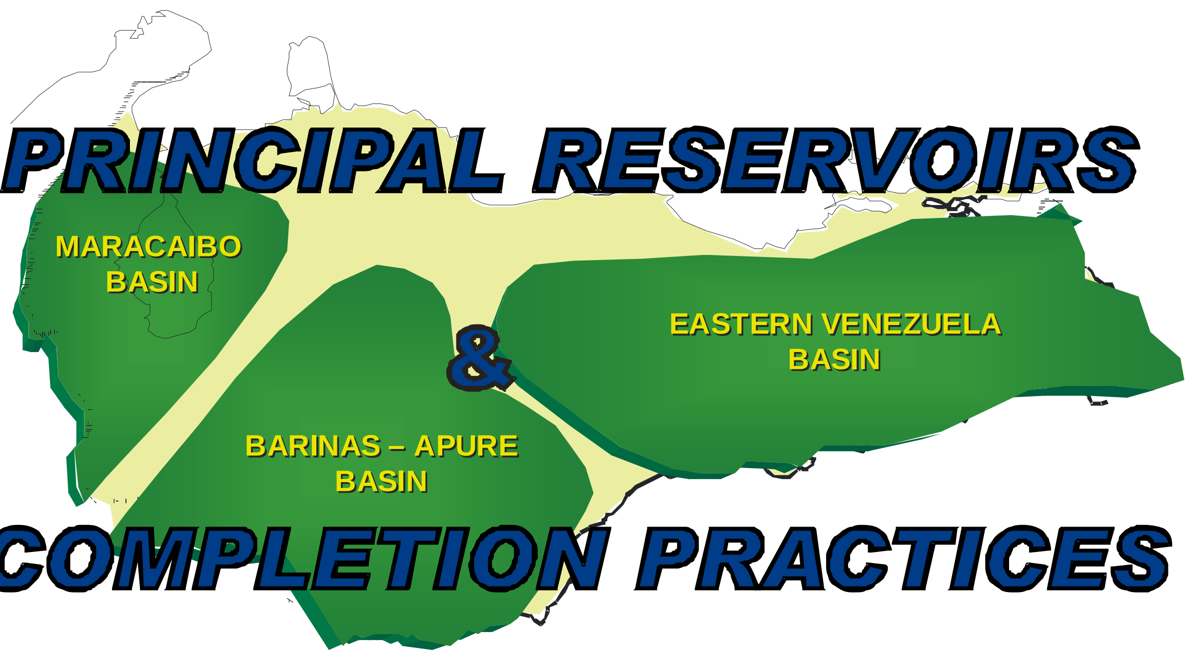
VENEZUELA SEDIMENTARY BASINS

PRINCIPAL RESERVOIRS & COMPLETION PRACTICES



By

Donald A. Goddard

(2006)

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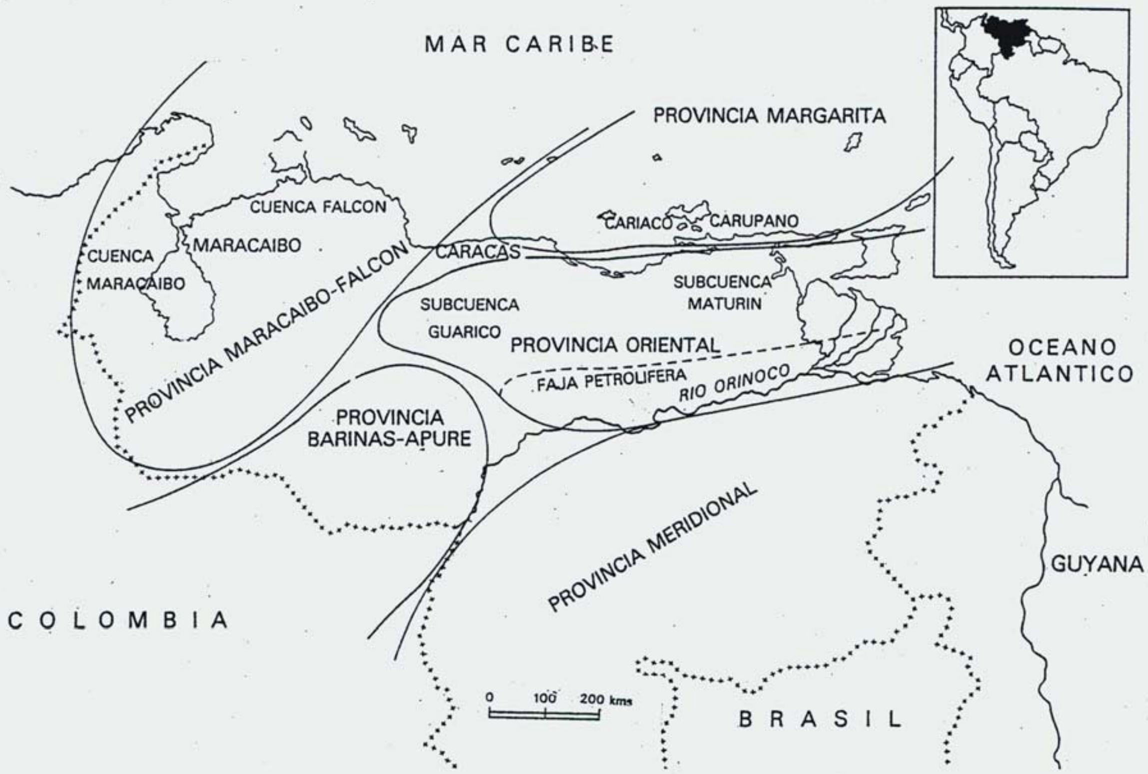


TABLE OF CONTENTS

TABLE OF CONTENTS

PREFACE

The information presented in this report was obtained from several publications such as those in the Selected Bibliography (Chapter 5). Much of the information regarding the clastic reservoirs of the Venezuelan sedimentary basins is scattered throughout a large volume of mostly Spanish literature. Therefore, the need exists to summarize, translate, and integrate the more important, basic geological parameters of these reservoirs. The geologic summary presented here can be considered an initial attempt at synthesizing some of the data.

Those not familiar with the principal producing intervals in these basins will find this to be a useful set of notes. A few figures are presented to give the reader an idea as to the general location of the reservoirs, as well as to their stratigraphic relationship with the overlying and underlying units. Also included in this publication are several well completion diagrams that can help the user plan the drilling strategies required in the different basins. Also presented are authorizations for expenditure (AFE) estimates for five depth ranges (2500', 5000', 10,000', 15,000' and 19,000'). The costs presented here are for the region of North America. It is estimated that drilling costs for Venezuela are approximately 20% higher. The date of the estimated costs is December 2005. During 2006 these costs have continued to increase.

1. MARACAIBO BASIN RESERVOIRS

1.1 MIOCENE LAGUNILLAS FORMATION

In the Coastal Bolivar Fields, from Cabimas to Bachaquero on the eastern shores of Lake Maracaibo, the Lagunillas Inferior Member has been the most prolific heavy oil producer in the area since the early 1920's (Fig. 1). The Lagunillas Formation is a subsurface deltaic interval that extends from the center of Lake Maracaibo to its eastern shore. Consisting of interbedded semi-consolidated sandstone, shale, and lignite, the interval has been subdivided into an upper member (Bachaquero), a middle member (Laguna) and a lower member (Lagunillas Inferior) (Fig. 2). The producing reservoirs are located between 2000 and 5000 feet (610 - 1525 m) in depth and consist of a series of stacked meandering distributary channels, levee overbank and bay fill sands, and some delta front deposits. Locally, these are typically unstructured reservoirs with oil located in stratigraphic traps for the most part. Where large anticlinal structures occur in Pueblo Viejo and Bachaquero, commonly they are flanked by updip sand pinch-outs. Porosity of the Miocene reservoirs is intergranular and related to the depositional facies. However, because of the loose and well-sorted nature of the sand grains, they tend to be high, ranging from 25 to 40%. Permeability is also high averaging approximately 600 md. Since most of the reservoirs consist of distributary channel sands, net oil sand intervals are large, averaging 120 feet (37 m) in thickness.

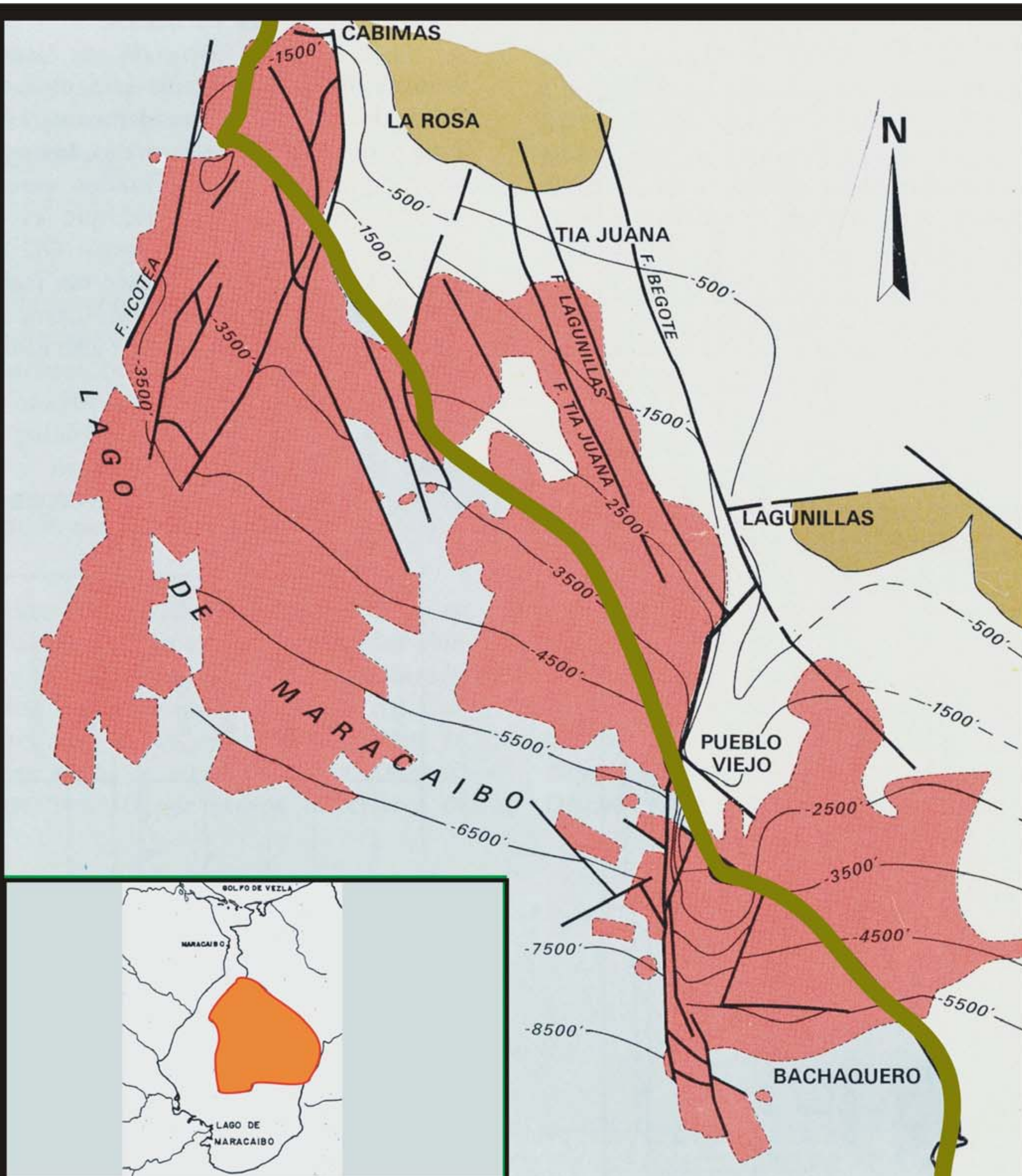


Figure 1: Location of the Coastal Bolivar Fields, near Cabimas, Tia Juana, Lagunillas, Pueblo Viejo, and Bachaquero in the region of Lake Maracaibo (Modified after Schlumberger, 1980).

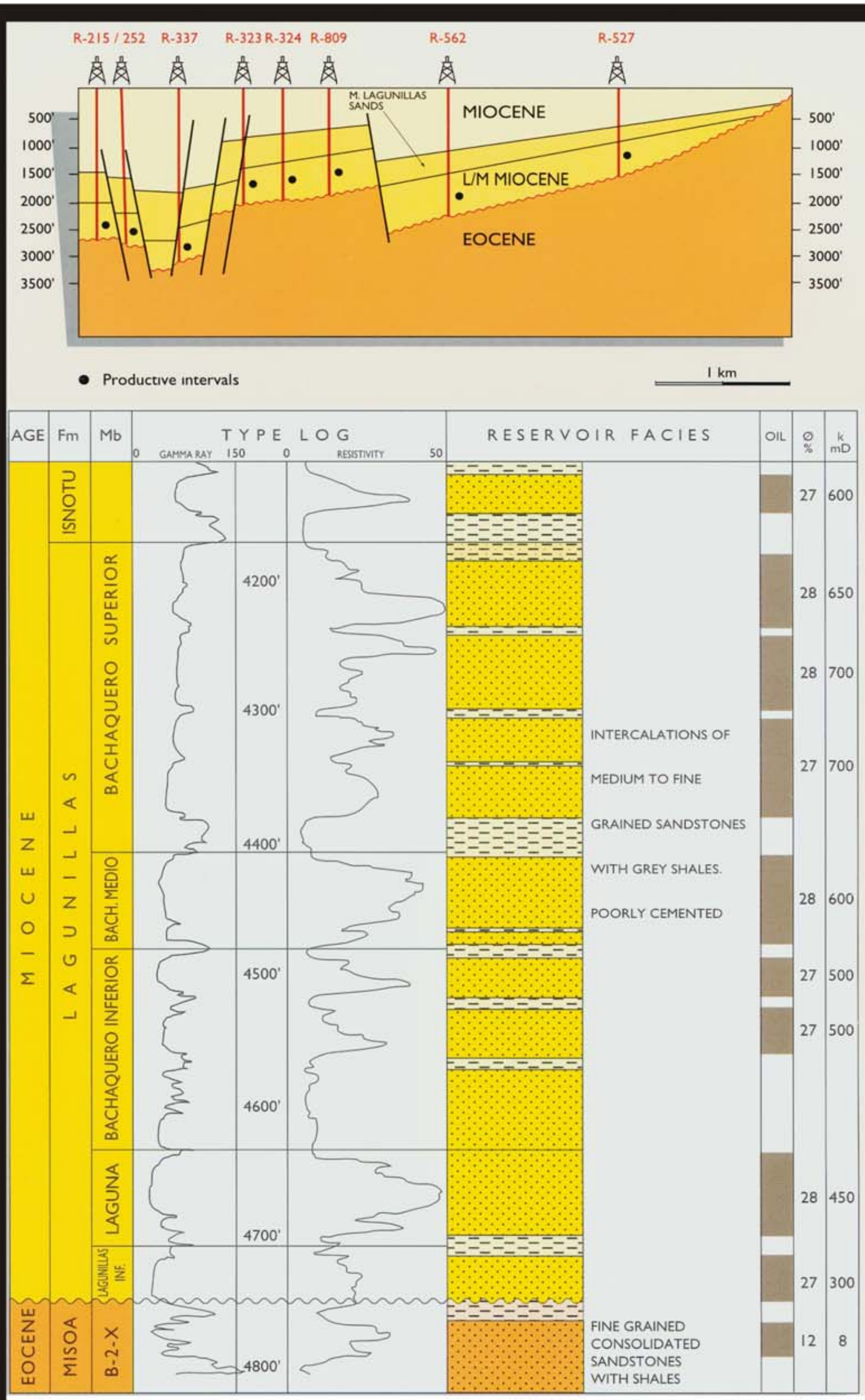


Figure 2: Stratigraphy of the Miocene Lagunillas Formation in the area of the Coastal Bolivar fields (Modified after Petroleos de Venezuela and MEM, 1996).

1.2 EOCENE MIRADOR FORMATION

A prolific producer in the subsurface of the Colon District of Zulia State, this Eocene, fluvial sequence of interbraided channels can be found cropping out in the Perija Range to the west and northwest and in the Venezuela Andes near San Cristobal to the southeast. In the subsurface, at depths between 1200 and 6000 feet (369-1800 m), the clean massive sandstone that comprises the producing intervals of the Mirador Formation, have porosity that ranges from 14 to 21% and permeability values averaging 600 md (Fig. 3). Based on palinological evidence, the Mirador correlates laterally with the lower Misoa Formation, a more deltaic facies located to the east and northeast of the Colon District.

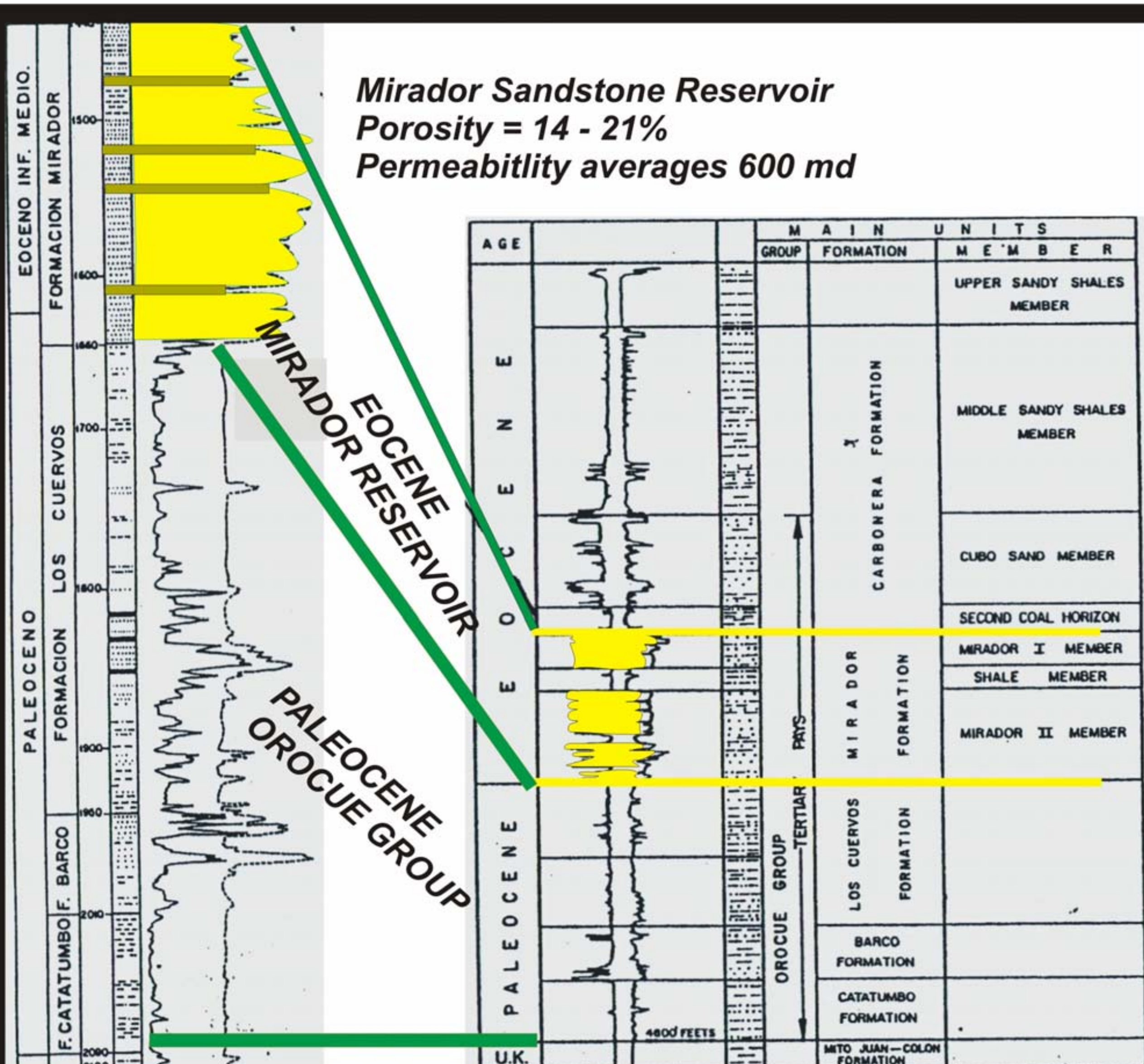


Figure 3: Paleocene - Eocene stratigraphy of southwest Maracaibo Basin (Modified after Molina, 1993; in AAPG Treatise of Petroleum Geology, Vol. VIII).

1.3 EOCENE MISOA FORMATION

In the subsurface in the center of Lake Maracaibo (Lama Field) and on its eastern shores (Coastal Bolivar, Ceuta and Barua-Motatan Fields) the Misoa deltaic sandstones are the principal producers. This formation consists of two sandy/shaly transgressive sequences, the upper B (B1 to B9) and the lower C (Cl to C7) sandstones. Figure 4 shows the general subsurface extent of the Misoa and Figure 5 gives the generalized lithology of the C6 – C7 interval.

In the center of Lake Maracaibo, e.g. Lama Field, depth to the top of the Misoa reservoirs varies between 7000 and 13500 feet (2100 - 4120 m). Average intergranular porosity is 22% and average permeability is 300 md.

The following abstract obtained from the 1993 AAPG, Caracas Meeting gives a brief description of the Lower Misoa C: CASAS, J.E. and CHACARTEGUI, F., Maraven S .A. Caracas, Venezuela.

"Sedimentological and Diagenetic Study of Lower Misoa (C6 and C7 Members) in Lama Field, Maracaibo Lake, Venezuela."

This sedimentological study describes the Lower Misoa Formation in the Lama Field and is a part of a project to simulate the reservoirs for E.O.R. purposes. The reservoirs were cored in four wells for a total of 1500 ft. The Lower Misoa (C6i-C7) is divided into six sedimentary units, four corresponding to C7 and the other two within C6i. Using integrated sedimentological and petrophysical data, four flow units are defined, two within C7 and two within C6i. Sporomorphus species observed at the top of C7, identify this unit as the palynological zone M corresponding to Lower Eocene. By defining sedimentary units using log character, it is possible to construct trend surface and isopach maps that show the geometry of the reservoir as an elongated body with a northeast-southwest orientation. Petrophysical and petrographical characterization of facies suggest that sedimentary facies control the variations observed in permeability, porosity, and oil accumulation in the reservoir. The most important diagenetic alterations are carbonate cementation, silica overgrowths and kaolinite precipitation. For the reservoir C6i the flow unit with the best performance is the number III characterized by Ø = 23 %, and K = 300 md. For C7 which is the best Lower Misoa reservoir in the field, the flow unit II has the best performance with Ø = 25 %, and K = 600 md. Characteristics such as primary sedimentary structures, lithofacies analysis and the floral-faunal analysis of samples, suggest that these sequences were deposited as a large barrier island complex with extensive coastal lagoons.

