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Results of the Nuclear Magnetic Resonance Application in Oil Fields in Putumayo, Colombia

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Abstract

The Nuclear Magnetic Resonance Technology is a geophysi- cal method developed and applied in the hydrocarbon's exploration and exploitation. This method is based on the study of electromagnetic re- sponses from different materials and / or structures in the subsoil. These spectral signatures emanate a single-frequency of electromagnetic radia- tion which can be registered using the stochastic resonance phenomenon. This technology can identify the presence and composition of elec- tromagnetic anomalies due to hydrocarbon in the satellite stage (Satellite Spectrographic). The accurate definition of the boundaries anomalous zone (accumulation area) is possible by the Method of formation of short- pulsed electromagnetic field (ECECI) and the Method of Vertical Elec- tro-Resonance Sounding (SVER), which can show a subsoil vertical per- spective pointing to the depth and thickness of layers saturated with in- terest material. This publication aims to show the results of the NUCLEAR MAGNETIC RESONANCE application on Putumayo oilfields located in the blocks: Area Occidental and Area Sur, the total area researched by Satellite Spec- trography in the specifics zones (Blocks: A. occidental, A. Sur and Orito) was 247.5 km2, 129 km2 with the ECECI and SVER methods equivalent to 268% of the original area requested by the client (48 km2).

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Keywords: Geo-Electrics Methods [‘], Anomalous [‘’], Polarization [‘’’], Infill [‘’’], [‘] Geo-electrics Methods: It is the branch of geophysics which deals with the behavior of rocks and sediments in relation to electric current, [‘’] Polarization: consists of the measurement of the decay of the potential difference after completing the injection of an intensity current I, [‘’’] Anomalies: Deviation in the common magnetic field of the study a rea, [‘’’’] Infill: Drilling new wells after primary or secondary production field development

Introduction

The NUCLEAR MAGNETIC RESONANCE for the hydrocarbon's detection is based on the study of the electromagnetic properties of subsoil materials at great depths with high precision (approximately one meter), using portable equipment for data acquisi- tion and for the fast and efficient processing and interpretation in a non-invasive way. This guarantees access to different types of terrain in all stages minimizing the risks and impacts both the environment and the community.

The results showed below correspond to evaluated areas in the Area occidental and Area Sur blocks and in the Acae, Loro and Caribe mature fields operated since 1965. In February 2010 this area had a cumulative production (Np) of 36,43 MBO with an original oil in place (OOIP) of 102 MBO, product of Cretaceous Rock from Caballos Formation and Palogene from Pepino Formation with an average recovery factor of 36.6%. it is indispensable to reevaluate these areas in order to find new undeveloped hydrocarbon accumulations.

Definitions

Satellite Spectrographic

The first stage of applying NUCLEAR MAGNETIC RESONANCE consists of acquir- ing spectroscopic satellite information in the area delimited by the coordinates provided by the customer.

Special sensors capture data at different range of electromagnetic spectrum, which de- pending on the interest material composition is emitted in a specific frequency and wavelength this is known as spectral signature. The use of a suitable combination of filters is possible to identify areas that may correspond to hydrocarbon accumulations considering their spectral characteristics.

The spectrographic analysis includes the establishment of the spectrographic intensity through mathematical algorithms. This analysis allows identifying areas where hydro- carbon deposits are located called type anomalies (gas and oil accumulations).

The most important results at this stage (spectrographic satellite) is a graphical repre- sentation of type anomalies for maps. This graph shows the relative pressure of the accumulated hydrocarbon, indicating areas with greater probability of success in find- ing hydrocarbon accumulation

Formation of Short-Pulsed Electromagnetic Field (ECECI)

This stage is carried out in the field, in the anomalous areas previously identified with the satellite data of the first. It consists of the acquisition, processing and interpretation of local electromagnetic information through stochastic resonance theory. To achieve this, it is necessary to study several points using transects that define the presence or absence of hydrocarbons. The intensity of this response can identify areas with greater accumulation.

The distance between transects depends on the needs and the difficulty of access to the field of study, being possible the acquisition of surface and / or air [1-3].

Vertical Electro-Resonance Sounding (SVER)

This stage is carried out in the field, in the anomalous areas previously identified with the satellite data of the first. It consists of the acquisition, processing and interpretation of local electromagnetic information through stochastic resonance theory. To achieve this, it is necessary to study several points using transects that define the presence or absence of hydrocarbons. The intensity of this response can identify areas with greater accumulation.

After refining the anomalies, the ECECI stage identifies the areas with the highest in- tensity (greatest hydrocarbon accumulation) by receiving, processing, and interpreting electromagnetic signals for the resonance effect. The acquired data correspond to in- formation of vertical depth in areas of higher anomaly intensity.

The vertical electro-resonance method performs a vertical study that allows the material of interest (oil, gas and water) to be identified and the depth and thickness of each layer to be defined. The resolution of the tool allows to study every meter of the ground components and approximately 10 kilometers (32,000 + feet) deep below the surface. Tool accuracy is over 90%. [4].

