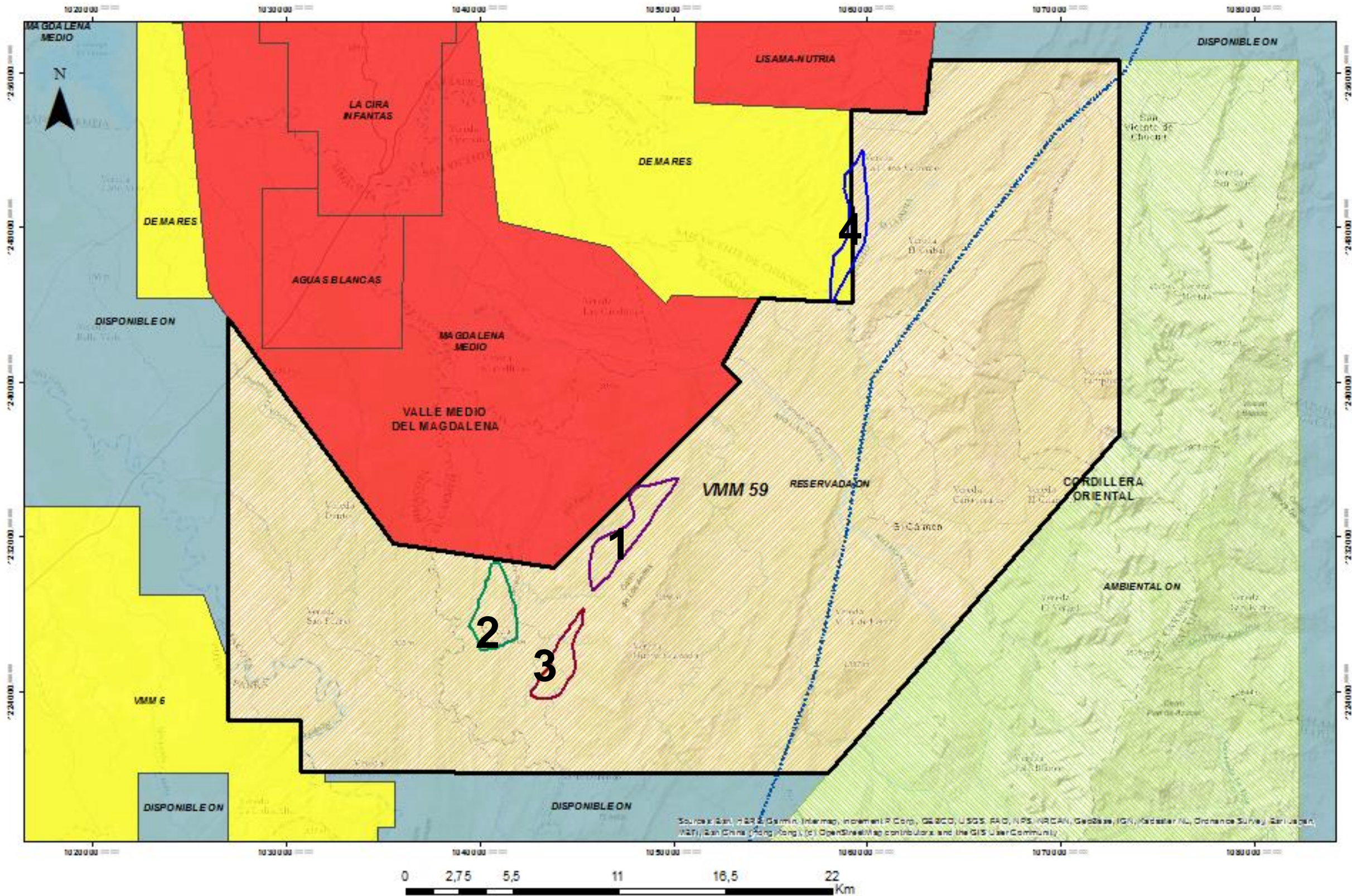
Prospective Resources

Lead No	AREA (Acres)	OOIP (MMBO)	Prospective Resources (MMBO)
1	1585	231,87	57,97

OOIP: 231,87 MMBO

PROSPECTIVE RESOURCES: 57,97 MMBO

VOLUMETRICS VMM-59:



PROSPECTIVE RESOURCES

4 LEADS

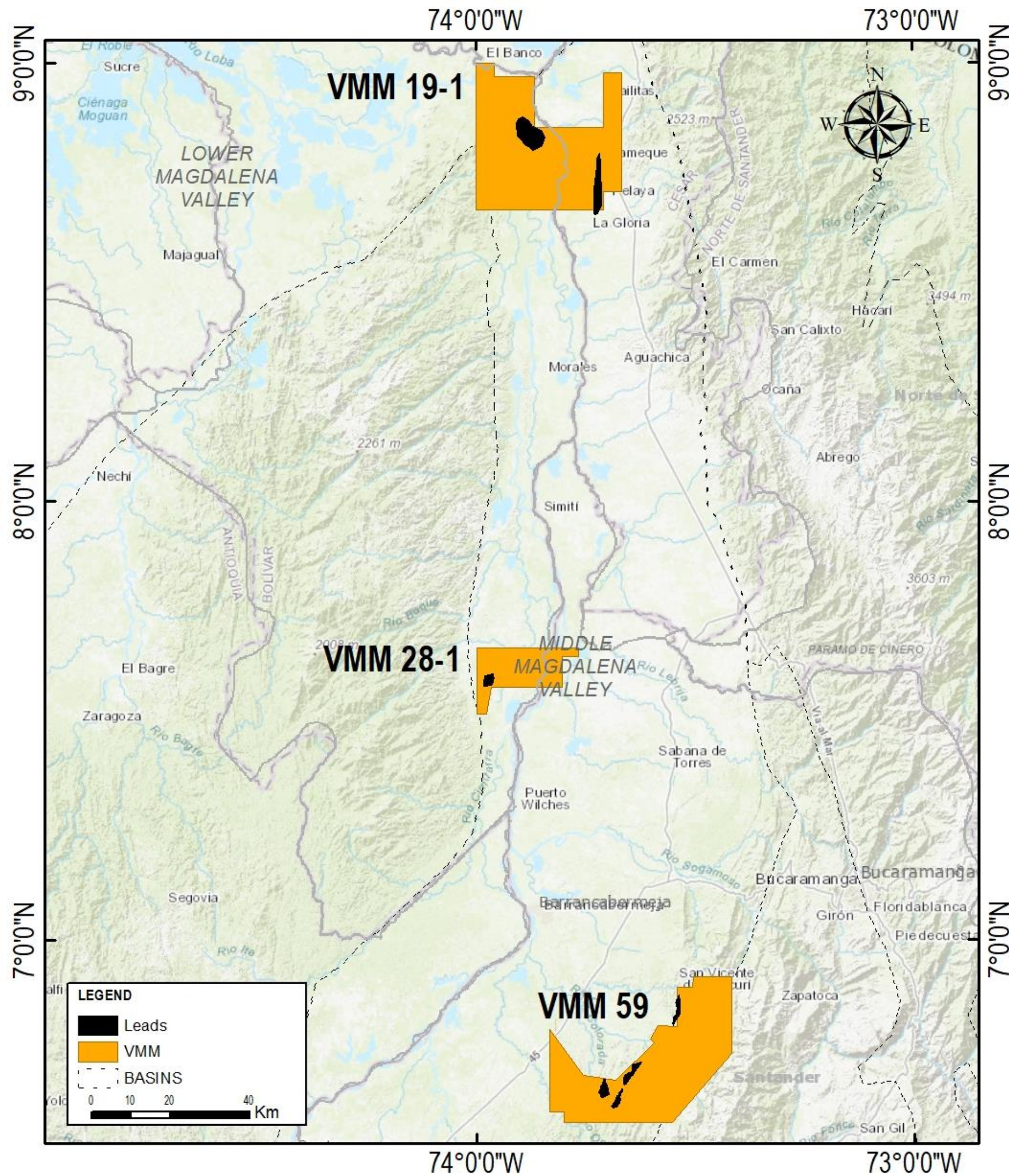
Prospective Resources

Lead No	AREA (Acres)	OOIP (MMBO)	Prospective Resources (MMBO)
1	1893	258,47	64,62
2	1733	236,62	59,16
3	1139	155,52	38,88
4	1554	212,18	53,05

OOIP: 862,8 MMBO

PROSPECTIVE RESOURCES: 215,7 MMBO

VOLUMETRICS: TOTAL



Oil and Gas (Deterministic)

- 5 leads in total (VMM 28-1 and VMM 59)

- OOIP: 862,8 MMBO

Recovery factor: 25%

- Prospective Resources

High Estimate: 215,7 MMBO
Best Estimate: 107,8 MMBO
 Low Estimate: 21,57 MMBO

- 2 leads in total (VMM 19-1)

- OGIP: 399,88 BCFS

Recovery factor: 25%

- Prospective Resources

High Estimate: 99,97 BCF
Best Estimate: 49,98 BCF
 Low Estimate: 9,997 BCF

CONCLUSIONS

- For the Colombia Round 2021, the ANH will be offering three blocks located in the Middle Magdalena Valley basin: **VMM 19-1, VMM 28-1 and VMM 59**, with an area of **214,413 Ha**.
- The VMM 19-1 is considered as an emergent area because of the data limitation and its location in the basin. The VMM 28-1 and VMM-59 are classified as mature areas.
- In the three areas there are available a total of 809,5 Km of 2D seismic. In the VMM 59 there are two pieces of 3D seismic volumes with a total area of 38 Km². Only in two blocks: VMM 28-1 and VMM 59, 12 wells have been drilled.
- The basin is divided in five different domains with two different structural styles. One associated with transtensional normal faults, and the other one with thrusting and development of foldbelts.
- The main reservoirs in the VMM 28-1 and VMM 59 blocks is considered the Esmeraldas and La Paz Formations of Upper Eocene age, while in the VMM 19-1 the Neogene units are considered the main reservoirs.
- Most of the leads are in trend with existent fields in a proven hydrocarbon system, such as the case of VMM28-1 and VMM-59.
- Shallow targets are one of the incentives of the offered leads that maybe has not been considered previously by the industry.
- Inside the areas offered by the ANH, seven leads have been identified with a best estimate prospective resources of **107,8 MMBO** for the VMM 28-1 and **49,98 BCF** for the VMM 19-1.

Thanks

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