In an easterly direction, depth to the top of Misoa in the Ceuta-Tomoporo Field can be located from 14000 feet (4300 m) to 16000 ft. (4900 m). Onshore, approximately 30 km ENE of Ceuta, the prolific Barua-Motatan Fields produce from Misoa sandstone reservoirs at 11,000 to 12,000 feet (3350 - 3650 m). The fluvio-deltaic nature of the Misoa deposits persist and reservoir parameters vary according to the facies characteristics. Porosity ranges from 14 to 20% and permeability from 150 - 400 md.

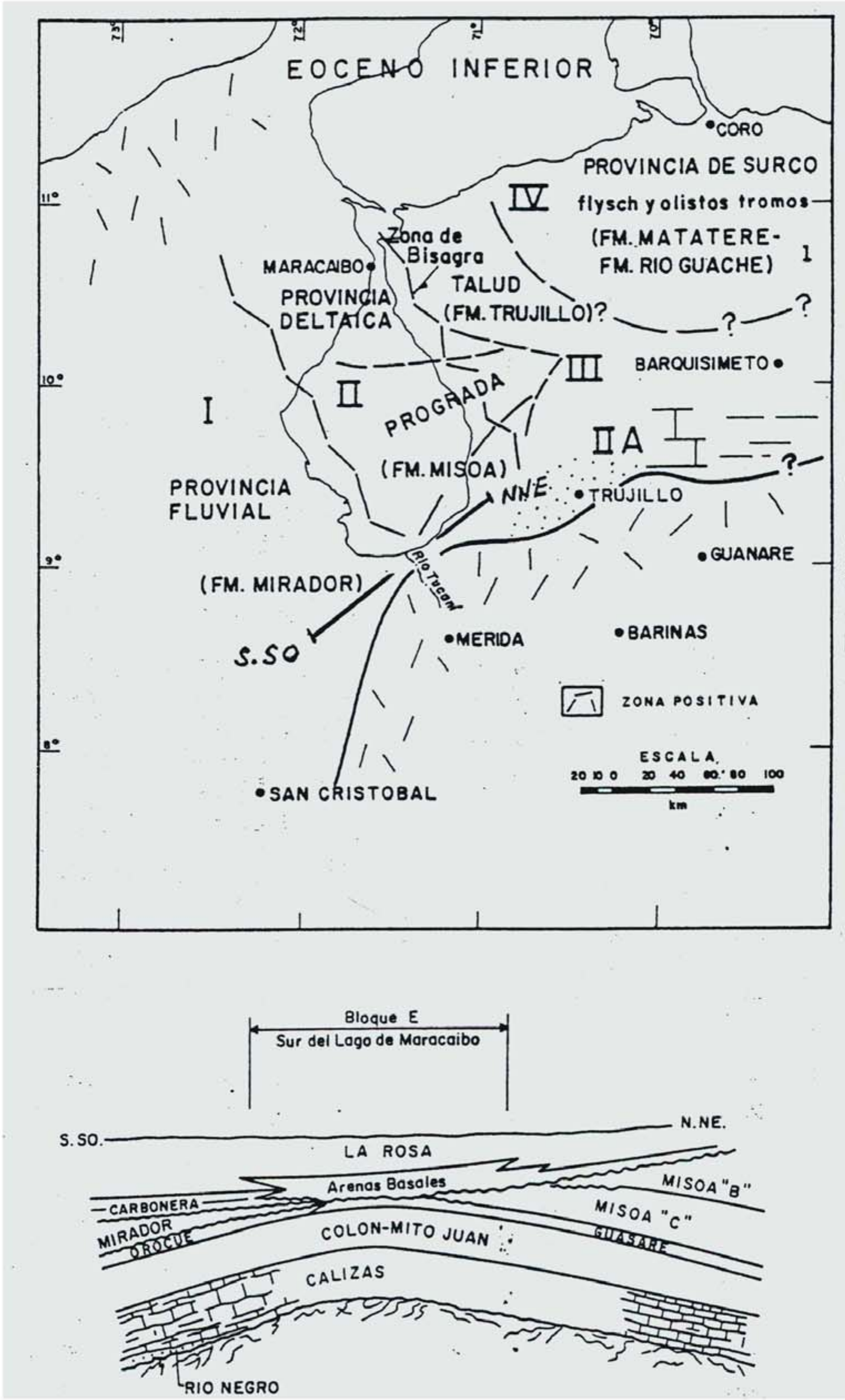


Figure 4: Distribution of Lower Eocene deposits in the Maracaibo Basin (After Gonzalez de Juana et al., 1980).

The following AAPG abstract also from the 1993 Caracas Meeting briefly describes the Ceuta area:

CHACARTEGUI, F., M. C. COLL, J. URDANETA, J. PINTO and D. LUGO, Maraven S.A., Caracas, Venezuela:"Laminated Sandstone Reservoir Characterization, Middle Eocene Lower Misoa Formation, Ceuta Field, Maracaibo Lake."

This study presents the results of a multidisciplinary, project and methodology used to describe a clastic reservoir, known as C-2/C-3, characterized by thin sandstones units masked by a mainly argillaceous sequence. The area, known as Area 2 of the Ceuta field, is located to the southeast of Maracaibo Lake, comprising an area of 75 km^2. Sedimentological facies description, characterization and analysis resulted in the identification of seven different lithofacies, of which only two are productive. Additionally, ten sedimentary units were recognized, based on related facies associations and nature of facies contacts. These sedimentary units were deposited by a prograding, fluvially dominated delta in a large estuarine environmental setting. Integration of sedimentological and petrophysical data were used to recognize and predict prospective intervals from well logs and to characterize them. A deconvolution of MICRO LOG resistivities proved to be the most successful technique to delineate productive intervals, and set the basis for flow unit identification. Production data, integrated with petrophysical and sedimentological parameters, were use to identify and characterize six flow units from the entire sequence. Log correlations, based on the sedimentological framework and stratigraphic sequence analysis techniques, in addition to 3-D seismic interpretations, were used to establish the external geometry and extension of flow units and thus, delineating the area and vertical limits of the reservoir. Reservoir application of this project include successful placing of appraisal wells to the south, grass-root drilling to the north, optimization of workover wells ove the entire area and a more realistic reserves quantification.

In a southerly direction, downdip from Ceuta and Barua-Motatan in the La Ceiba area, Misoa deltaic deposits exist with similar reservoir characteristics to those in the above mentioned fields. These deposits can be found at depths between 17500 and 18500 ft (5300 - 5600 m). Located at the eastern limit of the Misoa deltaics (Fig.4), delta front facies such as massive distributary mouth bar and barrier bar sands can be expected within the Misoa lower B and lower C intervals.

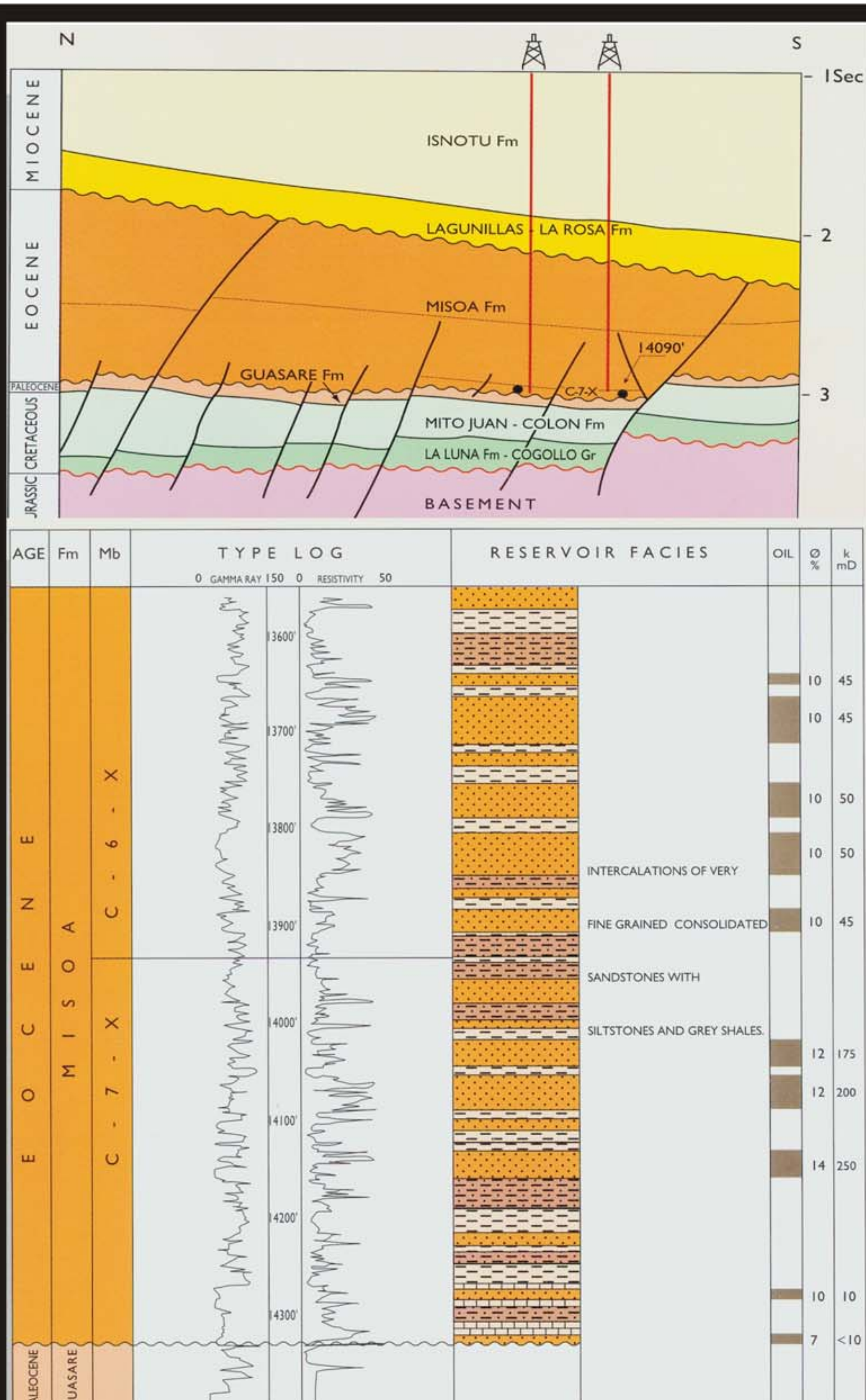


Figure 5: Structural section and type log showing the general lithology of the Misoa C6-C7 interval (Modified after Petroleos de Venezuela and MEM, 1996).

1.4 CRETACEOUS SANDSTONE (AGUARDIENTE FORMATION)

Excellent outcrops of the Albian Aguardiente Formation can be found in the Venezuelan Andes States of Trujillo, Merida, and Tachira, located east-southeast and south of the Maracaibo Basin. Its clastic facies consists primarily of fine to coarse-grained, clean quartzose sandstone (Fig. 6). Crossbedding and thin laminations can be observed in the basal sections. In outcrop, the Aguardiente measures from 1000 to 1600 ft. (300 - 500 m) in thickness. In southwest Zulia State and nearby in neighboring Colombia, outcrops average 525 ft (160 m) in thickness. The lithologic characteristics of the sand facies indicate fluvio-deltaic to coastal marine deposition. In the subsurface, in the southern areas of the Maracaibo Basin and in Barinas/Apure Basin, the Aguardiente Fm. lies unconformably on pre-Cretaceous rocks. In the subsurface of the Colon District, southwest of Lake Maracaibo, fine to coarse calcareous sandstones of the Aguardiente Formation are important reservoirs. The depth of hydrocarbon production, which occurs both from fractured carbonates and fractured calcareous cemented sandstone intervals, is at approximately 7500 feet (2280 m) in Tarra Field, and at about 15000 feet (4500 m) in Rosario Field. Fracturing plays an important role in the porosity which ranges from 4.55 to 20%. Permeabilty is rather low, between 0.1 and 4 md.

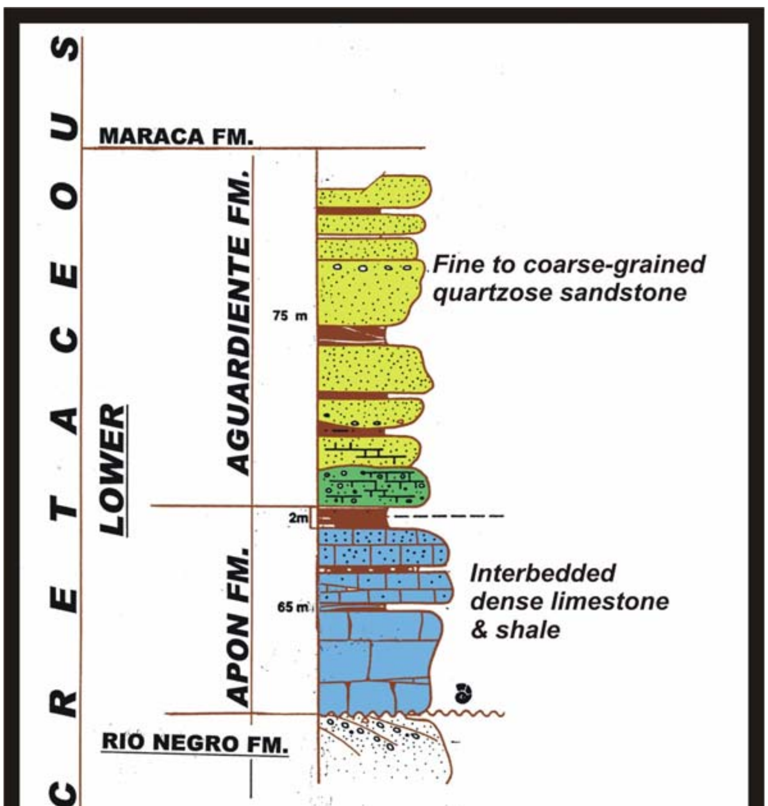


FIGURE 6: Lower Cretaceous lithology of the Apon and Aguardiente Formations(Modified after Goddard and Talukdar, 2002).

1.5 CRETACEOUS LIMESTONE (APON , LA LUNA/CAPACHO & COGOLLO GROUP)

In the southern region of the Maracaibo Basin, the Apon Formation consists of hard, nodular limestone and numerous interbeds of black, calcareous shale. The thickest of these shale layers, the Guaimaros Member, is approximately 100 feet (33 m) thick and is considered an important source rock and an excellent producer of oil and gas after fracture stimulation (Fig. 6).

La Luna Formation's importance as a reservoir, as well as its excellent sourcing characteristics and the Capacho Formation's hydrocarbon generation potential in the south, have made them the subject of numerous geological and geochemical studies. Since they also outcrop extensively in the mountains bordering the Maracaibo basin their lithologies have been well described by oil companies that have worked in the area.

The Capacho Formation is over 500 feet (170 m) thick, and consists predominantly of black limestone (basal La Grita Member) and overlying thick, black micaceous argillaceous shale (Seboruco Member). Its uppermost unit (Guayacan Member) is a crystalline limestone interbedded with black shale. The overlying La Luna Formation also consists of black calcareous shale interbedded with cryptocrystalline limestone and calcareous cherts (Fig. 7). Under the microscope, thin alternating bands of carbonate and shale can be observed mimicking the thicker layers. These rocks give off a strong petroliferous odor on a fresh break. In certain outcropping areas of the Venezuelan Andes, phosphatic interbeds occur within siliceous limestone intervals. In the north, the La Luna Formation attains a thickness of 400 feet (140 m) and thins gradually to the south to a thickness of 100 feet (34 m) in the Andean region where its source potential has diminished.

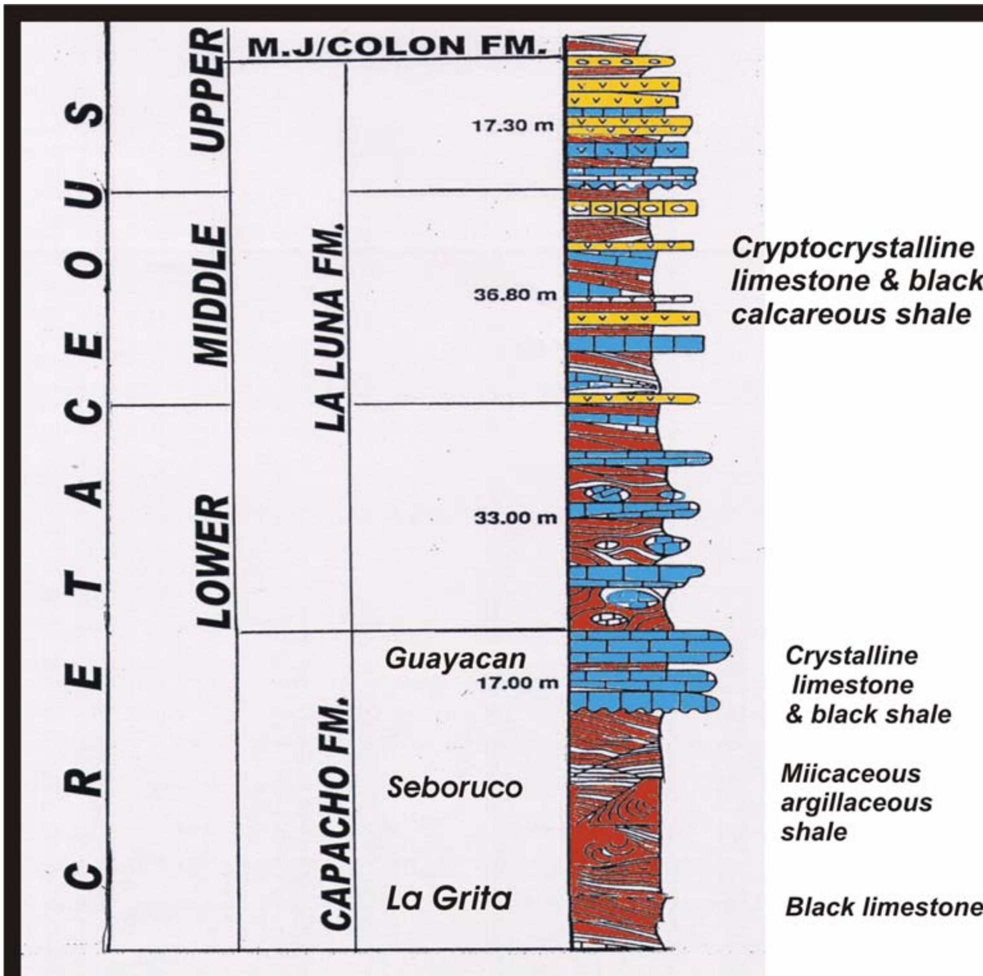


Figure 7: Cretaceous Capacho and La luna stratigraphy (Modified after Goddard & Talukdar, 2002).

In the northwestern onshore oil fields (La Paz, Mara, La Concepción) and the fields in Lake Maracaibo, the reservoirs in the Cogollo Group (Apon, Lisure, Maraca) produce where the wells intersect natural fractures and faults (Fig 8). The unit consists predominantly of micrite-rich carbonates with interbedded mudstone, wackestone, and shale. On modern resistivity and porosity logs through this unit, the porosity highs (9-12 %) tend to be erratic from top to bottom. Permeability tends to be low, and ranges from 0.5 to 10 md. It has been suggested that the high porosity zones are attributed not only to matrix porosity in the carbonates but also to the fracture-dominated mudstone and shale intervals. Therefore, optimum productivity of the Cogollo reservoirs occurs where both fractures and matrix porosity are present, and is independent of lithology.

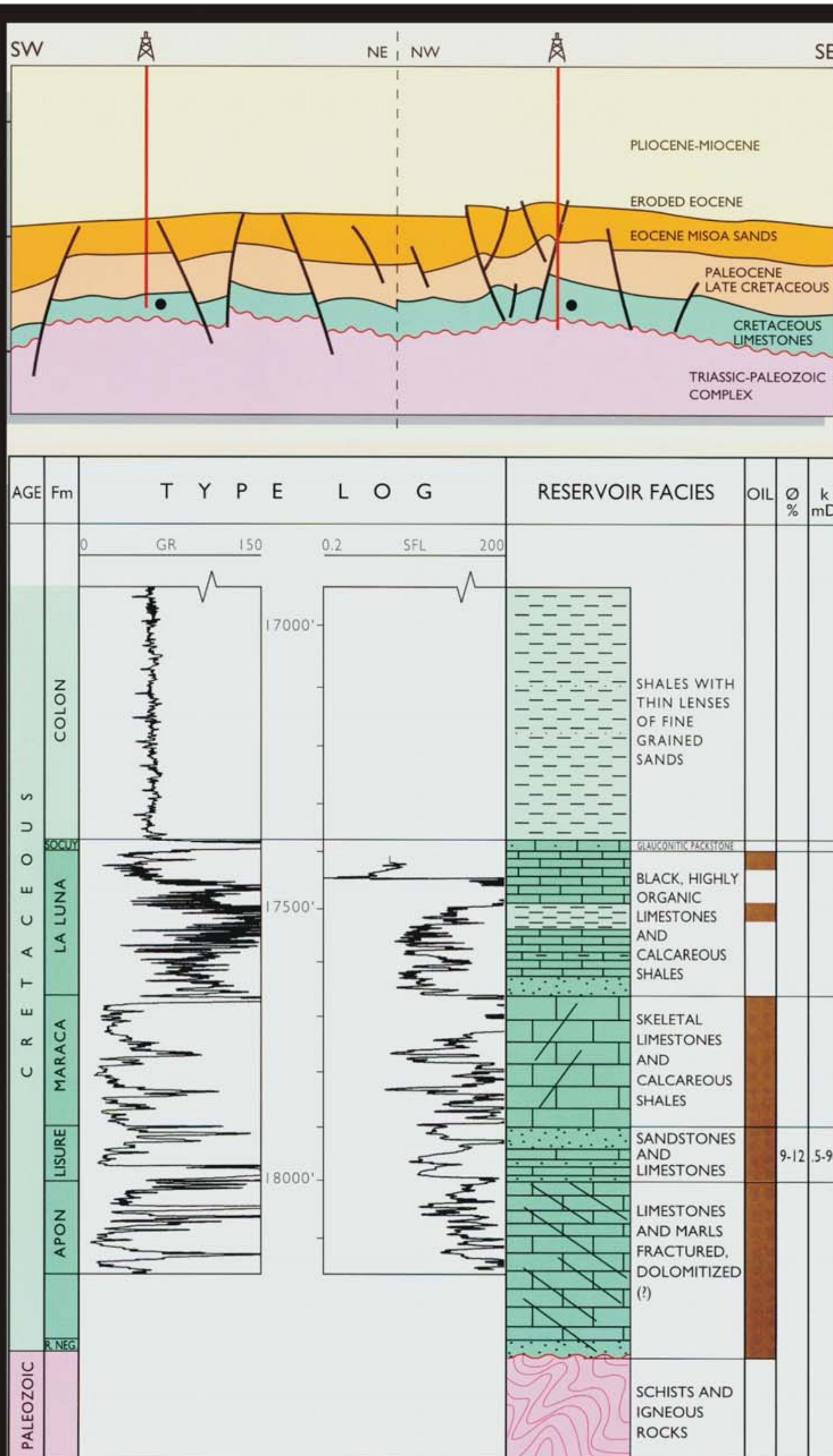


Figure 8:Structural section and type log for the Cretaceous Cogollo Group (Modified after Petroleos de Venezuela and MEM, 1996).