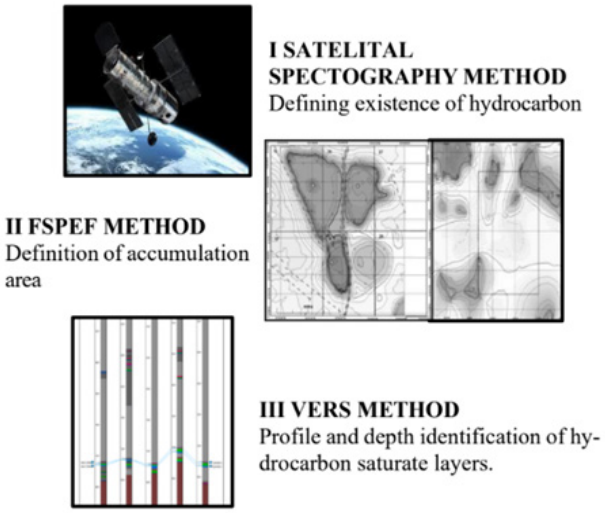

Figure 1: Graphic description of a proposed acquisition and exploration with NUCLEAR MAGNETIC RESONANCE

Tool Application Results in the Basin Cagúan, Putumayo.

The total area evaluated with satellite spectrographic data was 2475 km2. To accom- plish this, thirty-three spectrographic data images were acquired and processed with 1: 25,000-meter scale. (Figure 2)

Initially, the project included the evaluation of an effective area for the 18 km2 field stage by ECECI and 20 SVER soundings, located in the highest and best intensity anomalies identified by satellite spectroscopy, these areas were distributed as follows: Polygon (5 km2 of ECECI and 6 points SVER), Loro Polygon (6 km2 of ECECI and four points of SVER) and Acae (7 km2 of ECECI and 10 points of SVER). In addition, it was decided to implement the use of the Company option within agreement MA- 0025472, using the ECECI and SVER stages for Loro East with a study area of 30 km2. The project was fully implemented in five months.

In the Short Pulse Field Formation stage, a study of a full area of 129 km2 was analyzed, corresponding to 268% of the extension required by Company study full of 129 km2 which correspond at 268% of the extension required by Company.

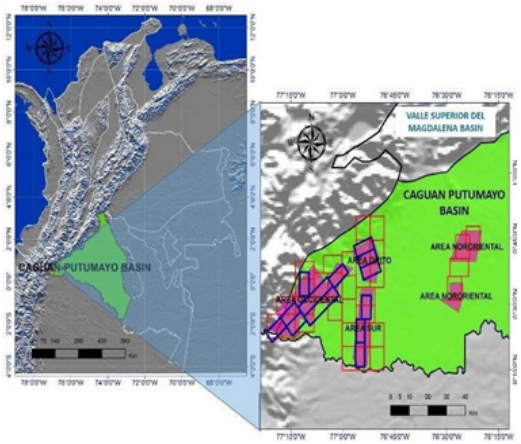

Figure 2: Geographic Location of Polygons Study.

Table 1: Represents the Relationship between Area of Analysis Requested by the Client and Total Area Analyzed.

FIELD	Area given by the client (km2)	Total area researched (km2)
ACAÉ	7	17
LORO OESTE	6	23
LORO ESTE	30	62
CARIBE	5	27
TOTAL	48	129

ACAE Polygon

Satellite Spectrographic Application in the ACAE Polygon

In the satellite stage, 33 spectrographic images were made in a 29-day period, directly over Acae Polygon, 75 km2 of area represented in spectrographic image number 28 was extended, as shown in Figure 3, which shows in the yellow outline the area corre- sponding to 75 km2 of spectrography, additionally in the area from 17km2 onwards, the ECECI method (white contour) was applied to the area requested by the company of 11 km2 (gray contour). Sample Heading (Forth Level). The contribution should con- tain no more than four levels of headings. The following ¡Error! No se encuentra el origen de la referencia. gives a summary of all heading levels.

The company requested a research area according to the results of the 6 km2 spectro- gram (Figure 3, gray line) that focuses on the area of greatest pressure detected by the spectrographic satellite. To provide a more detailed study, the research area was ex- panded to 17 km2 (240% more rented space).

The results allowed to establish anomalous zones of oil condensate deposits at a pres- sure of 5947 psi, making an E-W orientation. Depending on the intensity of the anomaly area, it was determined as follows: 66.74 km2 P1 (probability of 1%), 46.99 km2 P50, P90 and 0.22 km2

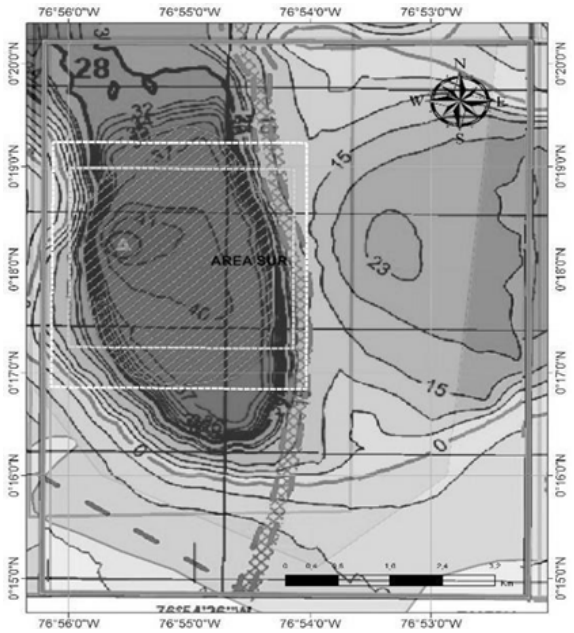

Figure 3: Satellite Spectrographic N° 26 (yellow contour) Acae Field. Area of ECECI method application.

Application of the ECECI Method in the ACAE Polygon.

When the anomalous areas were determined using satellite spectroscopic data, the field work was carried out, the ECECI method was the first to be done in order to identify in detail the anomalous zones boundaries. The results correspond to 15 deposit-type anomalies, where 6 anomalies are of oil and gas type, 6 areas of anomalies of free gas and 3 anomalies of condensed gas.

The results of applying the ECECI method gave a total area of oil accumulation of 20.88 km2; 3.79 km2 of free gas and 2.44 km2 of condensed gas. In figure 4 there are 6 anomalies of oil deposits, 6 anomalies of free gas deposits and 3 condensed gas de- posits, each with their respective accumulation areas represented in Table 2.

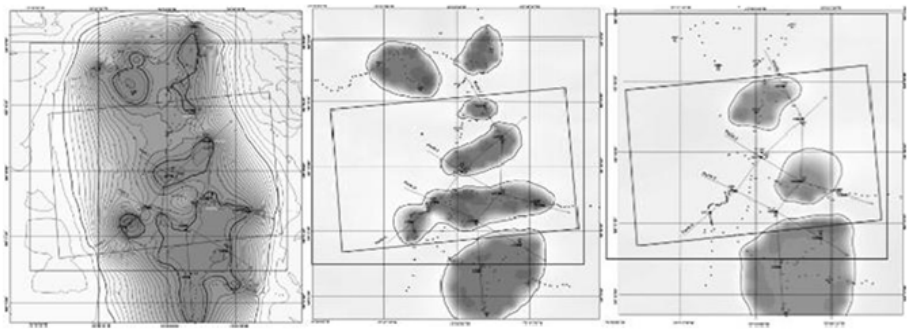

Figure 4, 1
Map of anomalies typified hydrocarbon (oil and gas) detected with the FSPEF method in the polygon ACAE.

Figure 4, 2
Map of anomalies typified free gas detected with the FSPEF method in the polygon ACAE.

Figure 4, 3
Map of anomalies typified condensate gas detected with the FSPEF method in the polygon ACAE.

Table 2: Areas and Pressures of Anomalies Typified from ECECI Method

ANOMALIES		TYPE		PRESSURE	AREAS (Km²) OIL			AREAS (Km²)	AREAS (Km²)
					P1	P50	P90	FREE GAS	CONDENSATE GAS
OIL-28	28--1	Oil	Free Gas	31 Mpa	9.88	1.12	0.22	0.58	
	28--2				9.88	1.12	0.17	0.28	
	28--3				9.88	2.58	0.26	0.46	
	28--4				11	2.58	1.14	1.35	
	28--5				11	2.58	0.1	1	
	28--6							0.12	
	28--7	Condensate Gas							0.47
	28--8								0.34
	28--9								1.63

SVER Method Application about ACAE Polygon

The integration of results with the spectrographic satellite and the ECECI data obtained in the field allowed us to propose the SVER distribution scheme. 10 vertical sounding points in 4 profiles to obtain the most significant information in the areas of greatest pressure, Figure 5 shows the location of each SVER point with nearby wells and the distance between the wells and the SVER point to validate the information obtained from the SVER data with the supplied nearby well.

With the results obtained from various sounding points, it was possible to correlate, as shown in Figure 6, the correlation of the SVER V207, V203 and V204 in the NW-SE direction. It was possible to correlate saturated layers of hydrocarbons (oil, gas) and water at depths between 10,450 and 10,700 feet, mainly, which effectively correspond to the producing formations.

The depth and thickness of the saturated layers obtained by SVER V2-07 were corre- lated with the interpreted data from the ACAE 8A well logs, which are located at a distance of 64 mm from SVER V2-07.

SVER	POZO CERCANO	DISTANCIA SVER-POZO (metros)
V2-01	ACAE 05	27
V2-02	ACAE 010	175
V2-03	ACAE 03	88,5
V2-04	ACAE 012	227,24
	ACAE 012 D	181,37
V2-05	ACAE 07	65
V2-06	ACAE 02	53
V2-07	ACAE 08 A	64
	ACAE 08	62
V2-08	ACAE 09	51
V2-09	SAN MIGUEL 4	66,27
V2-10	Zona No Explotada	

Figure 5: Location Map of Vertical Sounding Points, Distance between Wells and SVER Points on ACAE Field.