2. FALCON BASIN RESERVOIRS

2.1 MIOCENE LOWER LA PUERTA GROUP

The lower La Puerto Group sandstone deposits of Miocene age are the principal hydrocarbon reservoirs in southwest Falcon Basin (Tiguaje and Hombre Pintado Fields). The lenticular sandstones in this interval belong to a progradational deltaic complex that existed in the Dabajuro Block (Fig. 9). The abundant coal beds found in the basal La Puerta Group are an integral part of this Miocene deltaic deposition. Average porosities in the sandstone reservoirs are 22% and the permeability ranges from 74 to 1800 md. Producing depths are located between 800 and 3600 feet (245-1100 m). The average oil gravity is 22º API.

2.2 MIOCENE CAUJARAO AND SOCORRO FORMATIONS

Toward the east and northeast parts of the Falcon Basin, the Miocene Socorro and Caujarao Formations are shallow water marine deposits that contain the principal hydrocarbon reservoirs in the Cumarebo Field. These reservoirs are located between 500 and 3000 feet (150- 900 m) in depth. Discovered in 1931, the cumulative production by 1950 was 42.4 million barrels of oil. The principal reservoirs responsible for this production are: 1) the calcareous sand facies of the Lower Miocene Socorro Formation, and 2) the sandy limestone of the Middle Miocene Caujarao Formation. Their average porosity is 22%, with moderately high permeability ranging from several hundred millidarcies to 3 darcies. Gravity of the oil is 47.5º API.

2.3 LOWER MIOCENE AGUA CLARA FORMATION

The shallow water marine sediments that were deposited in seas of the Falcon basin during the early Miocene transgression are represented by the Agua Clara Formation and the lower part of the Agua Salada Group. In the La Vela Gulf, the Agua Clara interval consists of the lower Cauderalito Member of thin sandy fossiliferous limestone beds and the upper Santiago Member consisting of interbedded shale and sandstone deposits. In the offshore, the Cauderalito limestone is the reservoir of interest. Typically, these reefal deposits, averaging 100 feet (30 m) in thickness, are located between 8000 and 11,000 feet (2440 – 3350 m) in depth on top of basement horst blocks (Fig.10). Fractured and vuggy porosity of the reservoir section averages 15% and the permeability averages 120 md.

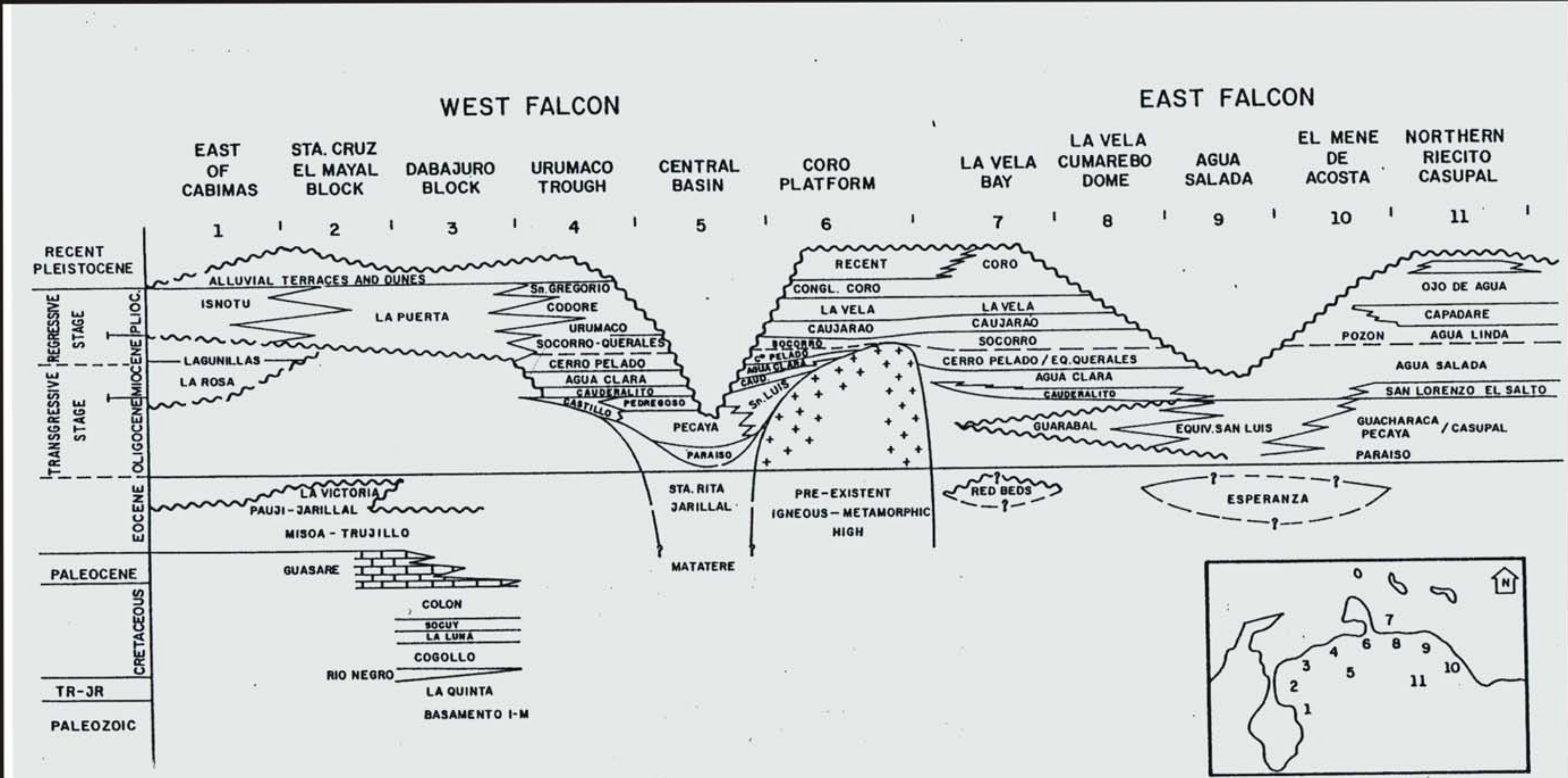


Figure 9: Stratigraphy of the Falcon Basin (After Boesi and Goddard, 1991 in AAPG Memoir 52.

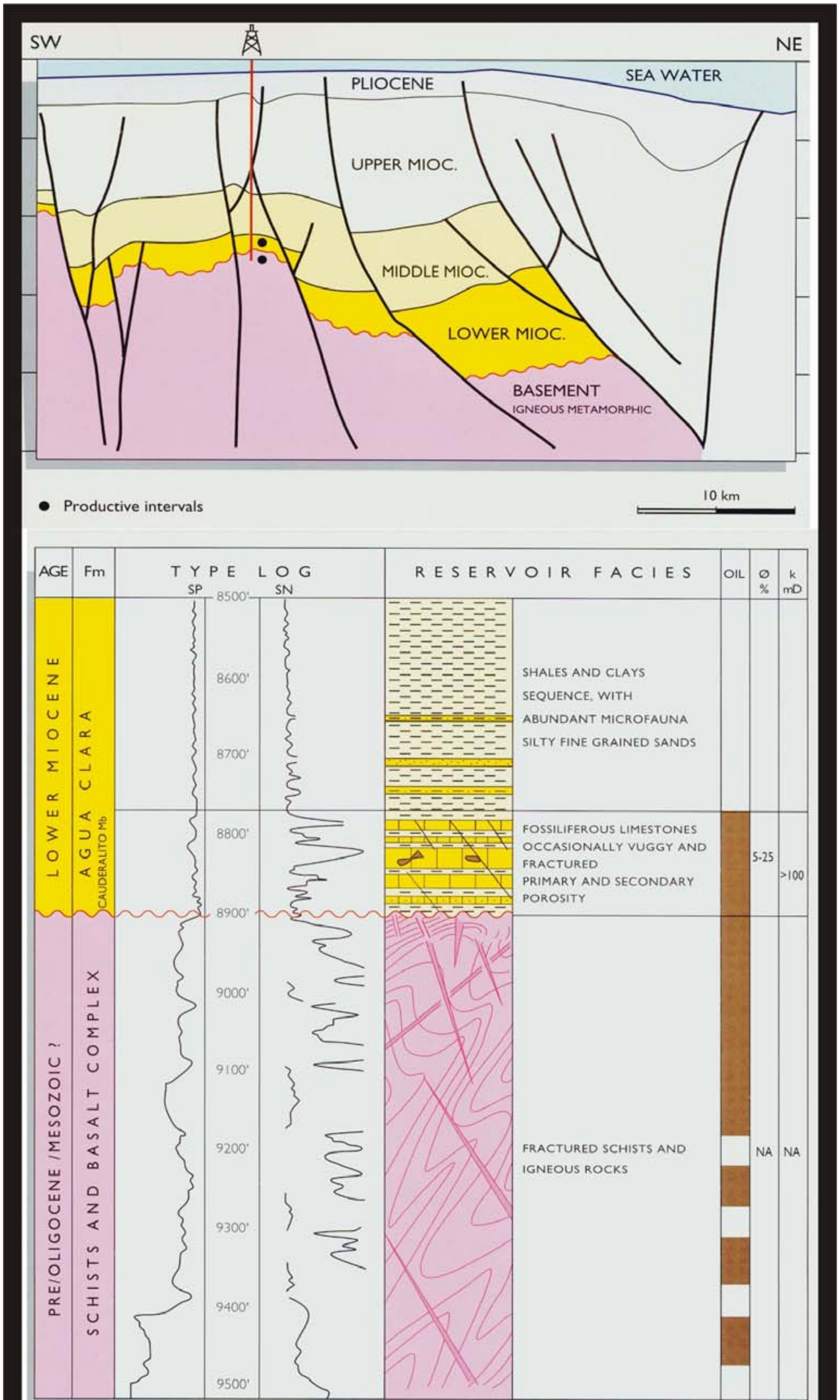


Figure 10: Structural section and type log with stratigraphy of the Agua Clara Formation (Modified after Petroleos de Venezuela and MEM,1996).

3. BARINAS/APURE BASIN RESERVOIRS

3.1 OLIGOCENE GUAFITA FORMATION

The basal portion of the Guafita Formation, known as the Arauco Member, is the main producer in the Guafita Field situated in southwest Barinas-Apure Basin). The reservoirs, located at approximately 7500 feet (2300 m), consist of crossbedded, medium to coarse-grained, poorly consolidated sandstone with net oil pays of 20 - 150 feet. This Oligocene interval is a deltaic sequence consisting of interbedded distributary channels, crevasse splays, and interdistributary bay shales. The Guafita Shale, a lagoonal deposit, is believed to be the effective seal overlying the oil sands of the Arauca Member. These distributary channel sands have average porosities of 25% and high permeability that ranges from 1.5 to 7 darcies.

3.2 EOCENE GOBERNADOR FORMATION

The Eocene transgression in the Barinas/Apure Basin is represented by the development of a thick basal clastic unit which is the Gobernador Formation (Fig.11). Similar to its equivalent, the Misoa Formation in the Maracaibo Basin, it consists of a series of thin stacked deltas. The interval is made up of friable quartzose sandstone interbedded with siltstone, shale, and thin lignite layers. The highly productive sandstone interval in the Silvestre oil fields of the Barinas area averages 100 ft. (30 m) in thickness. Located between 8000 and 10,000 feet (2400-3050 m) in depth, the reservoirs have porosity that varies between 20 and 28%, these being affected by abundant clay particles. Permeability values can be as low as 200 and as high as 2 darcies. Gravity of the oil found in the Gobernador reservoirs is 22º API.

3.3 CRETACEOUS ESCANDALOSA FORMATION

In the Barinas Basin, the Cretaceous Escandalosa Formation contains the main producing sandstone intervals in the Silvestre and Sinco Fields. Outcrop studies in the Andean foothills northeast of San Cristobal show the deposits to consist of glauconitic massive quartzose sandstone and black shale. Based on their faunal contents (Ostrea spp. and foraminifera), these sediments are believed to have been deposited in shallow water to neritic environment. Porosity in the producing sandstone intervals average 20% and permeability can be as high as 1 darcy, but averages 500 md (Fig.12). The sandstones, located between 10,000 and 11,000 feet (3050-3350 m) in depth in the Barinas fields, contain from 20 to 120 feet of net pay. The gravity of the oil from the producing interval averages 25° API. Geochemical analyses on Cretaceous

calcareous shale and limestone in the Morita and Quevedo Formations indicate a type II kerogen with predominantly marine organic matter. These rocks are equivalent in age and depositional environment to the La Luna Formation in the Maracaibo Basin. Therefore, they are considered the principal source rocks for the hydrocarbons found in the Oligocene Guafita, Eocene Gobernador, and Cretaceous Escandalosa reservoirs in Barinas-Apure Basin. However, other Cretaceous and Eocene marine shales deposited within the Barinas/Apure Basin cannot be ruled out as secondary source rocks.

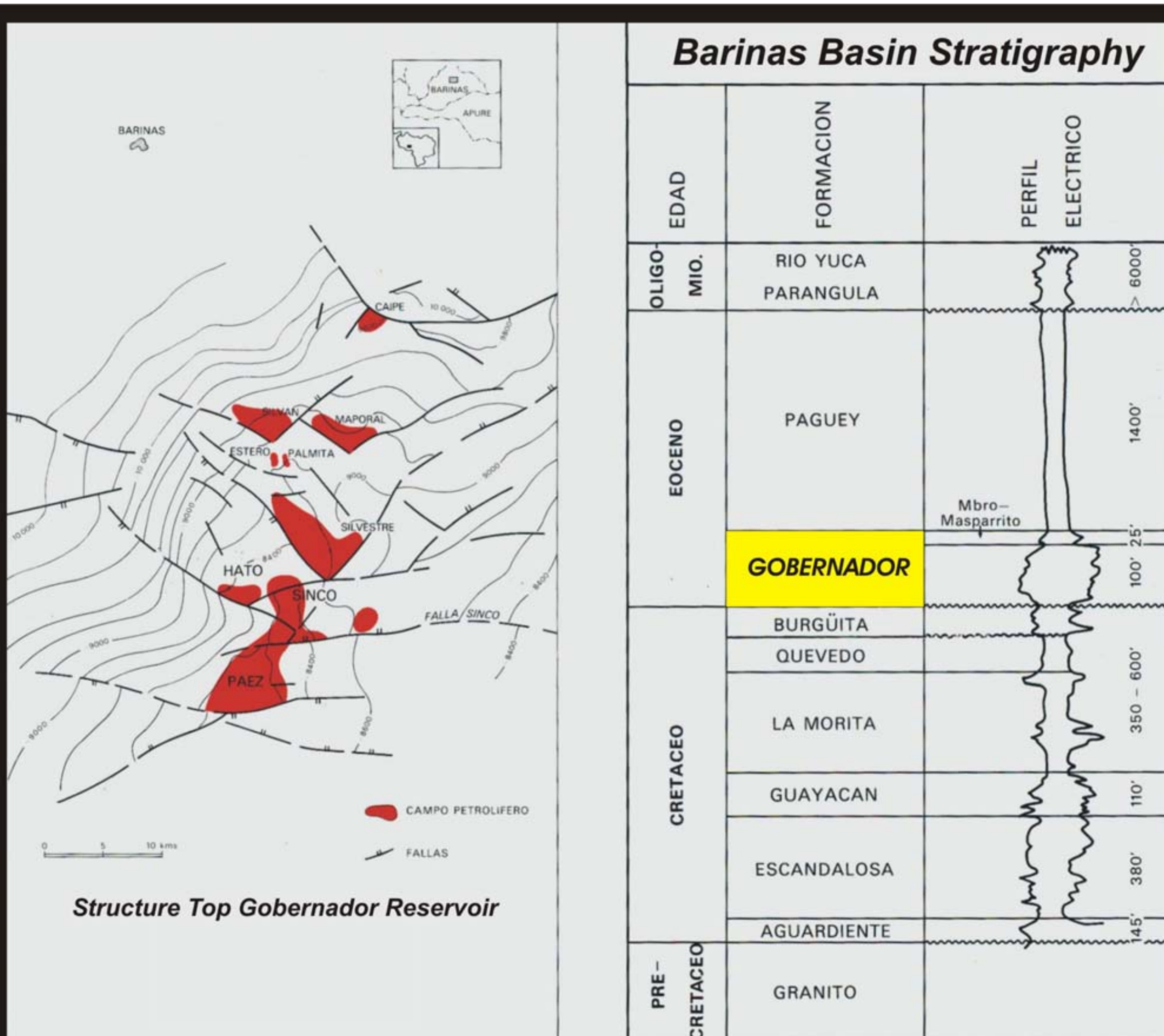
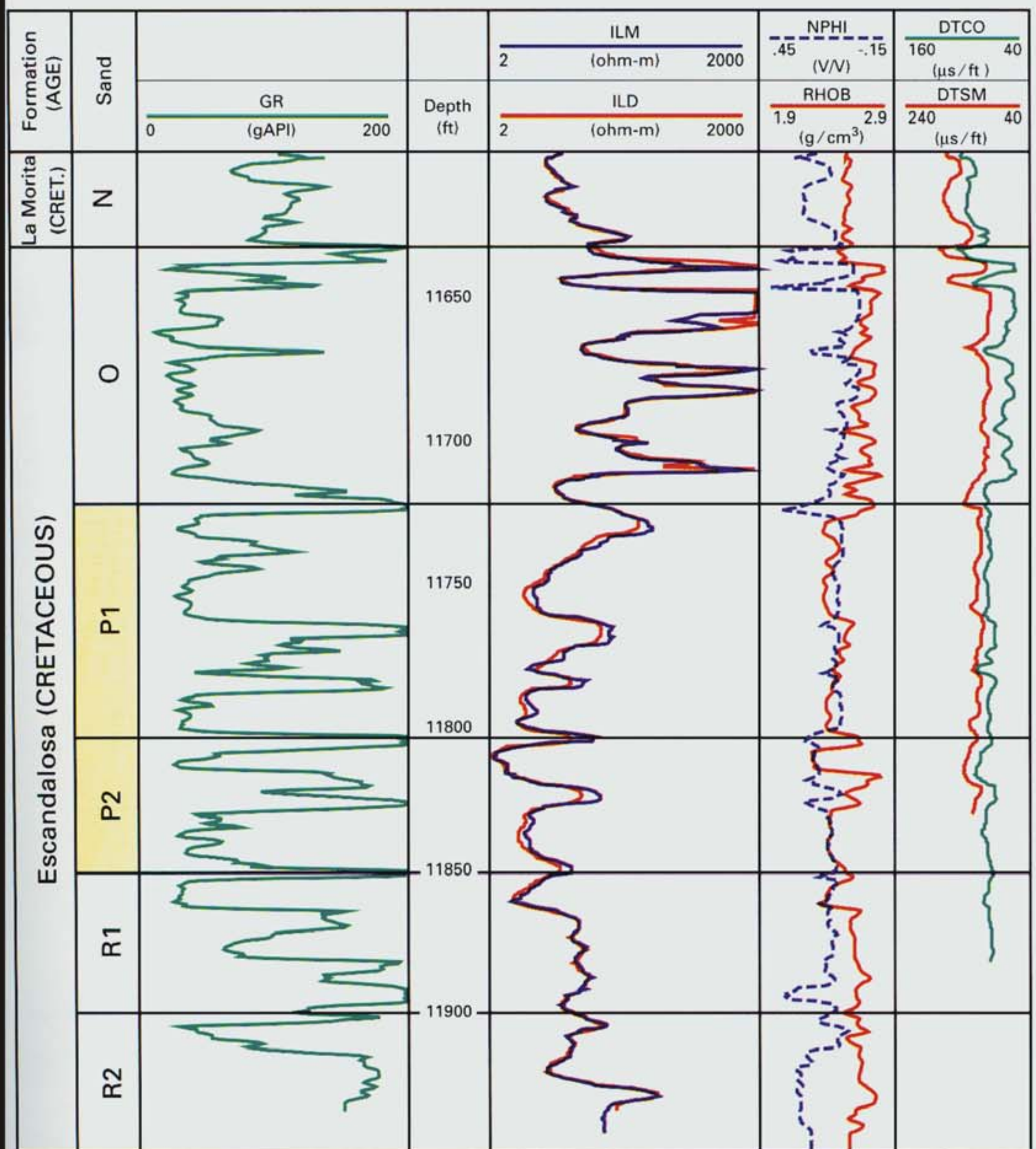


Figure 11: Stratigraphy of the Barinas Basin and structure on top of the Gobernador reservoir in Silvestre Field (Modified after Schlumberger, 1980).



	From cores	From logs
Porosity (%)	18.7	20.1
Water saturation (%)	39.0	34.0
Permeability (md)	556	90–753*

Figure 12: Type log and reservoir quality of the Cretaceous Escandalosa producing interval (Modified after Schlumberger, 1997) .