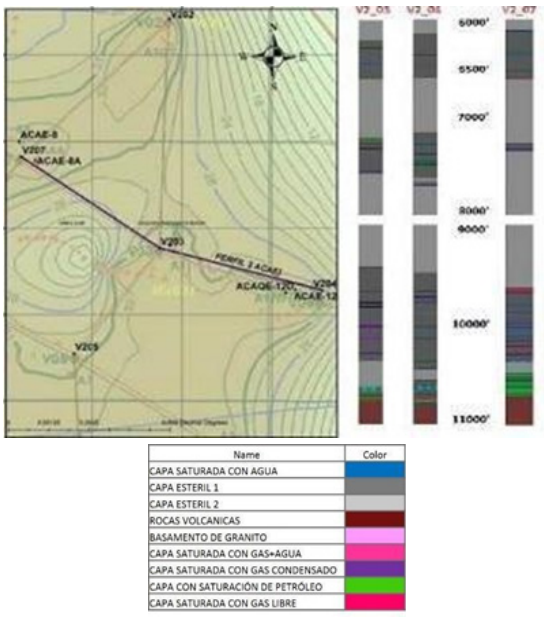

Figure 6: Profile 2 of Polygon Acaé of SVER in the Points V204, V203 and V207. Property Company

According to the correlation results to identify the saturated hydrocarbon layers, in SVER they correspond to the hydrocarbon accumulation zones identified in the well log found within the producing formations in the area. Caballos, Villeta and Pepino Formations.

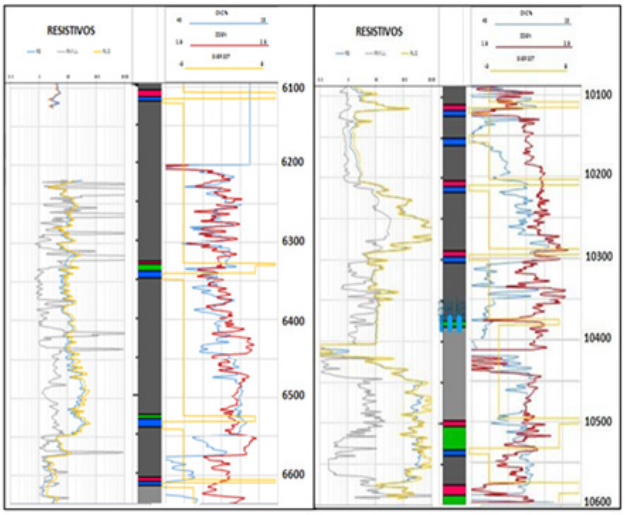

Figure 6-1

Well log and VERS sounding data in Pepino formation.

Figure 6-2

Well log and VERS sounding data in Caballos formation.

Table 3: Correlation Depths V207 with Electric Logs in Producing Formations; Certainty Factor of the Tool.

	SVER V2-07			REGISTROS ELECTRICOS ACAE 8A			
	DEPTH (FT)	THICKNESS (FT)	TIPO DE ANOMALIA	DEPTH (FT)	THICKNESS (FT)	TIPO DE ANOMALIA	% Factor de certeza
Formacion Pepino	6107	8	capa sat. con Gas Libre	6128	10	Gas	99.66%
	6115	6	capa sat. de Agua	6142	5	Agua	99.56%
	6327	3	capa sat. con Gas Libre	6312	10	Gas	99.76%
	6330	10	capa sat. de Petróleo	6318	12	Petróleo	99.81%
	6340	8	capa sat. de Agua	6340	8	Agua	100.00%
	6524	7	capa sat. de Petróleo	6490	50	Gas	99.48%
	6531	10	capa sat. de Agua	6540	30	Petróleo	99.86%
	6606	4	capa sat. con Gas Libre	6575	5	Gas	99.53%
	6610.5	5	capa sat. de Agua	6580	8	Agua	99.54%
	7357	7	capa sat. con Gas Libre	7306	12	Gas	99.31%
	7364	7	capa sat. de Agua	7318	5	Agua	99.38%
Formacion Caballos	9624	6.5	capa sat. con Gas Libre	9614	6	Gas	99.90%
	9648	7.5	capa sat. con Gas Libre	9643	6	Gas	99.95%
	10204	7	capa sat. con Gas Libre	10208	8	Petróleo	99.96%
	10211	7	capa sat. de Agua	10220	7	Agua	99.91%
	10289	7	capa sat. con Gas Libre	10275	5	Gas	99.86%
	10296	9	capa sat. de Agua	10289	11	Agua	99.93%
	10375	7	capa sat. de Petróleo	10370	4	Petróleo	99.95%
	10496	9	capa sat. con Gas Libre	10495	5	Agua	99.99%
	10503	30	capa sat. de Petróleo	10510	13	Agua	99.93%
	10533	7	capa sat. de Agua	10530	5	Gas	99.97%
	10575	13	capa sat. con Gas Libre	10540	15	Gas	99.67%
					% total de certeza		99.77%

Specifically, the primary producer interval of the Caballos Formation 10200'-10632' and the secondary producer of the Pepino Formation 6182'-7210' were analyzed, iden- tifying the layer saturated with water, gas and thinner layers of oil. The total percentage of precision indicated in Table 3 was 99.77%. The results show that 100% of the areas of interest contain hydrocarbon accumulation records that are validated with existing wells in the area. Areas with higher petrophysical characteristics with resistivities greater than 100 ohm-m, have a porosity between 10% and 15% and oil saturations greater than 80%. These zones correspond to the intervals 10510'-10540' and effec- tively determine the SVER.

Based on the results obtained by the vertical electro-resonance sounding in the ACAE field, it is possible to determine 13 new prospective intervals of drilling operations as shown in Table 4, where only the saturated layers of hydrocarbons (oil and gas) and water were considered.

Table 4: New Prospective Points where will be Possible Realize Performing and the Intervals of Performing of Acae Wells Field.

SVER	V2-03	V2-04	V2-07
PUNTOS DE CAÑONEO PROSPECTIVOS	7346-7350	6605-6609	6329-6335
	7596-7599	10640-10647	10503-10510
	10669-10674	10699-10705	10587-10598
	10744-10750	10790-10799	10658-10675
	10788- 10793		
POZOS	ACAE 03	ACAE 012	ACAE 08
PUNTOS CAÑONEADOS	10496-10502	10610-10620	10504-10509
	10504-10507	10620-10630	10516-10523
	10509-10511	10656-10666	10530-10536
	10514-10522	10695-10701	10544-10554
	10530-10540		10574-10588
	10567-10573		10594-10596
	10577-10580		
	10582-10585		
	10587-10592		
	10617-10625		

LORO Polygon

Satellite Spectrographic Application in the Loro West and Loro East. Polygon

In the first stage of the implementation of NUCLEAR MAGNETIC RESONANCE in the Loro field, spectrographic captures were made in an area of 75 km2, Figure 7 shows the location of the Loro polygon (7 km2) determined by the client and 23 km2 area evaluation, which coSVER an area between two anomalies situated within the southern area (green contour) for this reason, the evaluation area was expanded and, subse- quently, a second study was performed in the Loro East field, in the southern area of the Putumayo Operations Superintendence (red outline), with a total area of 30 km2.

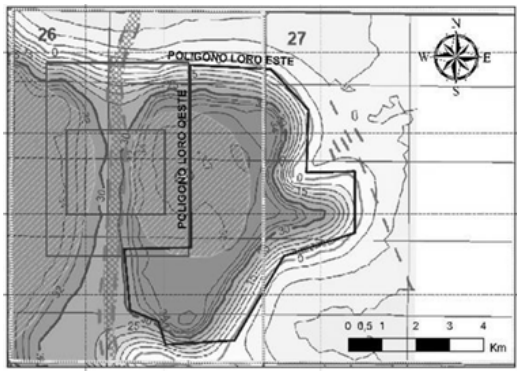

Figure 7: Spectrography Distribution Scheme. Loro Oeste Polygon (Green Polygon) and Loro Este (Red Polygon).

ECECI and SVER Method Application on the LORO Polygon

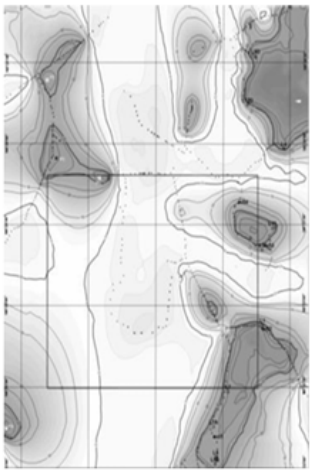

Figure 8-1
Deposit oil anomalies detected by FSPEF method on polygon Loro. Property of Ecopetrol S.A.Colombia

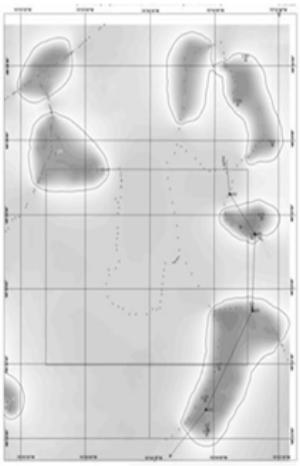

Figure 8-2
Deposit free gas anomalies detected by FSPEF method about polygon Loro. Property of Ecopetrol S.A.Colombia

As a result of the field phase, an anomaly map typified as oil and gas was obtained, which shows a refinement of the anomalies detected by the satellite spectrogram that determines an effective area of oil accumulation of 14.76 km2. Six oil-type anomalies were identified, with an estimated average pressure 3704.98 psi and a general trend in the NW-SE direction.

Table 5: Areas and Pressure of DTA Oil and Free Gas with ECECI Method into Polygon Loro West

ANOMALIAS		PRESION (psi)	AREAS (Km²) ANOMALIAS CRUDO			AREAS (Km²)
			P1	P50	P90	GAS LIBRE
OIL-16-26	16-26 1	4496.17	6.46	1.26	0.38	1.3
	16- 26 2		6.46	0.28	0.1	0.13
OIL-26-27	26- 27 1	3190.83	1	0.2	1	1.34
	26- 27 2	4496.17	6.77	2.24	1	1.34
	26- 27 3		6.77	0.36	0.15	0.32
	26- 27 4		6.77	1.75	0.99	1.5

With the application of the ECECI method, it was possible to identify six free gas anomalies, establishing a total area of 4.59 km2.

The integration of the results obtained from the satellite spectrograph with the infor- mation obtained in the field by the ECECI method allowed us to propose the distribu- tion scheme at 4 vertical sounding points in areas of greater hydrocarbon accumulation (Figure 9).

The results obtained from the surveys carried out in the LORO polygon identified two areas with significant accumulations at depths of 6000-7000 feet and 10250-10650 feet. (Figure 10).

Based on the results obtained in the SVER, the Loro West polygon suggested 13 pro- spective drilling points, in addition to six previously unidentified points in the west zone, three points in the anomalous zone of crude oil-26-27-2 to the NE of the polygon and 4 in Oil-26-27-4 in the anomaly of the polygon SE. The permeability bar was iden- tified in the center of the polygon with NS direction, of which the vertical electro-res- onance sounding (SVER) provided 12 new prospective intervals to carry out gunshot operations as shown in Table 6.