4. EASTERN VENEZUELA BASIN RESERVOIRS

GREATER OFICINA AND ANACO AREAS

4.1 MIOCENE OFICINA FORMATION

The Oficina Formation, first described in the Oficina No. 1 well (1937), is a subsurface unit of thin stacked deltas that extends along the southern portion of the Eastern Venezuelan Basin in the States of Monagas and Anzoategui. This thick deltaic interval consists of interbedded sandstone, shale and lignite layers. In the Greater Oficina area the entire sequence is around 5000 feet (1500 m) thick, more than 9000 ft.(2750 m) in the Anaco area, and approximately 1000 feet (305 m) thick in the area of Temblador. The reservoirs consist mainly of stacked distributary channel and bay fill sands with porosity ranging from 20-35% and permeability from 50 - 1000 md (Fig.13). Short distant lateral pinch-outs are common, but reservoir pressures and oil gravities indicate that many of the channels are in communication. In the Oficina and Anaco areas most of the oil is light (34º - 57º API) and highly paraffinic. To the south, in the Heavy Oil Belt, the gravity of the oils in the Oficina Formation reservoirs range from 8º to 12º API. Here, these shallow producing intervals (1000 - 3000 feet.) consist of unconsolidated distributary channel sands with porosity averaging 30% and very high permeability averaging 2 darcies.

4.2 OLIGOCENE MERECURE FORMATION

The Merecure Formation is also a thick (1600 - 2200 feet) subsurface unit in the Anaco and Oficina areas which was deposited in a more fluvial, continental environment. It consists of abundant massive, fine to coarse grained, crossbedded sandstone interbedded with thin, black carbonaceous shale. The sandstone layers are more abundant and continuous than those in the overlying Oficina Formation. In a northerly direction, toward the Maturin Sub-Basin, the Merecure Formation thickens and its equivalent is termed the Merecure Group. This Group is made up of the Los Jabillos, Areo, and Naricual Formations. These are predominantly two sandstone units (Los Jabillos and Naricual) separated by a thick prodelta shale interval (Areo). The prolific oil reservoirs of the Merecure Formation appear to be stacked interbraided channels whose sandstones have porosity that fluctuates between 20 and 25%. The permeability ranges between 150 and 350 md. The reservoirs, located at depths between 4000 and 8000 feet (1200 - 2400 m) also contain light oil averaging 35º API (Fig. 13).

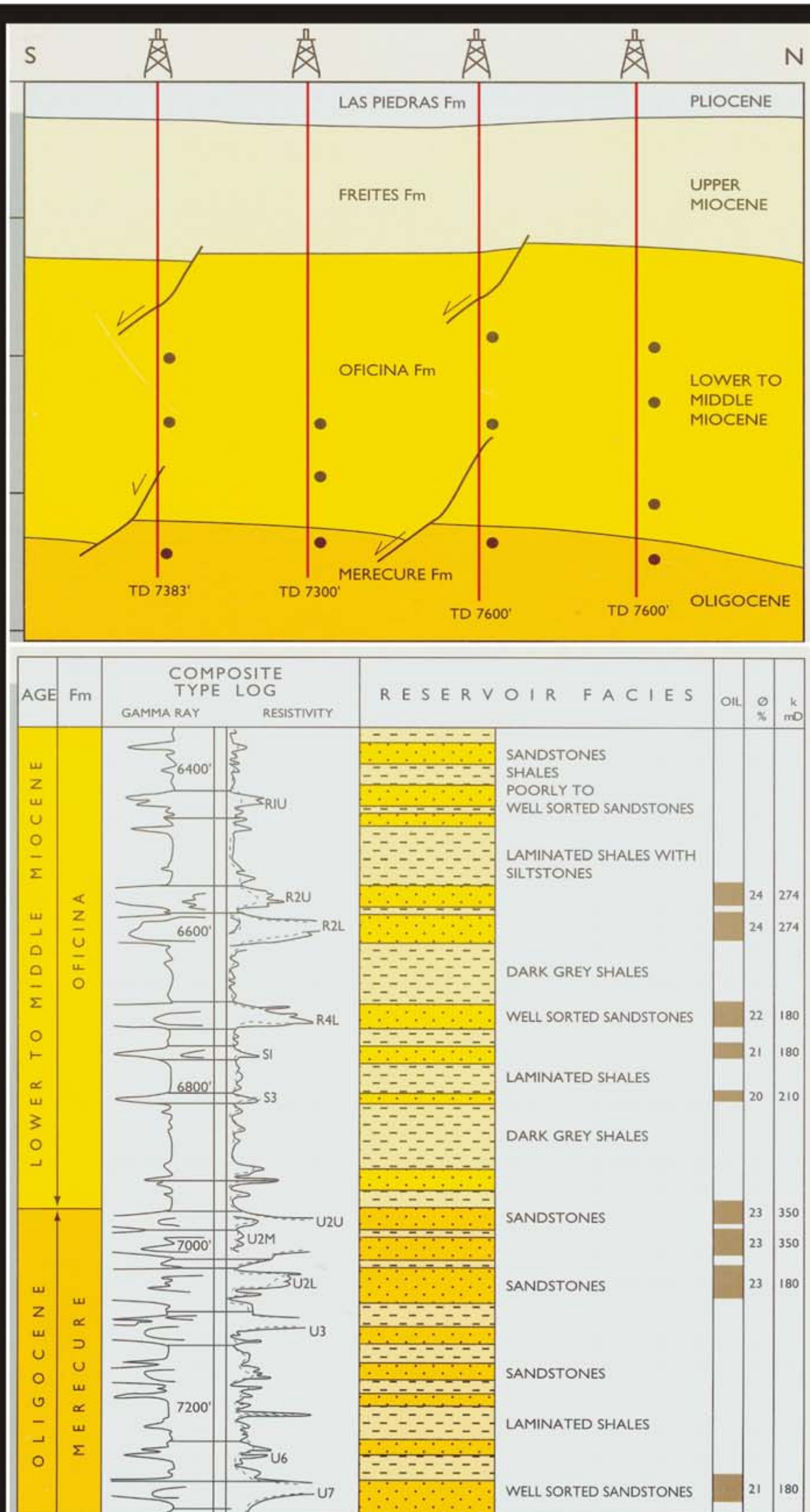


Figure 13: Stratigraphy,lithology and reservoir quality of the oficina and Merecure Formations (Modified after Petroleos de Venezuela and MEM, 1996).

4.3 MIOCENE LA PICA FORMATION

Lower delta plain to shallow marine (delta front) deposits of the La Pica Formation contain prolific reservoirs that produce in the areas of Santa Barbara and Jusepin in northern Monagas State (Fig. 14). The interval consists of alternating loose fine sands, shale, and lignitic, micaceous silty clay. The shallow marine facies (Textularia and Sigmoilina sands) contain the principal reservoirs. The entire La Pica interval measures 3000 to 6000 feet (900-1800 m) thick, and extends as far east as Pedernales. In this area of the northern Orinoco Delta, the lenticular, fine sand facies of the La Pica are also the important oil producers. Here, the average porosity is 27% and average permeability is 300 md. Gravity of the oil ranges from 17.5º to 31º API.

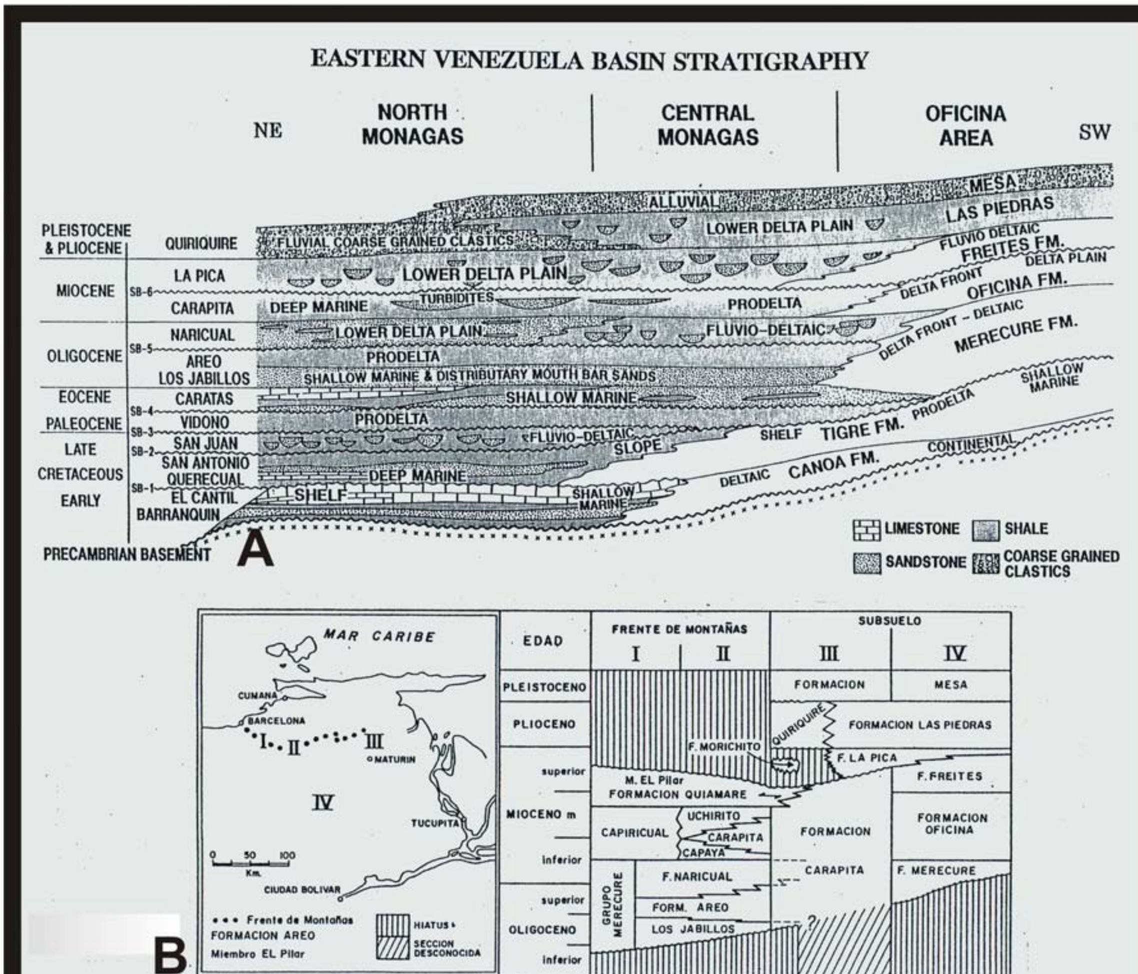


Figure 14: Stratigraphy of the Eastern Venezuela Basin (After A, Goddard, unpublished figure and B, Gonzalez de Juana et al., 1980).

4.4 OLIGOCENE NARICUAL FORMATION

The upper deltaic interval of the Merecure Group, the Naricual Formation, was originally described at its type location near Barcelona where it drew much attention because of its abundant coal measures. Here the interval measures 1750 feet (530 m) in thickness. It extends as far west as the frontal thrusts of Guarico State. In the subsurface toward the east it extends to the Santa Barbara and Jusepin Fields within the fold and thrust belt of the Maturin Sub-Basin. It was not until 1986, however, that Corpoven and Lagoven's intensive exploration efforts in these areas, using 3-D seismic methods, could locate adequate traps at the Naricual level. Successful drilling penetrated the Naricual prolific reservoirs between 14000 and 17500 feet (4250 -5350 m) in what is called today the Furrial Trend. The reservoirs are located in the upper part of the formation and consist of thick distributary channel sandstones. This Naricual deltaic sequence disappears farther to the east toward the Quiriquire Field where the Los Jabillos Formation becomes the interval containing important hydrocarbon reservoirs below the shallow Pliocene producers (Fig.15).

The following abstract from the 1994, AAPG Annual Meeting in Denver gives a brief description of the Oligocene Naricual sequence found beneath the Pirital allocthonous block: LANDER, R. A., A. GONZALEZ, J. FUENTES, and J.DAAL, Exploration Management, Corpoven S.A., Venezuela; "Exploration of the Late Cretaceous and the Oligocene Sequences Underneath the Pirital Allochthonous Block, Northern Monages Area, Eastern Venezuela Basin."

The search for prospective formations underneath the Pirital allochthonous block began in the 50th decade, when Mene Grande Oil Company drilled seven exploration wells. These penetrated the Pirital allochthonous block, but due to mechanical problems they did not reach the programmed objectives. At that time, the proposed exploratory model suggested a high-angle reverse fault at the base of the allochthonous block, which restricted the prospective section towards the north. Since 1989, after the drilling of 1 exploratory well along the El Furrial-El Tejero trend, a new exploratory model is proposed: the base of the Pirital block is a sub-horizontal plane, and the Upper Cretaceous and Oligocene-Lower Miocene sediments are extended northward, beneath it. The SBC-3E well was drilled in order to test the new model. It was completed in December 1989, with a production of 6100 BOPD (35 degree API) and 47 MMCFGD. A second well, PIC-1E, located 7.5 km northwest of the SBC-3E well, was drilled in order to investigate the quality of the reservoir rocks underneath the pirital block. This well was completed in April 1992, with a production of 4500 BOPD (36 degree API) and 37 MMFGD. The successful results of these two wells drilled north of the Pirital thrust suggest an exploratory area as big as the El Furrial-El Tejero trend, but two geological risks must be taken into account: the allochthonous block's thickness and the depth of the prospective sequences.

4.5 OLIGOCENE LOS JABILLOS FORMATION

The Los Jabillos Formation outcrops along the Interior Mountain Range in northwest Anzoategui and central Monagas States. To the south, in the subsurface beneath the overthrusted mountain front, it extends east past Quiriquire towards Trinidad. Beneath the Quiriquire Field the producing reservoirs consist of fine to medium quartz sandstone that averages 200 feet (60 m) thick. Both intergranular and fracture porosity exist and together reach as high as 18%, but average 15%. The permeability tends to be low between 70 and 120 md. The reservoirs contain light oil (38º API), gas and condensate (68º API). Depth to the producing intervals varies from 7000 to 10500 feet (2150-3200 m), but deepens rapidly in a southerly direction. The characteristics of the Los Jabillos reservoirs, and their stratigraphic position between the overlying Areo prodelta shales and the underlying shallow marine deposits of the Caratas Formation (Fig. 15), leads one to conclude that they are probably delta front, distributary mouth bar, and barrier bar deposits.

4.6 CRETACEOUS SAN JUAN FORMATION

The basal sandy unit of the Santa Anita Group, the San Juan Formation, outcrops in northeast Anzoategui and northern Monagas States. It consists mainly of thick, massive layers of fine to medium, well-sorted sandstone (Fig. 15). In the subsurface, wells have penetrated intervals of 350 to 700 feet (105-215 m) within the fold and thrust belt in the Maturin Sub-Basin. Reservoirs located between 13,500 and 15,000 feet (4100-4575 m) in depth have produced light oil (37º - 40º API) in the area of Orocual northeast of Jusepin Field. Located beneath the the Vidono prodelta shale, which acts as a regional seal, the San Juan sandstone reservoir characteristics are similar to those of: 1) delta front, thick distributary mouthbars, and 2) shallow marine glauconitic sheet sands that are calcareous cemented in places.

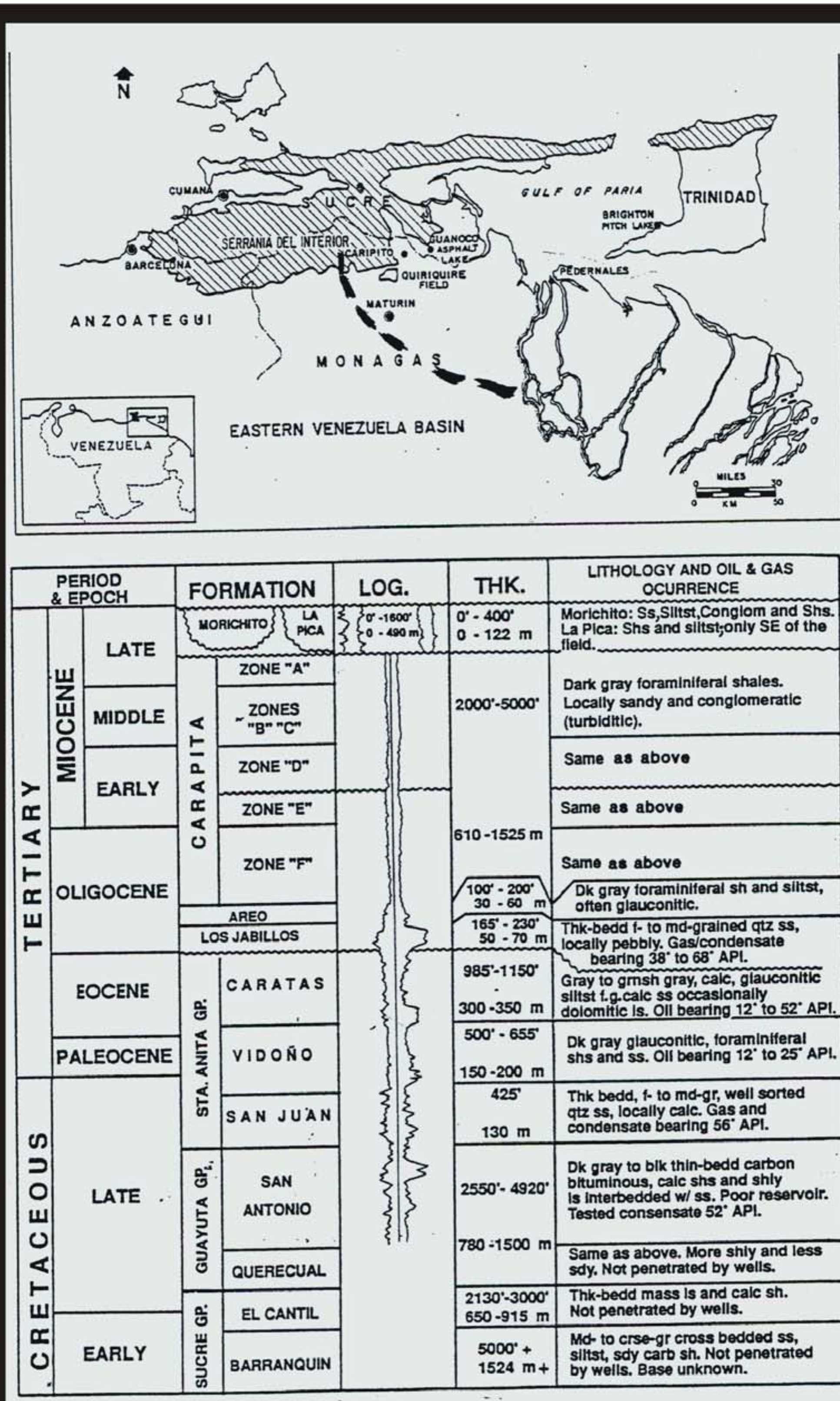


Figure 15:Stratigraphy of the Maturin Subbasin (After Salvador and Leon, 1992; in the AAPG Treatise of Petroleum, Vol. III).

4.7 OLIGOCENE LA PASCUA FORMATION

A prolific producer in the Las Mercedes oil fields in central Guarico State the La Pascua Formation consists of a series of thin stacked deltas (Fig. 16). Its lithology is characterized by interbedded sandstone (50%), shale, and thin lignite layers. The shale contains abundant plant material, molluscs and foraminifera, which is consistent with lower delta plain and delta front, interdistributary bay and lagoonal facies. The La Pascua deltas were formed during Lower Oligocene time on the northern margin of the Guyana Precambrian Shield, the source of its sediments. In northern Guarico state, in the frontal thrust zone out from the delta plain, a shaly lagoonal facies developed in the delta front. In the Yucal-Placer Field, a few reservoir quality sandstones (barrier bars, tidal channels) were found to be excellent gas producers within the La Pascua, and in the overlying Roblecito and Chaguaramas prodelta shaly formations (Fig. 16). The depth of this gas production ranges from 5,000 to 10,000 feet (1525 - 3050 m). To the south, in the Las Mercedes area, oil production, mainly from the La Pascua reservoirs, is located between 3,000 and 5,000 feet in sandstones with average porosity of 25% and permeability of 350 md. Geochemical studies carried out by INTEVEP in the 1980's, demonstrated that the principal source rock interval for the hydrocarbons in the Guarico Sub-Basin is the Cretaceous Tigre Formation of the Temblador Group, which contains type II marine kerogen. Because the source rocks are thermally over mature (1.2% to 2% Ro), due to deep burial, abundant gas has been generated in the area.