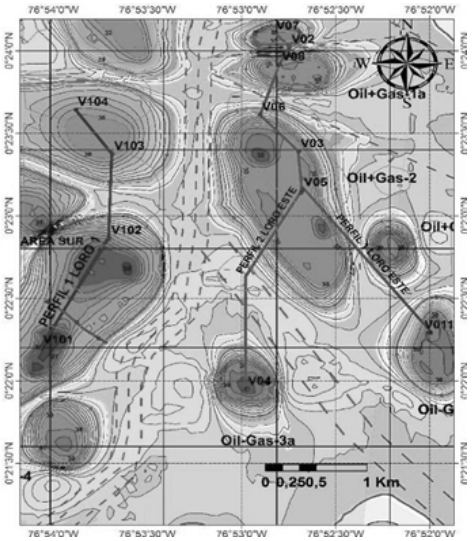

Figure 9: SVER Distribution on Polygon Loro West (Blue) and SVER distribution on Loro East (Red). Property Company

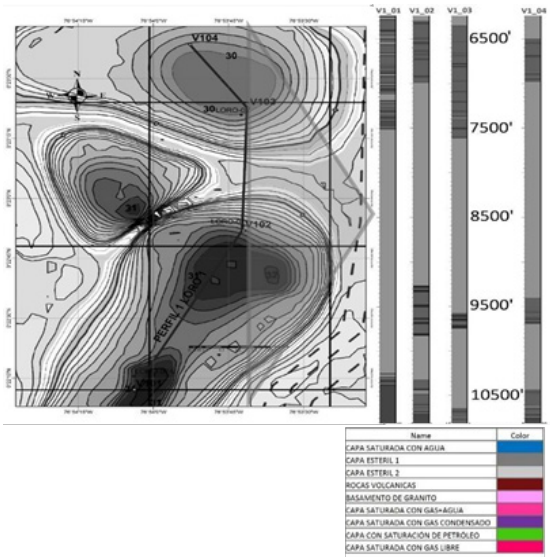

Figure 10: Spectrography Distribution Scheme. Loro Oeste Polygon (Green Polygon) and Loro Este (Red Polygon).

Table 6: New Prospective Points where will be Possible Realize Performing and the Intervals of Performing of Loro Wells Field.

SVER	V1-01	V1-02	V1-03	POZOS	LORO 01
PUNTOS DE CAÑONEO PROSPECTIVOS	6251-6271	6486-6495	7380-7396	PUNTOS CAÑONEADOS	10539-10543
	6468-6483	6629-6635	10644-10653		10555-10564
	6887-6904	10424-10479	10742-10752		10561-10572
	10253-10280	10598-10613	10840-10847		10576-10592
		10680-10699			10598-10636
					10626-10652
					10678-10684

ECECI and SVER Method Application on Polygon LORO East.

Using the ECECI method seven anomalies type oil was detected on East of the LORO field, within the Area South Block; these are divided by possible compartments in NW- SE direction. Using the ECECI method, a refinement of the contours of oil and gas anomalies of 1042 acres (4.23 km2) was obtained from an initial anomalous area of 10507 acres (42.52 km2) derived from the spectrographic satellite method [5,6].

Table 7: Areas and Pressure of DTA Oil and Free Gas with ECECI Method into Polygon Loro East

ANOMALIAS	PRESION	P1		P90	
	PSI	(ACRES)	(Km²)	(ACRES)	(Km²)
OIL-GAS-4	4496	120	0,49	87	0,16
OIL-GAS-3A		97	0,39	29	0,12
OIL+GAS-2	4351	499	2,00	250	1,00
OIL-GAS-5		144	0,58	53	0,21
OIL+GAS-2A		62	0,25	12	0,048
OIL+GAS-1		44	0,18	15	0,1
OIL+GAS-1A		80	0.32	32	0,13

The distribution of the SVER at Loro Field was determined based on the overlap of the contour of the anomalous areas identified by the FSEPF method on spectroscopy maps. Two SVER profiles were made, profile 1 coSVER an area of 5016 feet in a north-south direction, formed by the anomalous zones (Figure 11) Oil and gas-1, -1A Oil + Gas, Oil + Gas-Oil + Gas 2 -4, profile 2 located west of the polygon in NW-SE direction, covering an extension of 2000 feet through the Oil-Gas-4 anomaly. Eleven sounding points were established as shown in Figure 9 (east profile).

SVER sounding data detected saturated oil and gas layers with an average thickness of 13 feet, in DTA Oil + Gas 2, at a depth between 10,450 and 10,800 feet, at a depth between 6,000 and 7,000 feet, other layers were identified saturated with oil and gas with an average thickness of 9.8 feet. Eleven sounding points were established as shown in Figure 9 (East profile).