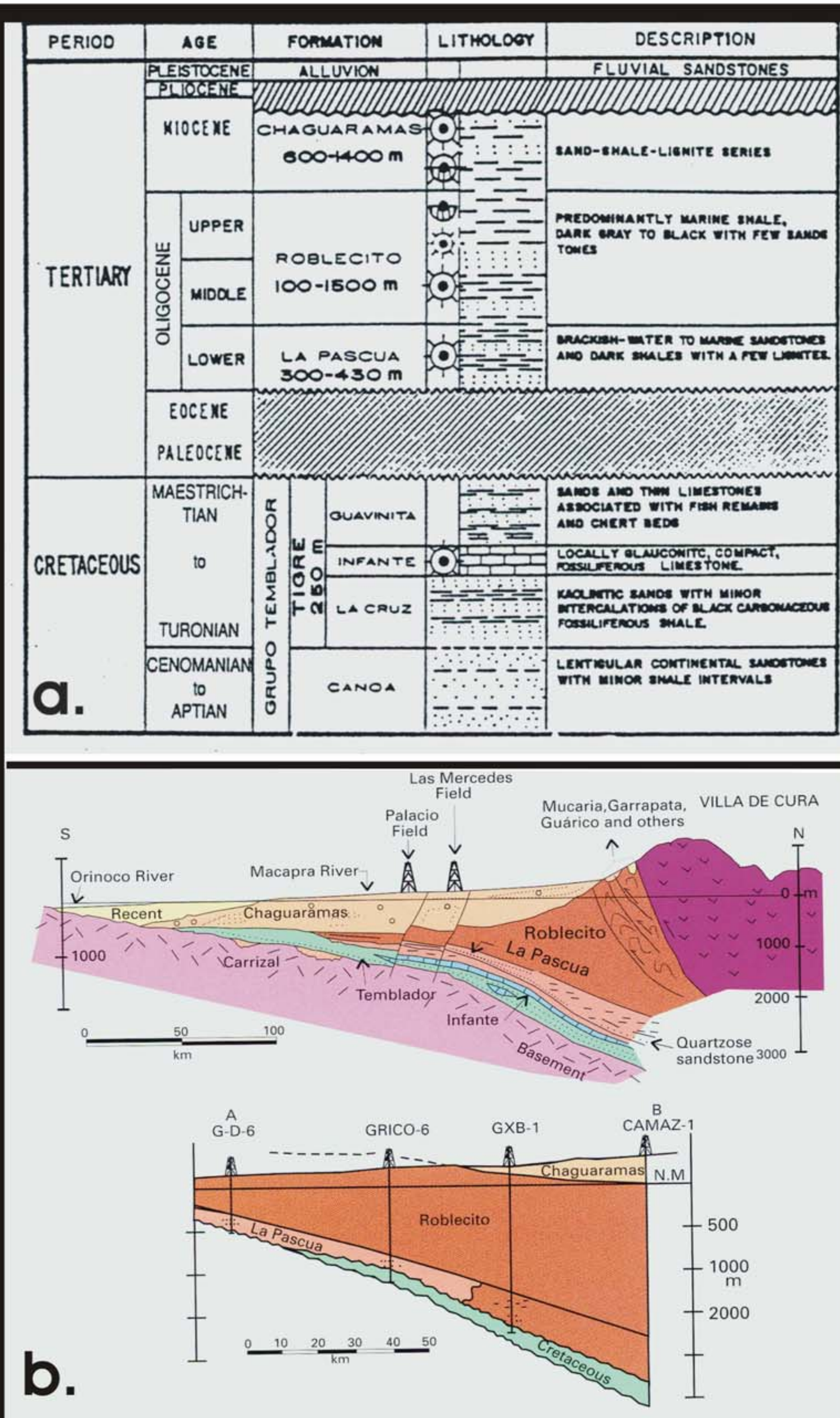


Figure 16: General Structure & Stratigraphy of the Guarico Subbasin (16a modified after Daal and Lander, 1993; in the Treatise of Petroleum Geology, Vol. VIII, and 16b modified after Gonzalez de Juana, et al., 1980)

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APPENDIX # 1

Authorizations for Expenditure (AFE)

Authorization for Expenditure (AFE)

Estimate for a 2500' Straight Hole (Precompletion Estimate Included)

ESTIMATED INTANGIBLE COSTS

	Day Rate	Days	Precompl.	DRILLING COST	PRECOMPL. COST	TOTAL AFE
Surveys and Permits/Environmental				$8,000	$2,000	$10,000
Rig Move (Mob. & Demob.)	$5,000	2		$10,000	$0	$10,000
Drilling Per Day	$5,000	2	1	$10,000	$5,000	$15,000
Fuel, Lubes and Water	$1,000	2	1	$2,000	$1,000	$3,000
Rental Equipment	$1,000	2	1	$2,000	$1,000	$3,000
Drill Bits				$10,000	$1,000	$11,000
Drilling Mud & Chemicals		2	1	$40,000	$0	$40,000
Mud Logging				$0	$0	$0
Cement & Squeeze Services				$25,000	$5,000	$30,000
Casing Crews & Tools				$10,000	$5,000	$15,000
Open Hole Logging+MWD/LWD				$50,000	$0	$50,000
Sidewall Cores & Analysis				$2,000	$0	$2,000
Transportation	$3,000	2	1	$6,000	$3,000	$9,000
Labor	$2,000	2	1	$4,000	$2,000	$6,000
Supervision	$850	2	1	$1,700	$850	$2,550
P&A Costs	$10,000	2	0	$20,000	$0	$20,000
Pipe Inspection				$5,000	$2,000	$7,000
Overhead	$500	2	1	$1,000	$500	$1,500
Insurance	$400	2	1	$800	$400	$1,200
Communications	$250	2	1	$500	$250	$750
				$208,000	**$29,000**	**$237,000**

TANGIBLE COSTS

	Depth (Ft)	Diameter	$/Ft			
Drive Pipe		30"	220 (not needed)	$0	$0	$0
Conductor		20"	60 (not needed)	$0	$0	$0
Surface Casing		16"	16 (not needed)	$0	$0	$0
Intermediate Casing	100	8-5/8"	25	$2,500	$0	$2,500
Production Liner	2500	5 1/2 "	12	$0	$30,000	$30,000
Wellhead Equipment				25,000	$5,000	$30,000
TOTAL TANGIBLES				**$27,500**	**$35,000**	**$62,500**
TOTAL AFE COSTS				**$235,500**	**$64,000**	**$299,500**

Range of Total Costs

	Base Case	Lower Limit	Higher Limit
Total Rig Cost	$25,000	$21,250	$27,500
Fuel, Lubes and Water	$3,000	$2,550	$3,300
Rental Equipment	$3,000	$2,550	$3,300
Drilling Mud & Chemicals	$40,000	$34,000	$44,000
Mud Logging	$0	$0	$0
Transportation	$9,000	$7,650	$9,900
Labor	$6,000	$5,100	$6,600
Supervision	$2,550	$2,168	$2,805
P&A Costs	$20,000	$17,000	$22,000
Insurance	$1,200	$1,020	$1,320
Communications	$750	$638	$825
Drive Pipe	$0	$0	$0
Conductor	$0	$0	$0
Surface Casing	$0	$0	$0
Intermediate Casing	$2,500	$2,125	$2,750
Production Liner	$30,000	$25,500	$33,000

Authorization For Expenditure (AFE)

Estimate for a 5000' Straight Hole w/1000HP Rig (Precompletion Estimate Included)

ESTIMATED INTANGIBLE COSTS

	Day Rate	Days	Precompl.	DRILLING COST	PRECOMPL. COST	TOTAL AFE
Surveys and Permits/Environmental				$10,000	$2,500	$12,500
Rig Move (Mob. & Demob.)	$5,000	4		$20,000	$0	$20,000
Drilling Per Day	$5,000	5	3	$25,000	$15,000	$40,000
Fuel, Lubes and Water	$1,000	5	3	$5,000	$3,000	$8,000
Rental Equipment	$1,000	5	3	$5,000	$3,000	$8,000
Drill Bits				$20,000	$2,000	$22,000
Drilling Mud & Chemicals		5	3	$75,000	$0	$75,000
Mud Logging	$800	2		$1,600	$0	$1,600
Cement & Squeeze Services				$50,000	$15,000	$65,000
Casing Crews & Tools				$15,000	$10,000	$25,000
Open Hole Logging+MWD/LWD				$100,000	$0	$100,000
Sidewall Cores & Analysis				$5,000	$0	$5,000
Transportation	$5,000	5	3	$25,000	$15,000	$40,000
Labor	$2,000	5	3	$10,000	$6,000	$16,000
Supervision	$850	5	3	$4,250	$2,550	$6,800
P&A Costs	$25,000	3	0	$75,000	$0	$75,000
Pipe Inspection				$10,000	$5,000	$15,000
Overhead	$500	5	3	$2,500	$1,500	$4,000
Insurance	$400	5	3	$2,000	$1,200	$3,200
Communications	$250	5	3	$1,250	$750	$2,000
				$461,600	**$82,500**	**$544,100**

TANGIBLE COSTS

	Depth (Ft)	Diameter	$/Ft			
Drive Pipe		30"	220 (not needed)	$0	$0	$0
Conductor		20"	60 (not needed)	$0	$0	$0
Surface Casing		16"	16 (not needed)	$0	$0	$0
Intermediate Casing	400	8-5/8"	25	$10,000	$0	$10,000
Production Liner	5,000	5 1/2 "	12	$0	$60,000	$60,000
Wellhead Equipment				50,000	$10,000	$60,000
TOTAL TANGIBLES				**$60,000**	**$70,000**	**$130,000**
TOTAL AFE COSTS				**$521,600**	**$152,500**	**$674,100**

Range of Total Costs

	Base Case	Lower Limit	Higher Limit
Total Rig Cost	$60,000	$51,000	$66,000
Fuel, Lubes and Water	$8,000	$6,800	$8,800
Rental Equipment	$8,000	$6,800	$8,800
Drilling Mud & Chemicals	$75,000	$63,750	$82,500
Mud Logging	$1,600	$1,360	$1,760
Transportation	$40,000	$34,000	$44,000
Labor	$16,000	$13,600	$17,600
Supervision	$6,800	$5,780	$7,480
P&A Costs	$75,000	$63,750	$82,500
Insurance	$3,200	$2,720	$3,520
Communications	$2,000	$1,700	$2,200
Drive Pipe	$0	$0	$0
Conductor	$0	$0	$0
Surface Casing	$0	$0	$0
Intermediate Casing	$10,000	$8,500	$11,000
Production Liner	$60,000	$51,000	$66,000

Authorization For Expenditure (AFE) (12/2005)

Estimate for a 10,000' Straight Hole w/1500HP Rig (Precompletion Estimate Included)

ESTIMATED INTANGIBLE COSTS

	Day Rate	Days	Precompl.	DRILLING COST	PRECOMPL. COST	TOTAL AFE
Surveys and Permits/Environmental				$20,000	$5,000	$25,000
Rig Move (Mob. & Demob.)	$12,000	7		$84,000	$0	$84,000
Drilling Per day	$12,000	30	5	$360,000	$60,000	$420,000
Fuel, Lubes and Water	$1,500	30	5	$45,000	$7,500	$52,500
Rental Equipment	$2,000	30	5	$60,000	$10,000	$70,000
Drill Bits				$50,000	$5,000	$55,000
Drilling Mud & Chemicals		30	5	$250,000	$0	$250,000
Mud Logging	$800	5		$4,000	$0	$4,000
Cement & Squeeze Services				$100,000	$30,000	$130,000
Casing Crews & Tools				$30,000	$20,000	$50,000
Open Hole Logging+MWD/LWD				$300,000	$0	$300,000
Sidewall Cores & Analysis				$15,000	$0	$15,000
Transportation	$8,000	30	5	$240,000	$40,000	$280,000
Labor	$2,000	30	5	$60,000	$10,000	$70,000
Supervision	$850	30	5	$25,500	$4,250	$29,750
P&A Costs	$80,000	5	0	$400,000	$0	$400,000
Pipe Inspection				$20,000	$10,000	$30,000
Overhead	$700	30	5	$21,000	$3,500	$24,500
Insurance	$500	30	5	$15,000	$2,500	$17,500
Communications	$250	30	5	$7,500	$1,250	$8,750
				$2,107,000	**$209,000**	**$2,316,000**

TANGIBLE COSTS

	Depth (Ft)	Diameter	$/Ft			
Drive Pipe		30"	220 (not needed)	$0	$0	$0
Conductor		20"	60 (not needed)	$0	$0	$0
Surface Casing		16"	16 (not needed)	$0	$0	$0
Intermediate Casing	3,100	9-5/8"	30	$93,000	$0	$93,000
Production Liner	10,000	7 "	13	$0	$130,000	$130,000
Wellhead Equipment				100,000	$15,000	$115,000
TOTAL TANGIBLES				**$193,000**	**$145,000**	**$338,000**
TOTAL AFE COSTS				**2,300,000**	**$354,000**	**$2,654,000**

Range of Total Costs

	Base Case	Lower Limit	Higher Limit
Total Rig Cost	$504,000	$428,400	$554,400
Fuel, Lubes and Water	$52,500	$44,625	$57,750
Rental Equipment	$70,000	$59,500	$77,000
Drilling Mud & Chemicals	$250,000	$212,500	$275,000
Mud Logging	$4,000	$3,400	$4,400
Transportation	$280,000	$238,000	$308,000
Labor	$70,000	$59,500	$77,000
Supervision	$29,750	$25,288	$32,725
P&A Costs	$400,000	$340,000	$440,000
Insurance	$17,500	$14,875	$19,250
Communications	$8,750	$7,438	$9,625
Drive Pipe	$0	$0	$0
Conductor	$0	$0	$0
Surface Casing	$0	$0	$0
Intermediate Casing	$93,000	$79,050	$102,300
Production Liner	$130,000	$110,500	$143,000

Authorization For Expenditure (AFE)

Estimate for a 15,000' Straight Hole w/2000HP Rig (Precompletion Estimate Included)

ESTIMATED INTANGIBLE COSTS

	Day Rate	Days	Precompl.	DRILLING COST	PRECOMPL. COST	TOTAL AFE
Surveys and Permits/Environmental				$20,000	$5,000	$25,000
Rig Move (Mob. & Demob.)	$15,000	7		$105,000	$0	$105,000
Drilling Per day	$15,000	50	7	$750,000	$105,000	$855,000
Fuel, Lubes and Water	$1,500	50	7	$75,000	$10,500	$85,500
Rental Equipment	$2,000	50	7	$100,000	$14,000	$114,000
Drill Bits				$50,500	$5,500	$56,000
Drilling Mud & Chemicals		50	7	$300,000	$0	$300,000
Mud Logging	$800	8		$6,400	$0	$6,400
Cement & Squeeze Services				$110,000	$35,000	$145,000
Casing Crews & Tools				$35,000	$21,500	$56,500
Open Hole Logging+MWD/LWD				$350,000	$0	$350,000
Sidewall Cores & Analysis				$15,500	$0	$15,500
Transportation	$8,000	50	7	$400,000	$56,000	$456,000
Labor	$2,000	50	7	$100,000	$14,000	$114,000
Supervision	$850	50	7	$42,500	$5,950	$48,450
P&A Costs	$85,000	5	0	$425,000	$0	$425,000
Pipe Inspection				$20,000	$10,000	$30,000
Overhead	$700	50	7	$35,000	$4,900	$39,900
Insurance	$500	50	7	$25,000	$3,500	$28,500
Communications	$250	50	7	$12,500	$1,750	$14,250
				$2,977,400	**$292,600**	**$3,270,000**

TANGIBLE COSTS

	Depth (Ft)	Diameter	$/Ft			
Drive Pipe		30"	220 (not needed)	$0	$0	$0
Conductor		20"	60 (not needed)	$0	$0	$0
Surface Casing	100	16"	16	$1,600	$0	$1,600
Intermediate Casing	4,000	9-5/8"	30	$120,000	$0	$120,000
Production Liner	15,000	5-1/2 "	12	$0	$180,000	$180,000
Wellhead Equipment				100,000	$15,000	$115,000
TOTAL TANGIBLES				**$221,600**	**$195,000**	**$416,600**
TOTAL AFE COSTS				**3,199,000**	**$487,600**	**$3,686,600**

Range of Total Costs

	Base Case	Lower Limit	Higher Limit
Total Rig Cost	$960,000	$428,400	$554,400
Fuel, Lubes and Water	$85,500	$44,625	$57,750
Rental Equipment	$114,000	$59,500	$77,000
Drilling Mud & Chemicals	$250,000	$212,500	$275,000
Mud Logging	$6,400	$3,400	$4,400
Transportation	$456,000	$238,000	$308,000
Labor	$114,000	$59,500	$77,000
Supervision	$48,450	$25,288	$32,725
P&A Costs	$425,000	$340,000	$440,000
Insurance	$28,500	$14,875	$19,250
Communications	$14,250	$7,438	$9,625
Drive Pipe	$0	$0	$0
Conductor	$0	$0	$0
Surface Casing	$0	$0	$0
Intermediate Casing	$120,000	$79,050	$102,300
Production Liner	$180,000	$110,500	$143,000

Authorization For Expenditure (AFE)

Estimate for a 19,000' Straight Hole w/2500HP Rig (Precompletion Estimate Included)

ESTIMATED INTANGIBLE COSTS

	Day Rate	Days	Precompl.	DRILLING COST	PRECOMPL. COST	TOTAL AFE
Surveys and Permits/Environmental				$20,000	$5,000	$25,000
Rig Move (Mob. & Demob.)	$30,000	10		300,000	$0	$300,000
Drilling Per day	$30,000	150	7	4,500,000	$210,000	$4,710,000
Fuel, Lubes and Water	$1,500	150	7	$225,000	$10,500	$235,500
Rental Equipment	$2,000	150	7	$300,000	$14,000	$314,000
Drill Bits				$75,500	$7,500	$83,000
Drilling Mud & Chemicals		150	7	$500,000	$0	$500,000
Mud Logging	$1000	90		$90,000	$0	$90,000
Cement & Squeeze Services				$150,000	$35,000	$185,000
Casing Crews & Tools				$50,000	$25,000	$75,000
Open Hole Logging+MWD/LWD				$500,000	$0	$500,000
Sidewall Cores & Analysis				$15,500	$0	$15,500
Transportation	$8,000	150	7	$1,200,000	$56,000	$1,256,000
Labor	$2,000	150	7	$300,000	$14,000	$314,000
Supervision	$1000	150	7	$150,000	$7,000	$157,000
P&A Costs	$85,000	15	0	$1,275,000	$0	$1,275,000
Pipe Inspection				$20,000	$10,000	$30,000
Overhead	$700	150	7	$105,000	$4,900	$109,900
Insurance	$500	150	7	$75,000	$3,500	$78,500
Communications	$250	150	7	$37,500	$1,750	$39,250
				$9,888,500	**$404,150**	**$10, 292,650**

TANGIBLE COSTS

	Depth (Ft)		Diameter	$/Ft			
Drive Pipe			30"	220 (Not needed)	$0	$0	$0
Conductor	3000	26"	60		$180,000	$0	$180,000
Surface Casing		9900	13 3/8"	20	$198,000	$0	$198,000
Intermediate Casing	12,600		9-5/8"	30	$378,000	$0	$378,000
Production Liner	16,700-19,000		4-1/2 "	12	$0	$27,600	$27,600
Wellhead Equipment					$100,000	$15,000	$115,000
TOTAL TANGIBLES					**$856,000**	**$42,600**	**$898,600**
TOTAL AFE COSTS					**$10,744,500**	**$446,750**	**$11,191,250**

Range of Total Costs

	Base Case	Lower Limit	Higher Limit
Total Rig Cost	$5,010,000	$4,258,500	$5,511,000
Fuel, Lubes and Water	$235,500	$ 200,175	$259,050
Rental Equipment	$314,000	$266,900	$345,400
Drilling Mud & Chemicals	$500,000	$425,000	$550,000
Mud Logging	$90,000	$76,500	$99,000
Transportation	$1,256,000	$1,067,600	$1,381,600
Labor	$314,000	$226,900	$345,400
Supervision	$157,000	$133,450	$172,700
P&A Costs	$1,275,000	$1,083,750	$1,402,500
Insurance	$78,500	$66,725	$86,350
Communications	$39,250	$33,363	$43,175
Drive Pipe	$0	$0	$0
Conductor	$180,000	$153,000	$198,000
Surface Casing	$198,000	$ 168,000	$217,800
Intermediate Casing	$378,000	$321,300	$415,800
Production Liner	$27,600	$23,460	$30,360

APPENDIX # 2

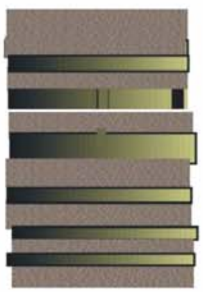
Venezuela Wellbore

Completion Schematics (in Spanish)

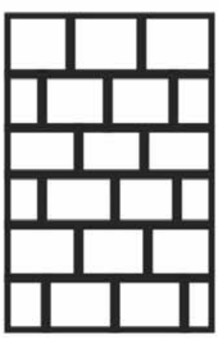
LITHOLOGY LEGEND

Predominantly Sandstone

Predominently Shale & Siltstone



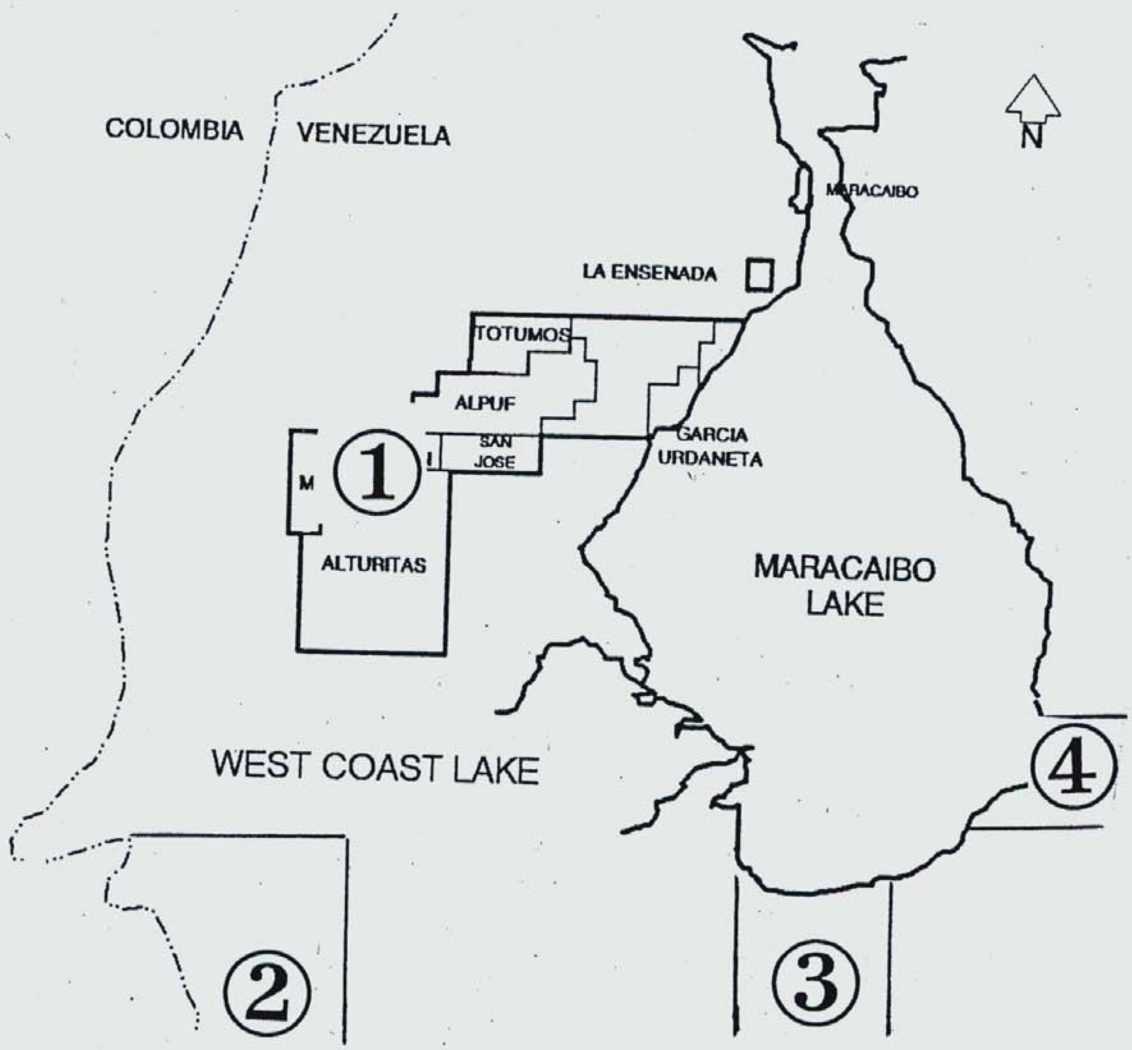
Predominantly Interbedded Sandstone & Shale



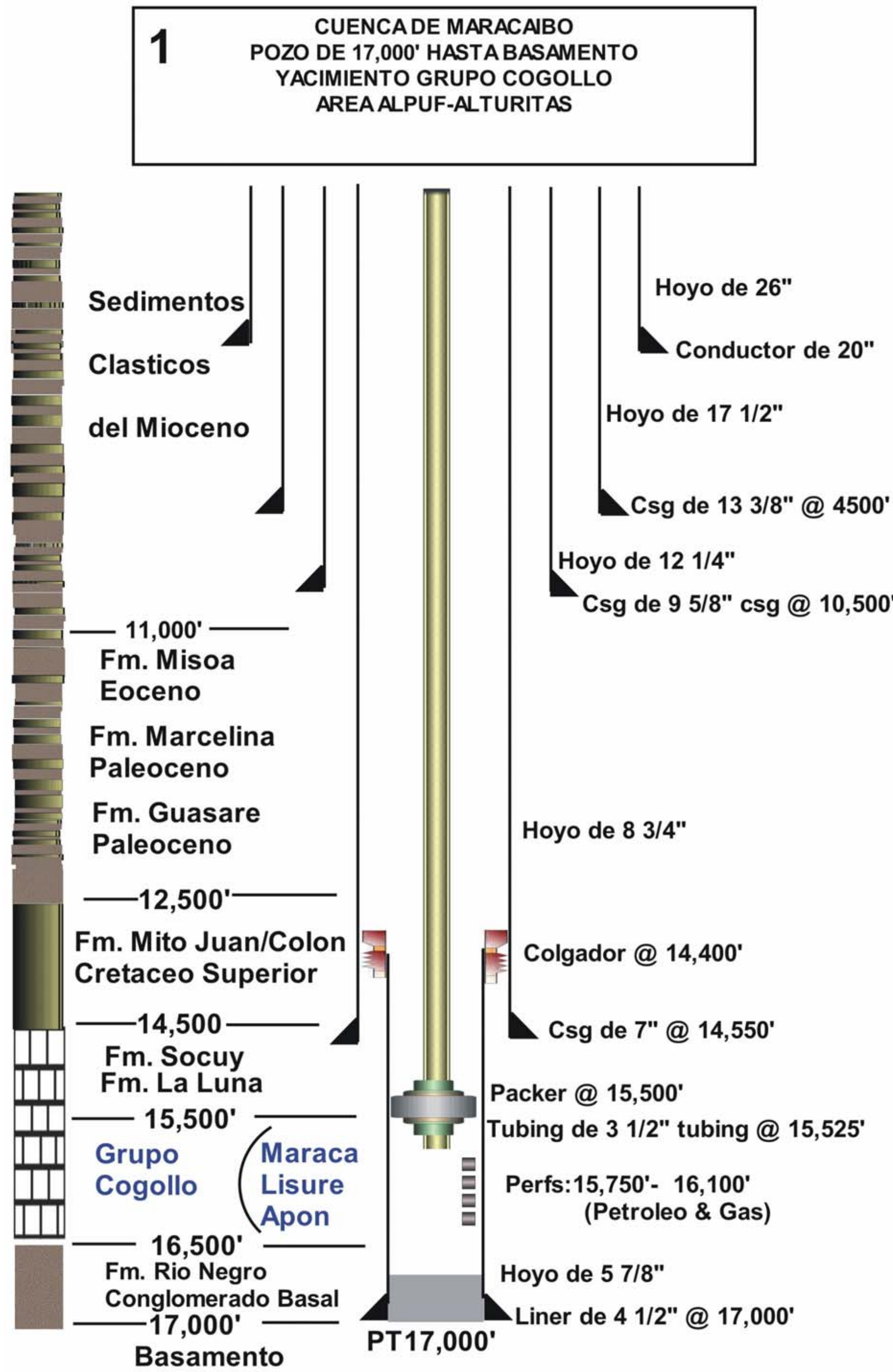
Predominantly Limestone and/or Dolomite, Chalk & Marl

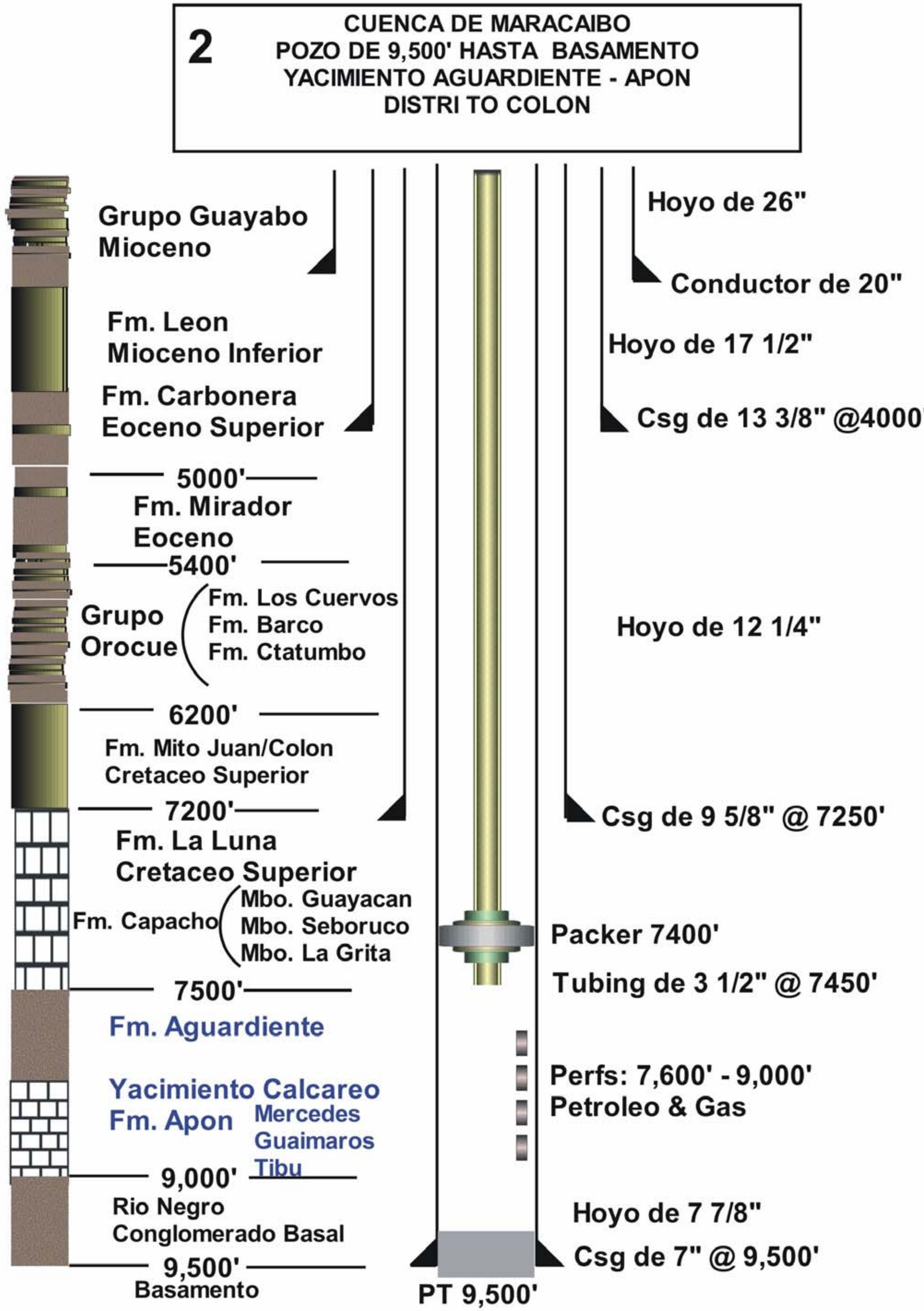
Predominantly Calcareous Sandstone & Limestone

MARACAIBO BASIN
Example Well Locations

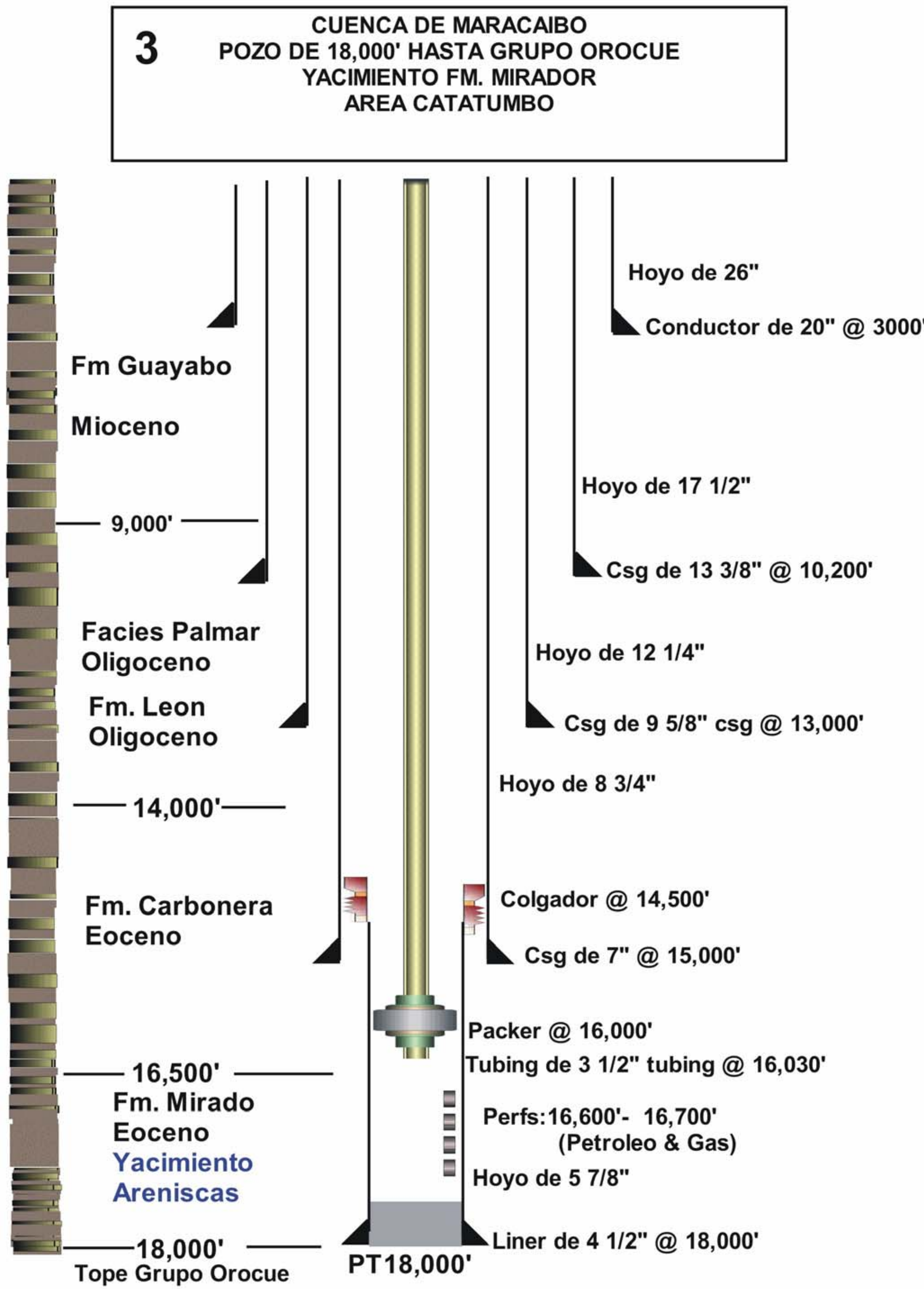


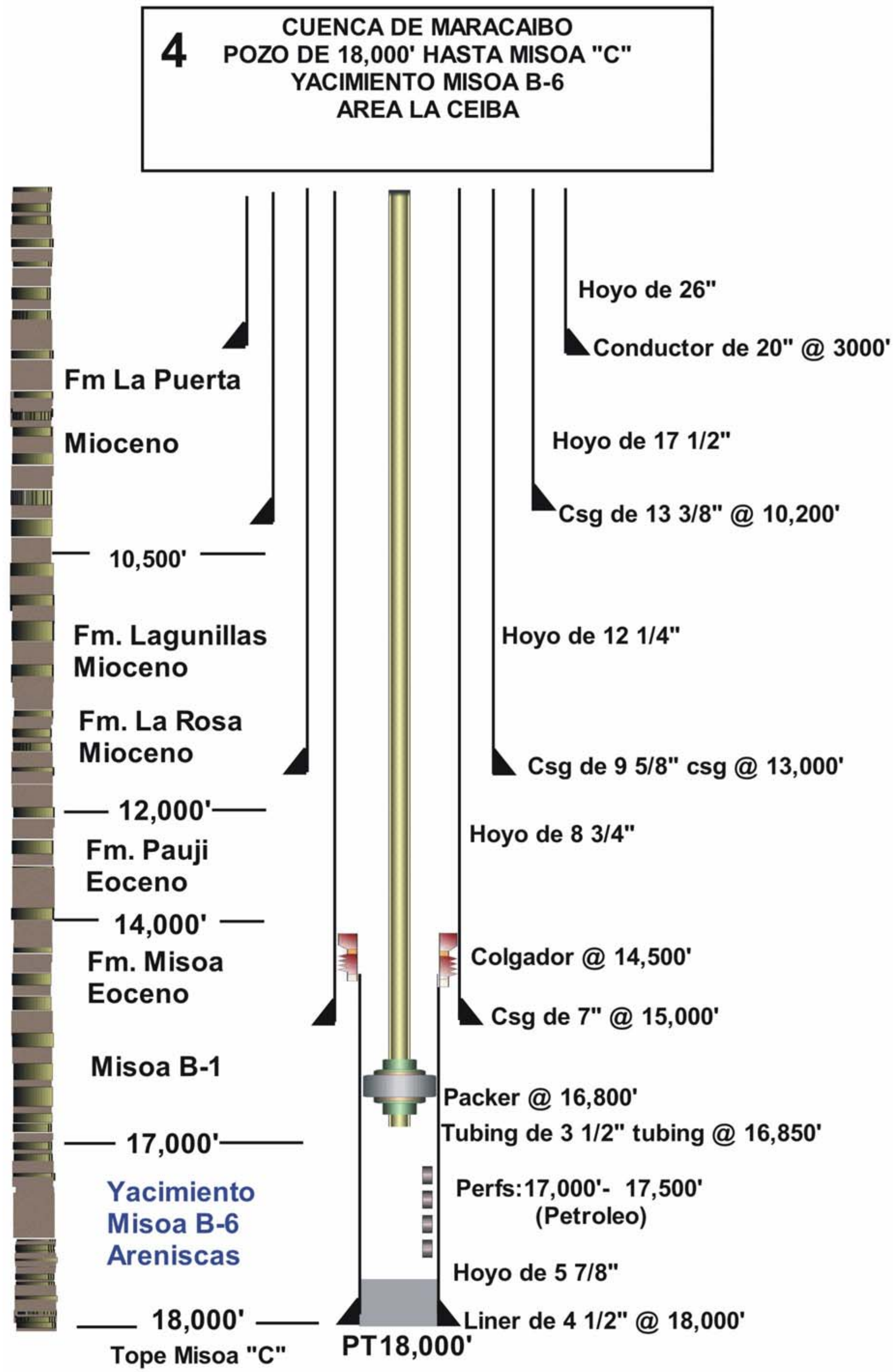
1. WEST LAKE FIELDS (ALTURITAS, ALPUF)
2. COLON DISTRICT (TARRA, BONITO, LAS CRUCES)
3. CATATUMBO (BLOCK 1)
4. LA CEIBA (BLOCK 2)

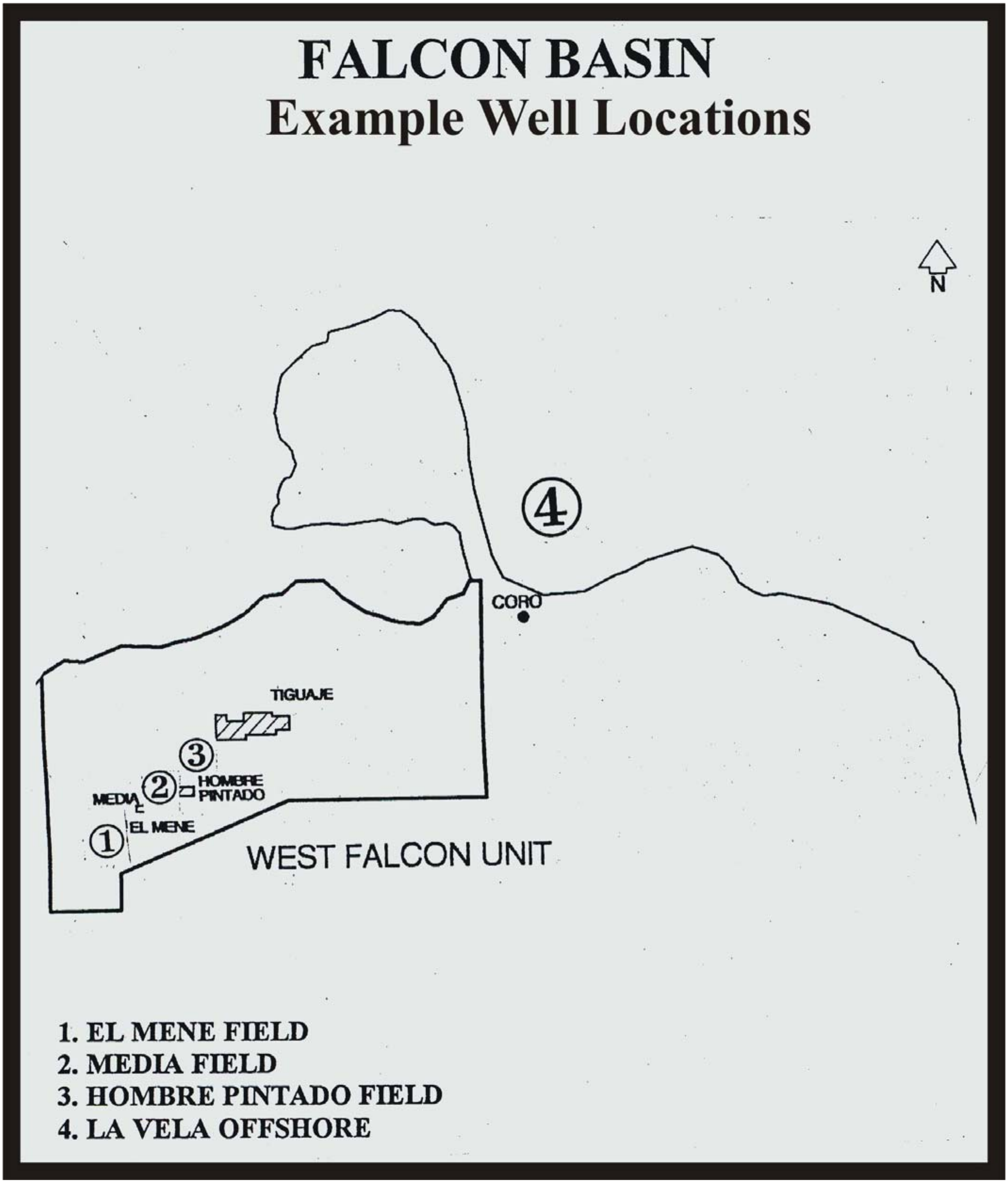

1
CUENCA DE MARACAIBO
POZO DE 17,000' HASTA BASAMENTO
YACIMIENTO GRUPO COGOLLO
AREA ALPUF-ALTURITAS
Sedimentos
Clasticos
del Mioceno
Hoyo de 26"
Conductor de 20"
Hoyo de 17 1/2"
Csg de 13 3/8" @ 4500'
Hoyo de 12 1/4"
Csg de 9 5/8" csg @ 10,500'
11,000'
Fm. Misoa
Eoceno
Fm. Marcelina
Paleoceno
Fm. Guasare
Paleoceno
Hoyo de 8 3/4"
12,500'
Fm. Mito Juan/Colon
Cretaceo Superior
Colgador @ 14,400'
14,500
Csg de 7" @ 14,550'
Fm. Socuy
Fm. La Luna
Packer @ 15,500'
15,500'
Tubing de 3 1/2" tubing @ 15,525'
Grupo
Cogollo
Maraca
Lisure
Apon
Perfs:15,750'- 16,100'
(Petroleo & Gas)
16,500'
Fm. Rio Negro
Conglomerado Basal
Hoyo de 5 7/8"
Liner de 4 1/2" @ 17,000'
17,000'
Basamento
PT17,000'