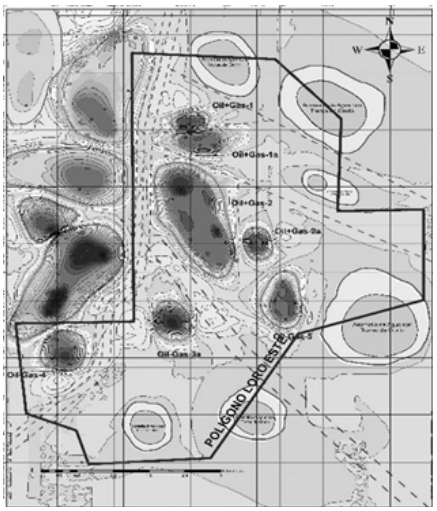

Figure 11: Deposit Oil and Gas Anomalies Detected with ECECI Method about Polygon Loro East.

The results obtained with the SVER method detected saturated layers of oil and gas with an average of 13 feet, in the oil and gas anomaly 2 at depths between 10,450 and 10,800 feet, mainly. Other saturated layers of oil and gas with an average thickness of 9.8 feet at depths between 6000 and 7000 feet were identified, of which 15 new pro- spective intervals were defined to carry out the following depths of canyons. (Table 8)

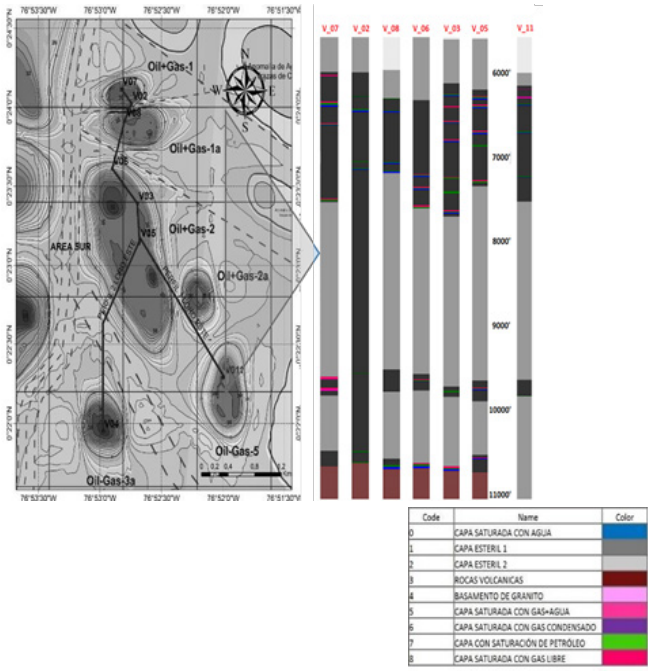

Figure 12: Loro East Polygon SVER point V101, V102, V103, V104, V105, V106 and V107 South-North Direction.

Table 8: New Prospective Points where will be Possible Realize Performing and the Intervals of Performing of Loro East field.

SVER	V01	V02	V03	V04	V06	V08	V12
PUNTOS DE CAÑONEO PROSPECTIVOS (Ft)	7070-7080	6451-6467	7070-7080	7100-7113	7580-7615	7170-7185	6200-6216
	10750-10788	10479-10492	10750-10788	7200-7213	7660-7673	10600-10623	6600-6625
				9800-9812	9800-9813		10750-10768

CARIBE Polygon

In the Putumayo department of Colombia, municipality of Orito, in the West Area block is the polygon of interest called Caribe.

Satellite Spectrographic Application in the Caribe Polygon.

The set of satellite spectrographs in the West Zone contains fifteen imaging spectro- graphs, the area of interest determined by the client covered an area of 5 km2, but the total area analyzed was 27 km2 to provide high-quality results; The region of interest is located in an oil and gas anomaly in the NE of the West block, SW-NE direction (Figure 13), it has been identified based on 8, 13, 10 and 14 spectrographic images.

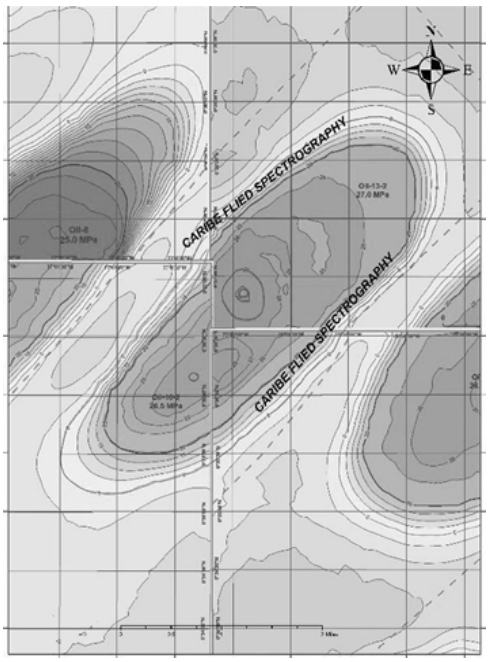

Figure 13: Satellite Spectrography, of Four take Satellites Showing Polygon Caribe Location.

Satellite ECECI Method Application on the Caribe Polygon
Six Oil-type anomalies were identified at a pressure of 3190.83 psi, three of the unde- veloped zones were determined as new prospective zones for drilling. Based on the detailed delimitation of the Caribbean Area, an anomalous zone was identified that es- tablishes an area (P1) of 8.6 km2.