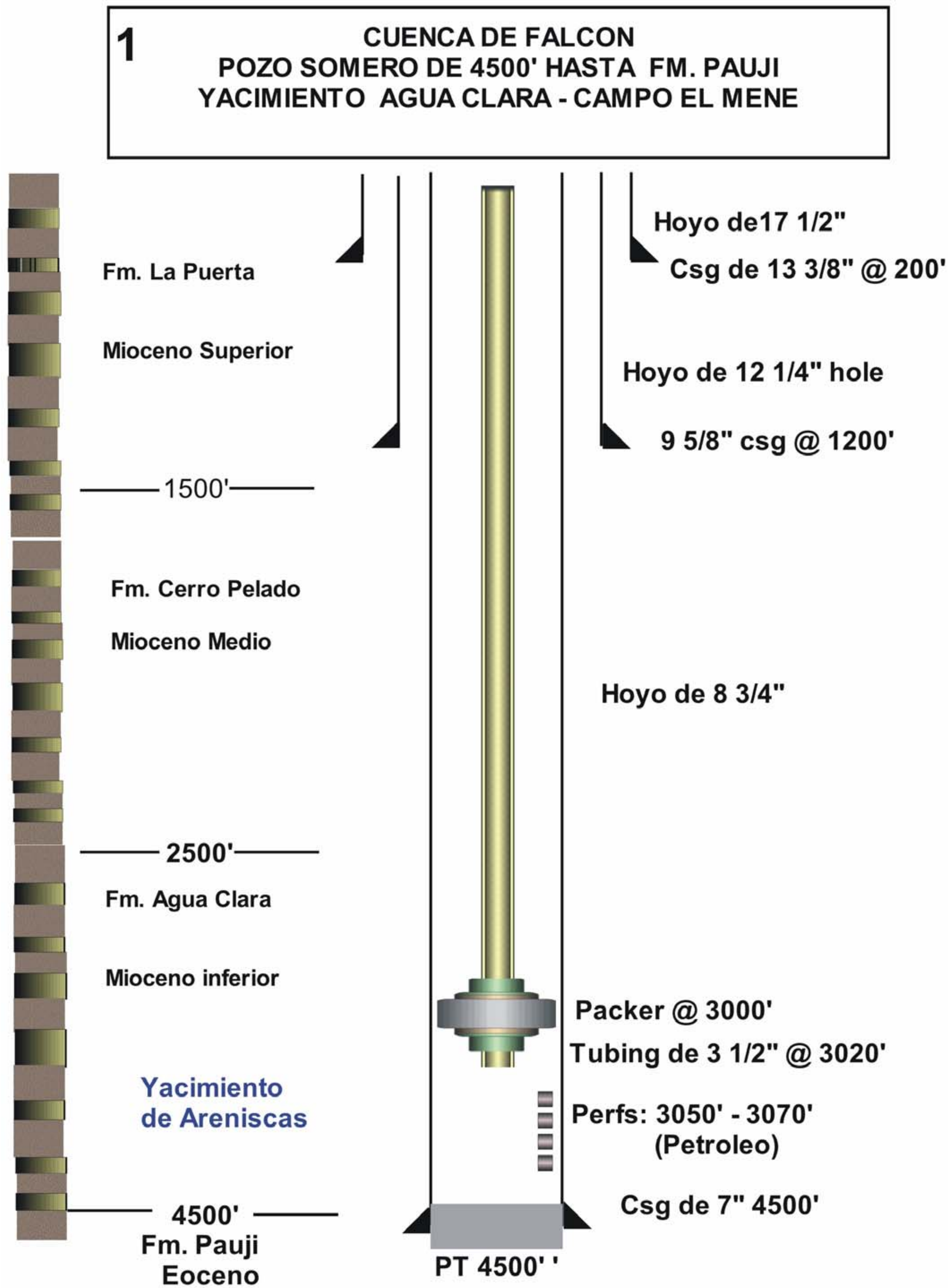


2
CUENCA DE MARACAIBO
POZO DE 9,500' HASTA BASAMENTO
YACIMIENTO AGUARDIENTE - APON
DISTRI TO COLON
Grupo Guayabo
Mioceno
Fm. Leon
Mioceno Inferior
Fm. Carbonera
Eoceno Superior
5000'
Fm. Mirador
Eoceno
5400'
Grupo
Orocue
Fm. Los Cuervos
Fm. Barco
Fm. Ctatumbo
6200'
Fm. Mito Juan/Colon
Cretaceo Superior
7200'
Fm. La Luna
Cretaceo Superior
Fm. Capacho
Mbo. Guayacan
Mbo. Seboruco
Mbo. La Grita
7500'
Fm. Aguardiente
Yacimiento Calcareo
Fm. Apon
Mercedes
Guaimaros
Tibu
9,000'
Rio Negro
Conglomerado Basal
9,500'
Basamento
Hoyo de 26"
Conductor de 20"
Hoyo de 17 1/2"
Csg de 13 3/8" @4000'
Hoyo de 12 1/4"
Csg de 9 5/8" @ 7250'
Packer 7400'
Tubing de 3 1/2" @ 7450'
Perfs: 7,600' - 9,000'
Petroleo & Gas
Hoyo de 7 7/8"
Csg de 7" @ 9,500'
PT 9,500'

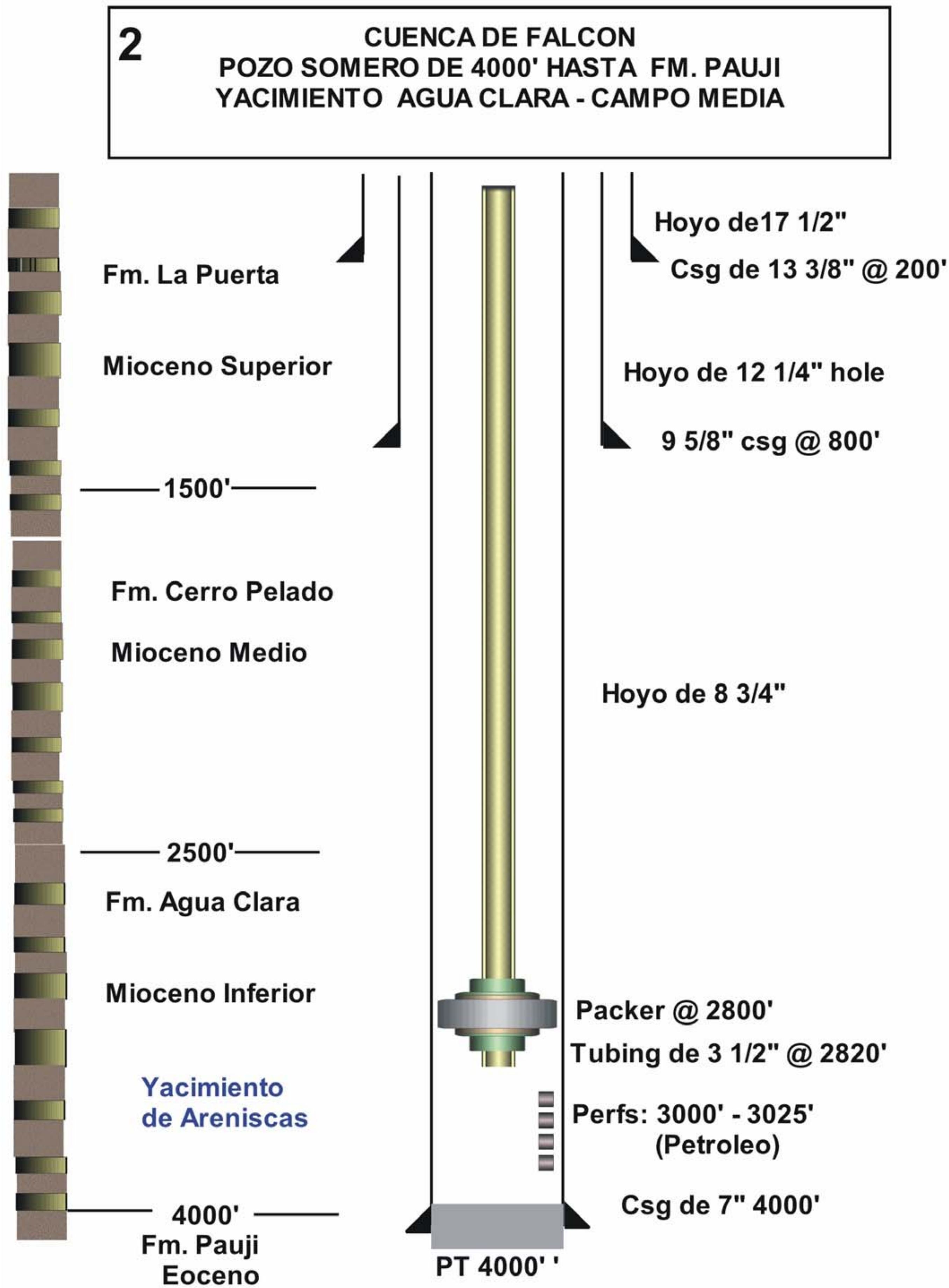

3
CUENCA DE MARACAIBO
POZO DE 18,000' HASTA GRUPO OROCUE
YACIMIENTO FM. MIRADOR
AREA CATATUMBO
Hoyo de 26"
Conductor de 20" @ 3000'
Fm Guayabo
Mioceno
Hoyo de 17 1/2"
9,000'
Csg de 13 3/8" @ 10,200'
Facies Palmar
Oligoceno
Hoyo de 12 1/4"
Fm. Leon
Oligoceno
Csg de 9 5/8" csg @ 13,000'
Hoyo de 8 3/4"
14,000'
Fm. Carbonera
Eoceno
Colgador @ 14,500'
Csg de 7" @ 15,000'
Packer @ 16,000'
Tubing de 3 1/2" tubing @ 16,030'
16,500'
Fm. Mirado
Eoceno
Yacimiento
Areniscas
Perfs:16,600'- 16,700'
(Petroleo & Gas)
Hoyo de 5 7/8"
18,000'
Tope Grupo Orocue
PT18,000'
Liner de 4 1/2" @ 18,000'


4
CUENCA DE MARACAIBO
POZO DE 18,000' HASTA MISOA "C"
YACIMIENTO MISOA B-6
AREA LA CEIBA
Hoyo de 26"
Conductor de 20" @ 3000'
Fm La Puerta
Mioceno
Hoyo de 17 1/2"
Csg de 13 3/8" @ 10,200'
10,500'
Fm. Lagunillas
Mioceno
Hoyo de 12 1/4"
Fm. La Rosa
Mioceno
Csg de 9 5/8" csg @ 13,000'
12,000'
Hoyo de 8 3/4"
Fm. Pauji
Eoceno
14,000'
Fm. Misoa
Eoceno
Colgador @ 14,500'
Csg de 7" @ 15,000'
Misoa B-1
Packer @ 16,800'
Tubing de 3 1/2" tubing @ 16,850'
17,000'
Yacimiento
Misoa B-6
Areniscas
Perfs:17,000'- 17,500'
(Petroleo)
Hoyo de 5 7/8"
18,000'
Liner de 4 1/2" @ 18,000'
Tope Misoa "C"
PT18,000'

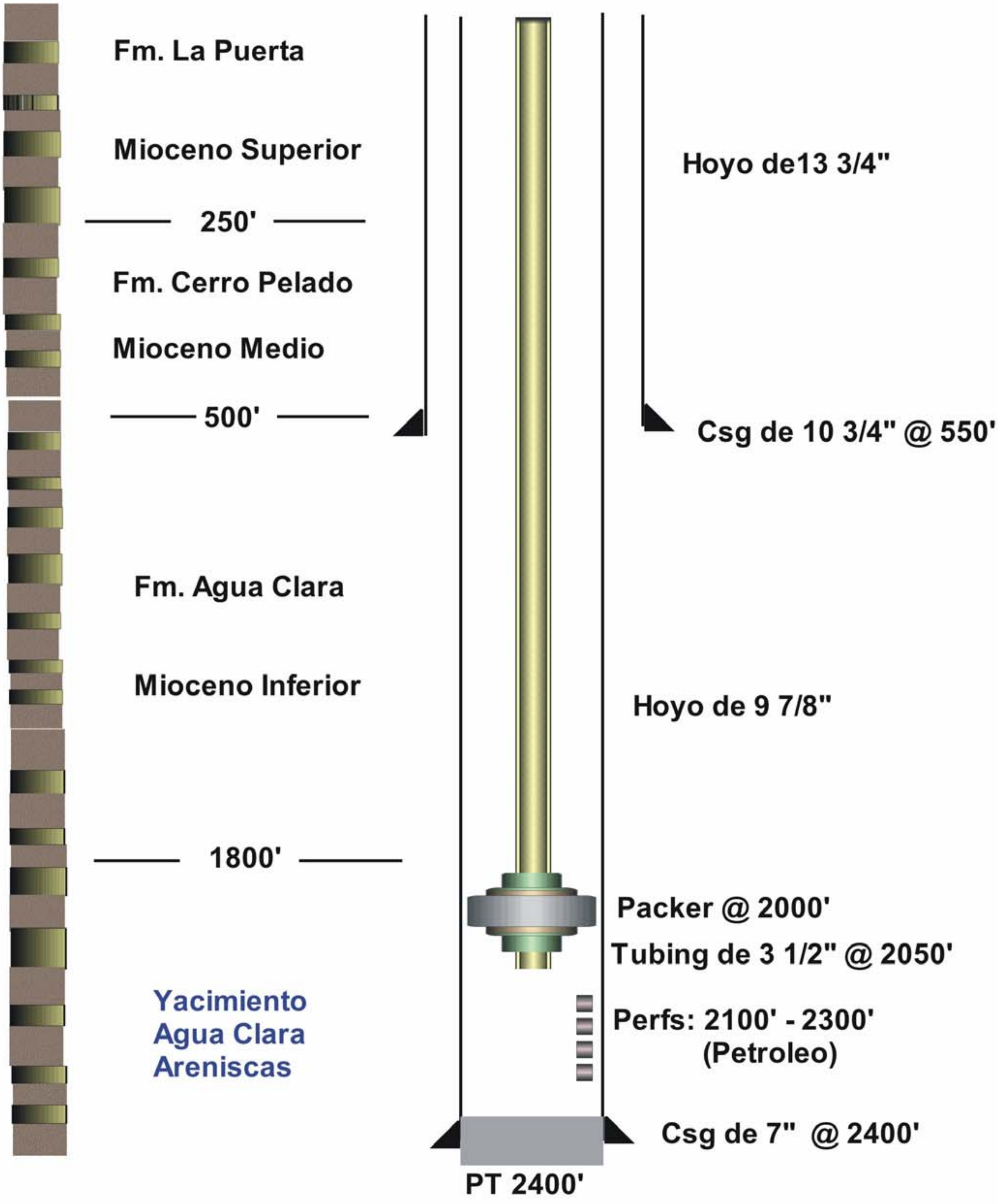

FALCON BASIN
Example Well Locations
N
4
CORO
TIGUAJE
3
2
HOMBRE PINTADO
MEDIA
EL MENE
1
WEST FALCON UNIT
1. EL MENE FIELD
2. MEDIA FIELD
3. HOMBRE PINTADO FIELD
4. LA VELA OFFSHORE

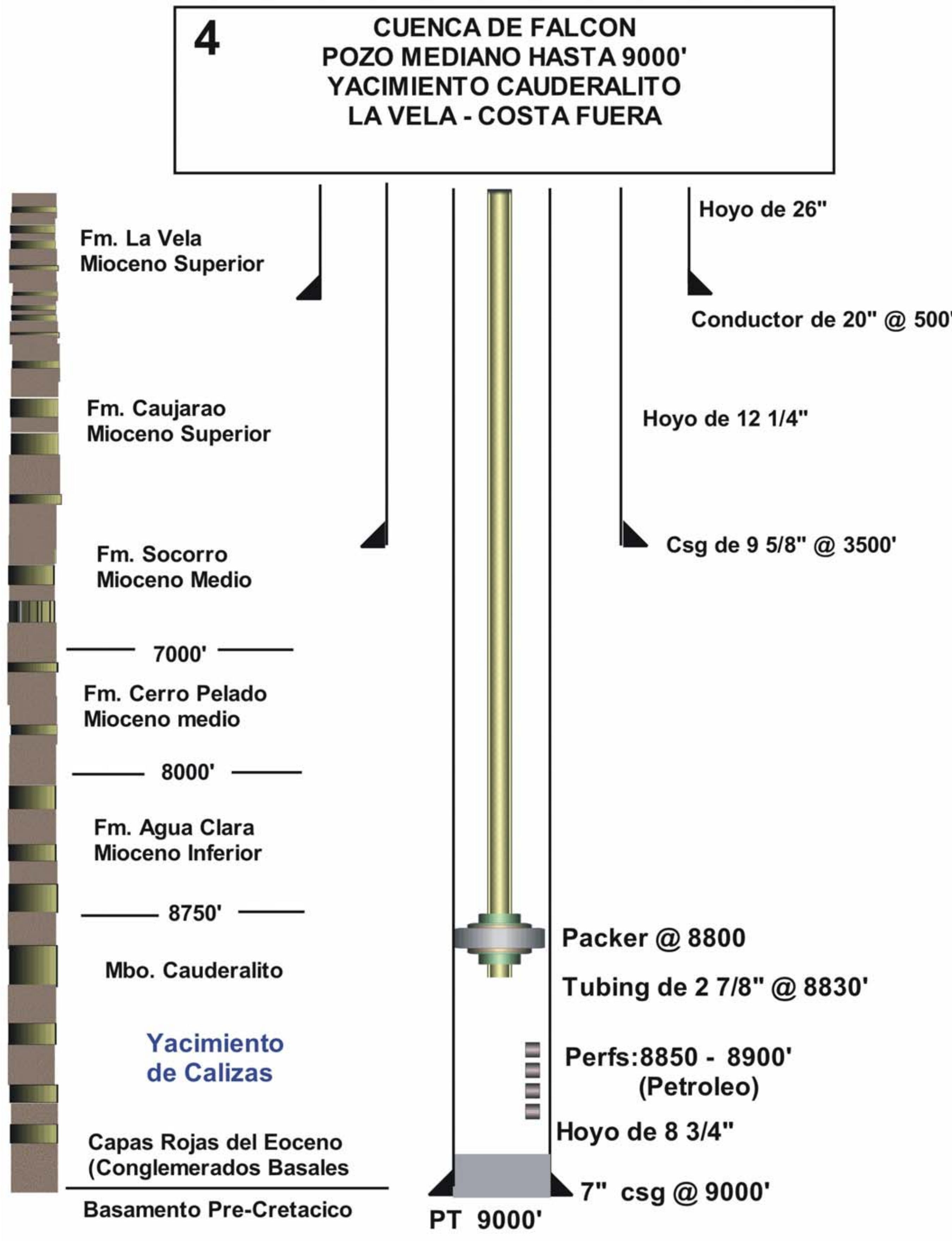


1
CUENCA DE FALCON
POZO SOMERO DE 4500' HASTA FM. PAUJI
YACIMIENTO AGUA CLARA - CAMPO EL MENE
Hoyo de17 1/2"
Csg de 13 3/8" @ 200'
Fm. La Puerta
Mioceno Superior
Hoyo de 12 1/4" hole
9 5/8" csg @ 1200'
1500'
Fm. Cerro Pelado
Mioceno Medio
Hoyo de 8 3/4"
2500'
Fm. Agua Clara
Mioceno inferior
Packer @ 3000'
Tubing de 3 1/2" @ 3020'
Yacimiento de Areniscas
Perfs: 3050' - 3070' (Petroleo)
Csg de 7" 4500'
4500'
Fm. Pauji
Eoceno
PT 4500' '

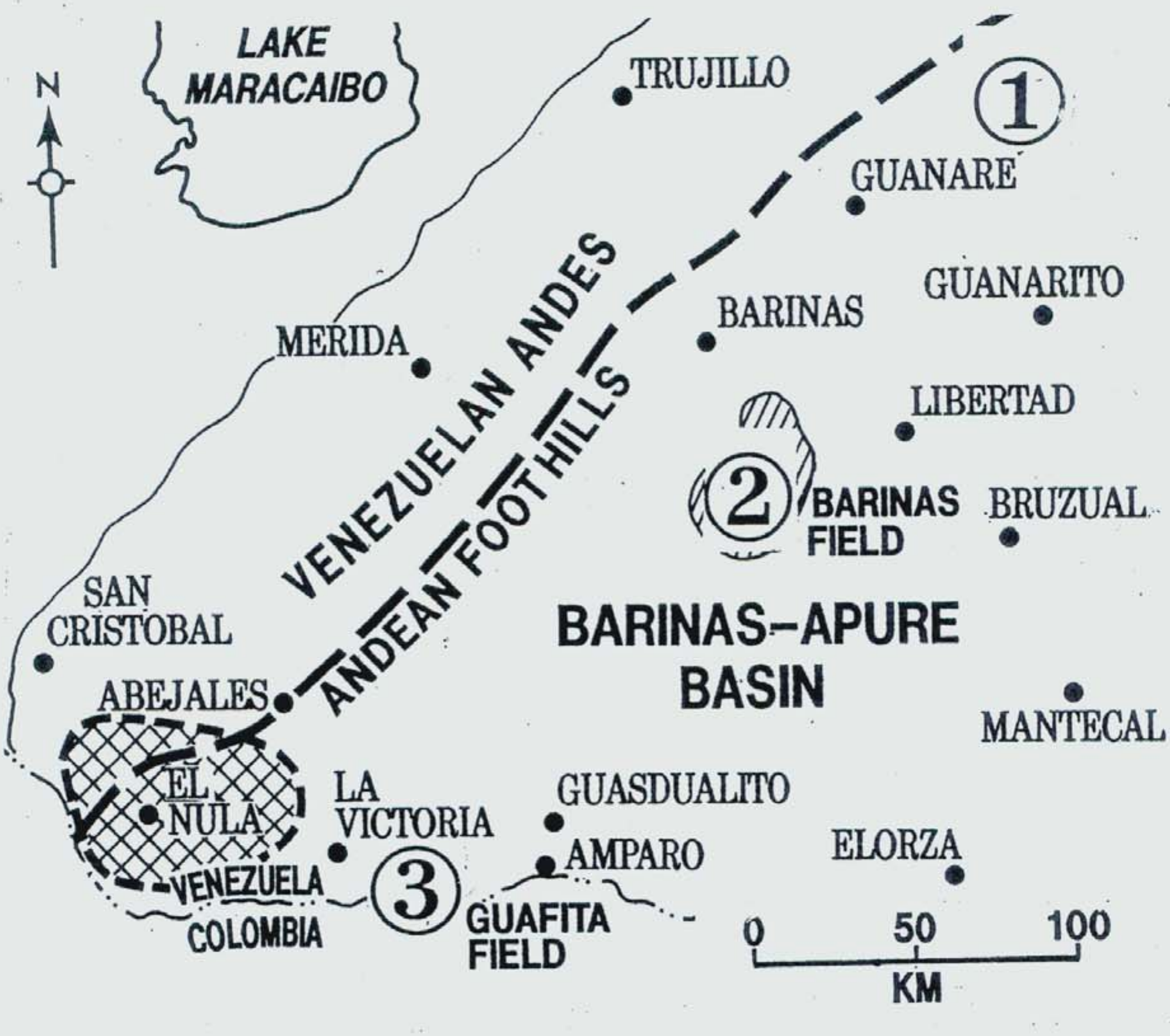

2
CUENCA DE FALCON
POZO SOMERO DE 4000' HASTA FM. PAUJI
YACIMIENTO AGUA CLARA - CAMPO MEDIA
Hoyo de17 1/2"
Csg de 13 3/8" @ 200'
Fm. La Puerta
Mioceno Superior
Hoyo de 12 1/4" hole
9 5/8" csg @ 800'
1500'
Fm. Cerro Pelado
Mioceno Medio
Hoyo de 8 3/4"
2500'
Fm. Agua Clara
Mioceno Inferior
Packer @ 2800'
Tubing de 3 1/2" @ 2820'
Yacimiento
de Areniscas
Perfs: 3000' - 3025'
(Petroleo)
Csg de 7" 4000'
4000'
Fm. Pauji
Eoceno
PT 4000' '