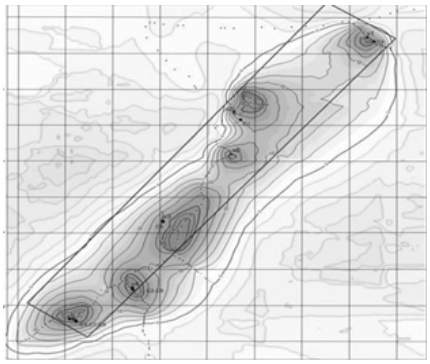

Figure 14: DTA Oil Detected by ECECI Method on Polygon Caribe.

Satellite ECECI Method Application on the Caribe polygon

Six sounding points were established in the way that the anomalies of interest pass through, allowing the large extension of the area to be sampled, the profile is NE-SW direction, as shown in Figure 15.

The results of applying the SVER method identified the anomalous zone with the great- est thickness of hydrocarbon accumulation at depths between 7500 -7900 feet, of which 20 new prospective intervals were determined for canon operations, at the following depths (Table 9).

Table 9: Areas and Pressure of DTA Oil with ECECI Method into Polygon Caribe.

ANOMALIAS		PRESION (psi)	AREAS (Km²) ANOMALIAS CRUDO		
			P1	P50	P90
OIL-13-2	13-2 1	3190.83	8.56	0.2	0.01
	13-2 2			2.94	0.1
	13-2 3				0.06
OIL-10-2	10-2 1				0.19
	10-2 2				0.1
	10-2 3				0.1

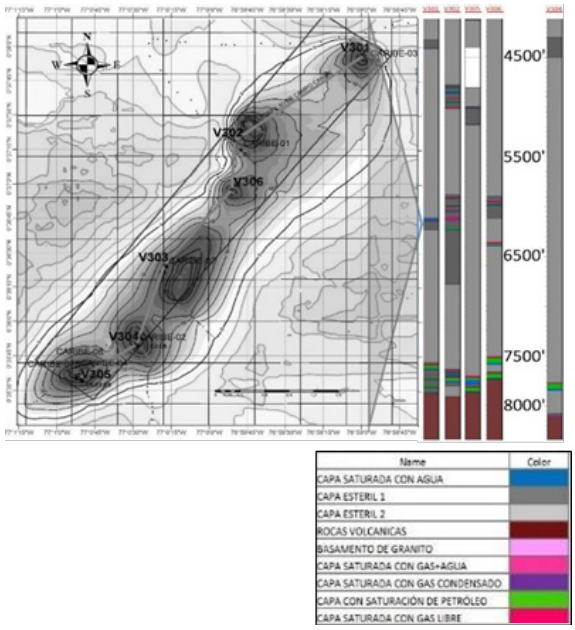

Figure 15: SVER's Profile Number One Polygin Caribe V101 V305, V304, V303, V306, V302 y V301 (South-North severally).

Table 10: New Prospective Points where will be Possible Realize Performing and the Intervals of Performing of Caribe Wells Field

SVER	V3-01	V3-02	V3-05	V3-06	V3-04
PUNTOS DE CAÑONEO PROSPECTIVOS	7621-7651	4950-4963	5000-5003	5972-5982	7778-7789
	7757-7766	6062-6067	7714-7739	6379-6395	7795-7810
	7826-7839	6232-6245	7812-7849	7525-7578	7815-7827
	7826-7839	7673-7682		7685-7728	
		7708-7717			
		7742-7772			
POZOS	CARIBE 03	CARIBE 01	CARIBE 04		CARIBE 02
PUNTOS CAÑONEADOS	Se abandono el pozo durante perforacion	7425-7431	7549-7559	No hay pozos existentes cercanos	7561-7568
		7442-7454	7581- 7590		7627-7632
		7501-7522	7620-7630		7666-7672
		7541-7553	7640-7650		7675-7682
		7572-7606	7658-7664		7718-7722
		7627-7628			7734-7749

Conclusions

The Oil & Gas finder technology application within the Acae, Loro and Caribe field showed its optimal performance in the search for hydrocarbons and the economic ef- fectiveness that its implementation implies, as it is not a technology with socioenviron- mental impacts that allows a shorter duration of application. with respect to conven- tional technologies.

Spectroscopy turned out to be a reliable source for recognition and delimitation of areas with hydrocarbon accumulations, the ECECI method allowed to define in detail the oil anomalies contours, condensed gas and free gas located in the three fields described (Acae, Loro and Caribe), emphasizing its excellent application to find new prospective points for hydrocarbon option within agreement MA-0025472, using the ECECI and SVER stages for exploration, suggesting forty-three new prospective and fill wells, of which seven are located in the ACAE industrial estate, thirteen are located in the Loro West industrial estate, eleven points of landfill and nine new wells in the Loro Este industrial estate, and three new wells in the Caribe industrial estate.

Validated high reliability of third method SVER, which showed us an accuracy of 99.77%, regarding the location and thickness of the layers saturated hydrocarbon to be correlated with existing well logs ACAÉ-8A in the

ACAE field, demonstrating resolu- tion layers able to detect for up to 3 feet thick, is very useful locating new prospective 70 points for cannonading operations in supposed areas considered by the third stage of technology as a viable production intervals, it must be realized although the technol- ogy SVER indicates the presence of hydrocarbon accumulation, this doesn't indicate the characteristics under which the fluid and petrophysical properties of the formation is.

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