3 CUENCA DE FALCON
POZO SOMERO DE 2400' HASTA FM. AGUA CLARA
YACIMIENTO AGUA CLARA - CAMPO HOMBRE PINTADO

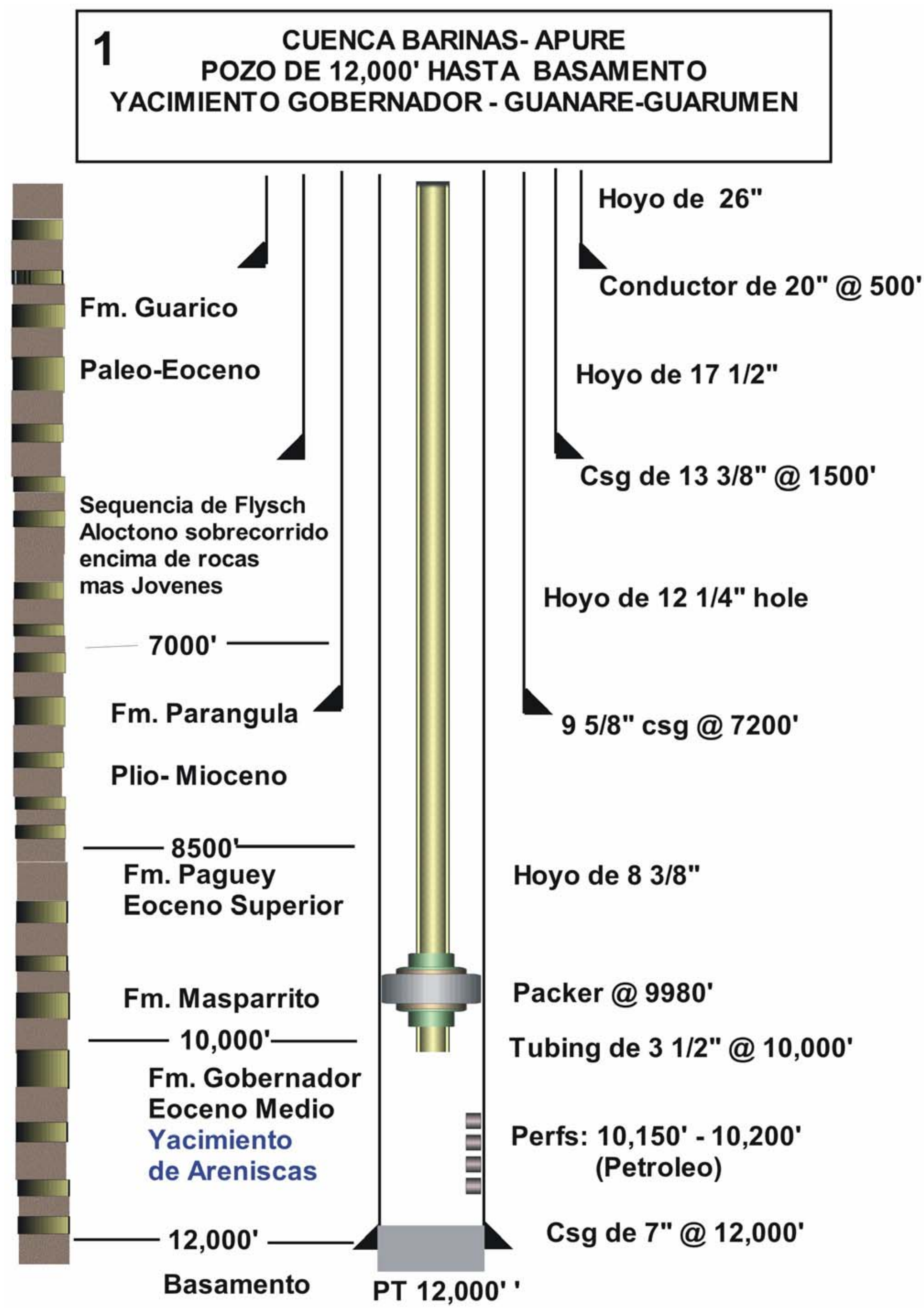


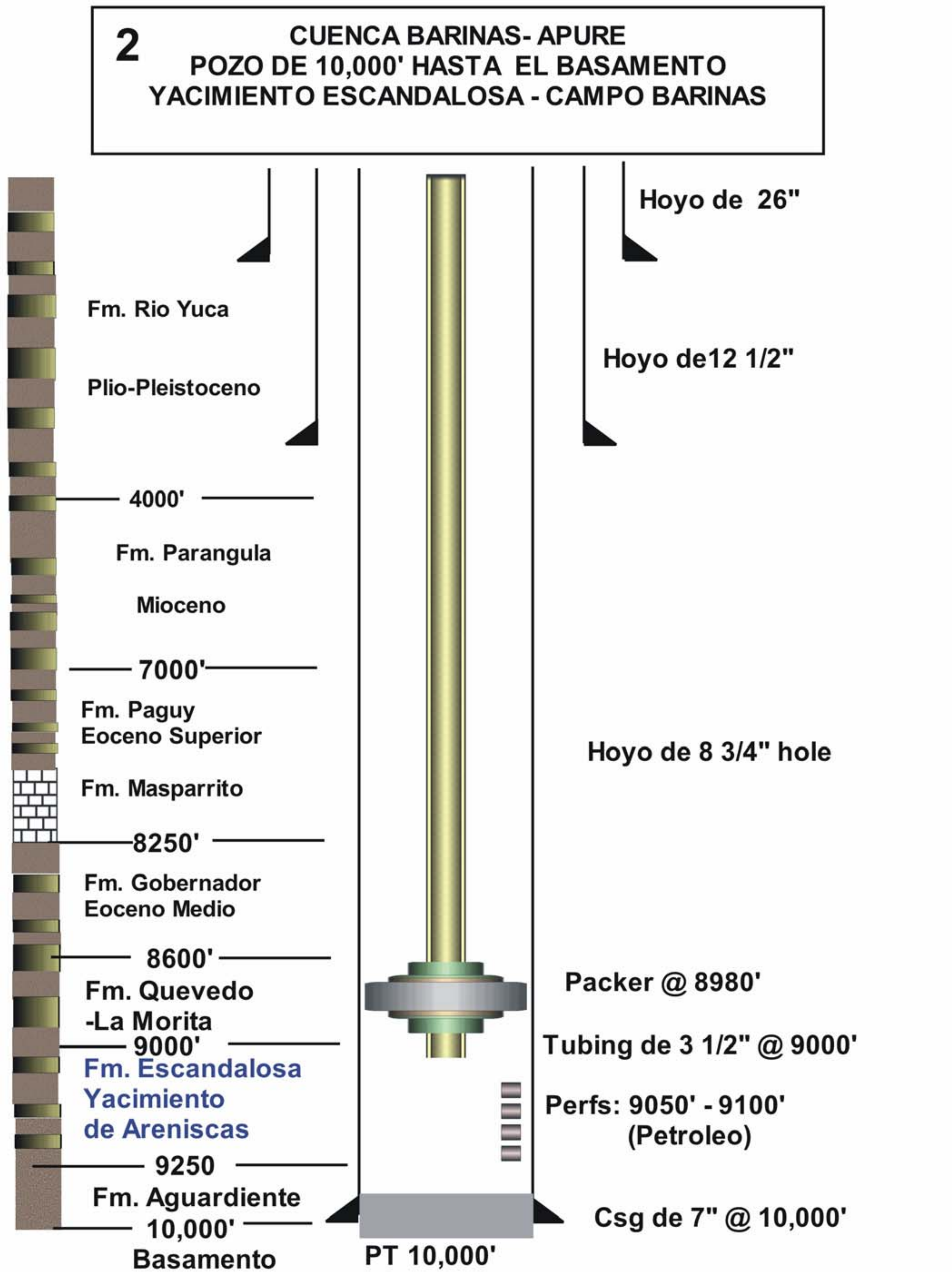

4
CUENCA DE FALCON
POZO MEDIANO HASTA 9000'
YACIMIENTO CAUDERALITO
LA VELA - COSTA FUERA
Hoyo de 26"
Fm. La Vela
Mioceno Superior
Conductor de 20" @ 500'
Fm. Caujarao
Mioceno Superior
Hoyo de 12 1/4"
Csg de 9 5/8" @ 3500'
Fm. Socorro
Mioceno Medio
7000'
Fm. Cerro Pelado
Mioceno medio
8000'
Fm. Agua Clara
Mioceno Inferior
8750'
Packer @ 8800
Mbo. Cauderalito
Tubing de 2 7/8" @ 8830'
Yacimiento
de Calizas
Perfs:8850 - 8900'
(Petroleo)
Hoyo de 8 3/4"
Capas Rojas del Eoceno
(Conglemerados Basales
7" csg @ 9000'
Basamento Pre-Cretacico
PT 9000'

BARINAS - APURE BASIN
Example Well Locations



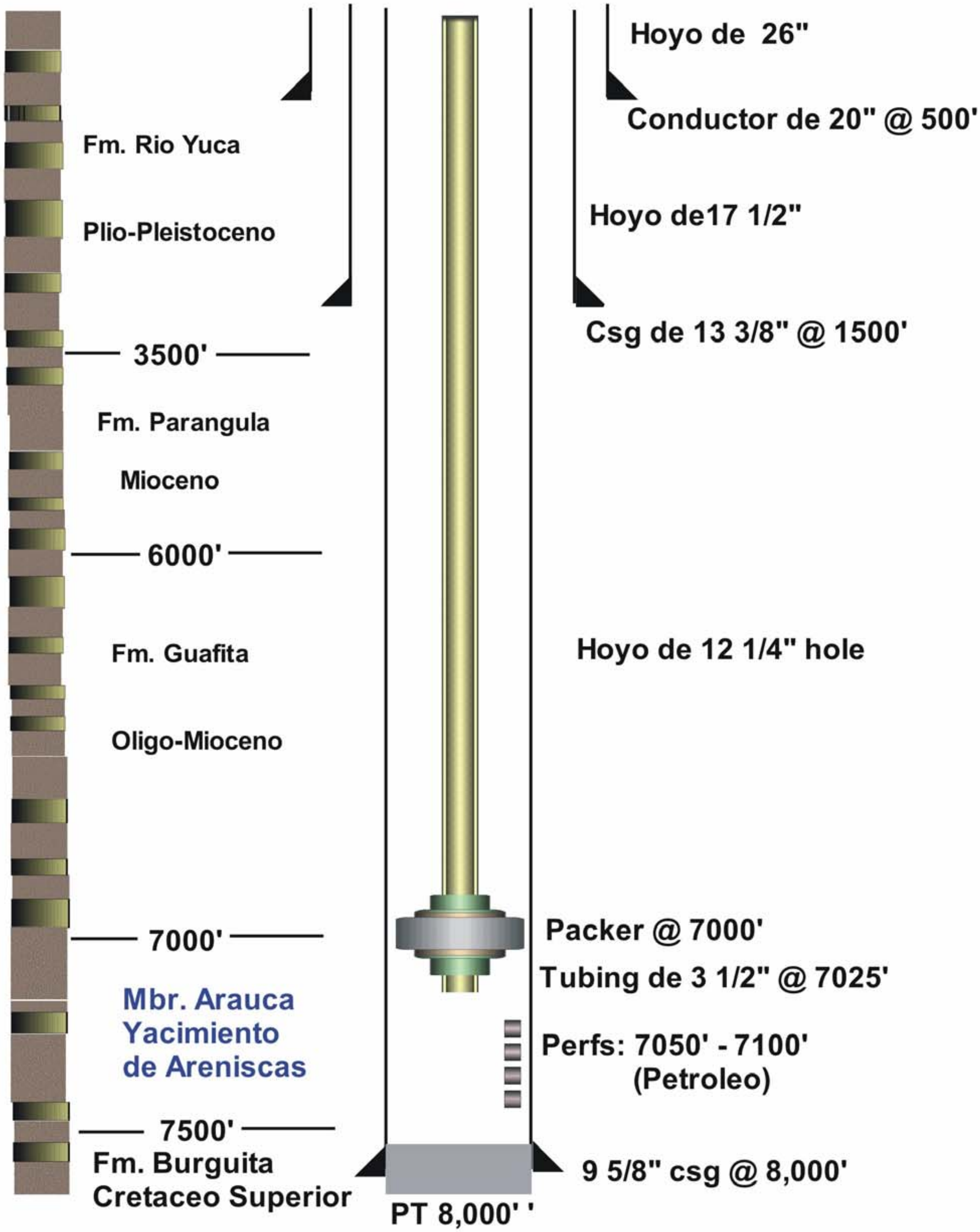
1. GUANARE - GAURUMEN (BLOCKS 3 & 4)
2. BARINAS FIELDS (SINCO, SILVESTRE)
3. GUAFITA FIELD (S.W. APURE)


1
CUENCA BARINAS- APURE
POZO DE 12,000' HASTA BASAMENTO
YACIMIENTO GOBERNADOR - GUANARE-GUARUMEN
Hoyo de 26"
Conductor de 20" @ 500'
Fm. Guarico
Paleo-Eoceno
Hoyo de 17 1/2"
Csg de 13 3/8" @ 1500'
Sequencia de Flysch
Aloctono sobrecorrido
encima de rocas
mas Jovenes
Hoyo de 12 1/4" hole
7000'
Fm. Parangula
9 5/8" csg @ 7200'
Plio- Mioceno
8500'
Fm. Paguey
Eoceno Superior
Hoyo de 8 3/8"
Fm. Masparrito
Packer @ 9980'
10,000'
Tubing de 3 1/2" @ 10,000'
Fm. Gobernador
Eoceno Medio
Yacimiento
de Areniscas
Perfs: 10,150' - 10,200'
(Petroleo)
12,000'
Csg de 7" @ 12,000'
Basamento
PT 12,000' '

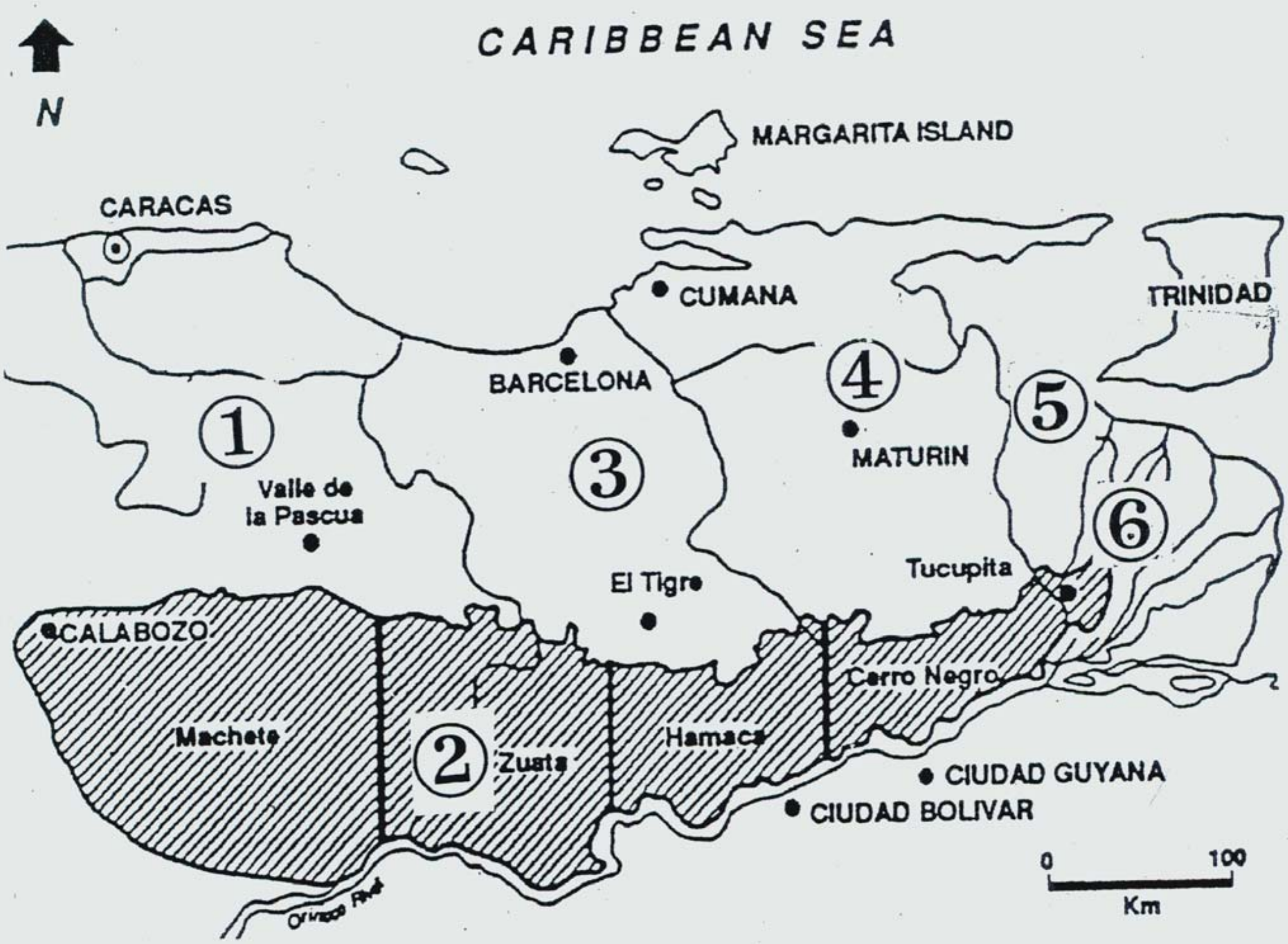

2
CUENCA BARINAS- APURE
POZO DE 10,000' HASTA EL BASAMENTO
YACIMIENTO ESCANDALOSA - CAMPO BARINAS
Hoyo de 26"
Fm. Rio Yuca
Plio-Pleistoceno
Hoyo de12 1/2"
4000'
Fm. Parangula
Mioceno
7000'
Fm. Paguy
Eoceno Superior
Hoyo de 8 3/4" hole
Fm. Masparrito
8250'
Fm. Gobernador
Eoceno Medio
8600'
Packer @ 8980'
Fm. Quevedo
-La Morita
9000'
Tubing de 3 1/2" @ 9000'
Fm. Escandalosa
Yacimiento
de Areniscas
Perfs: 9050' - 9100'
(Petroleo)
9250
Fm. Aguardiente
10,000'
Basamento
Csg de 7" @ 10,000'
PT 10,000'

3

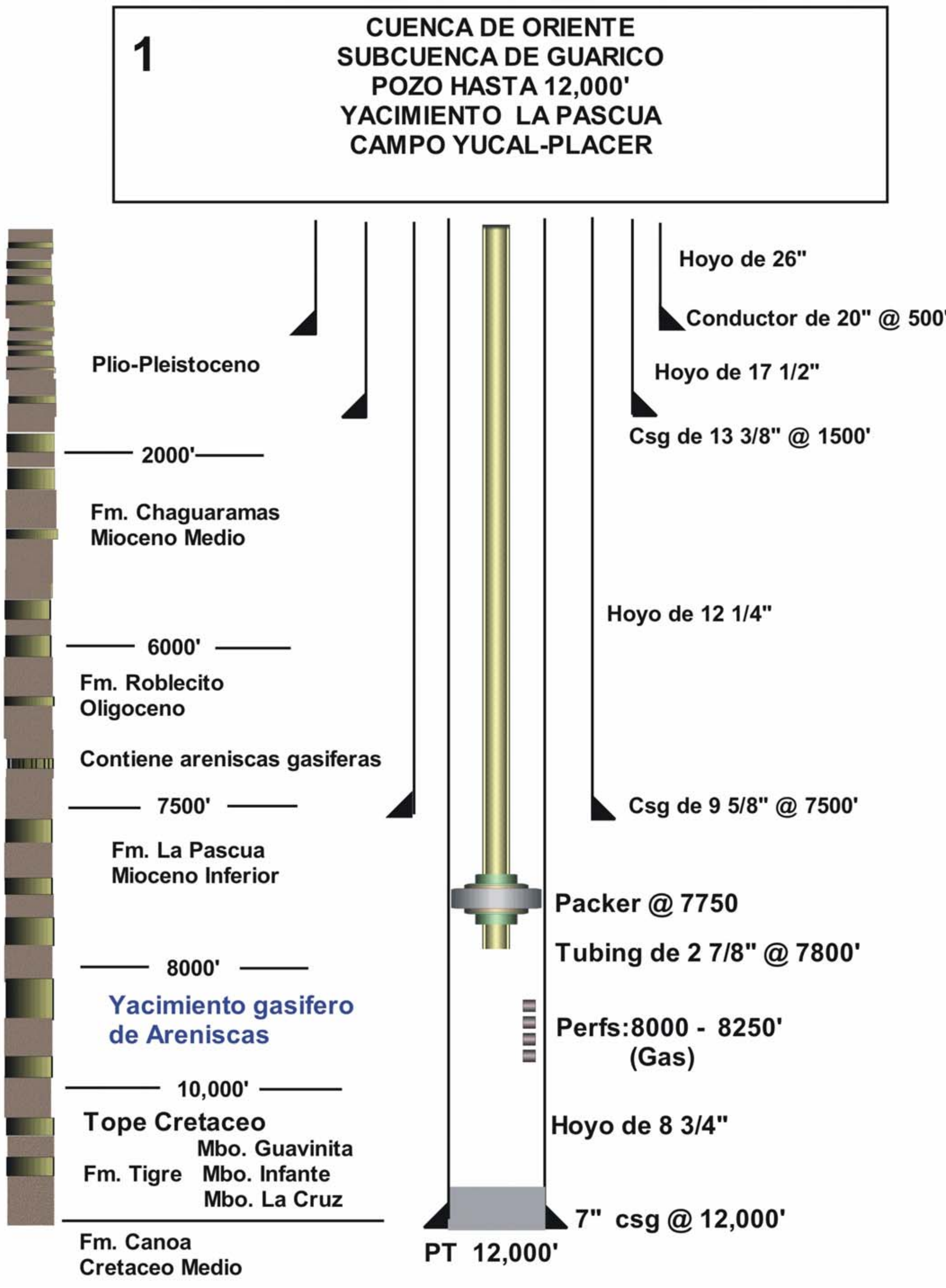
CUENCA BARINAS- APURE
POZO DE 8,000' HASTA FM. BURGUITA
YACIMIENTO MBR. ARAUCA - CAMPO GUAFITA

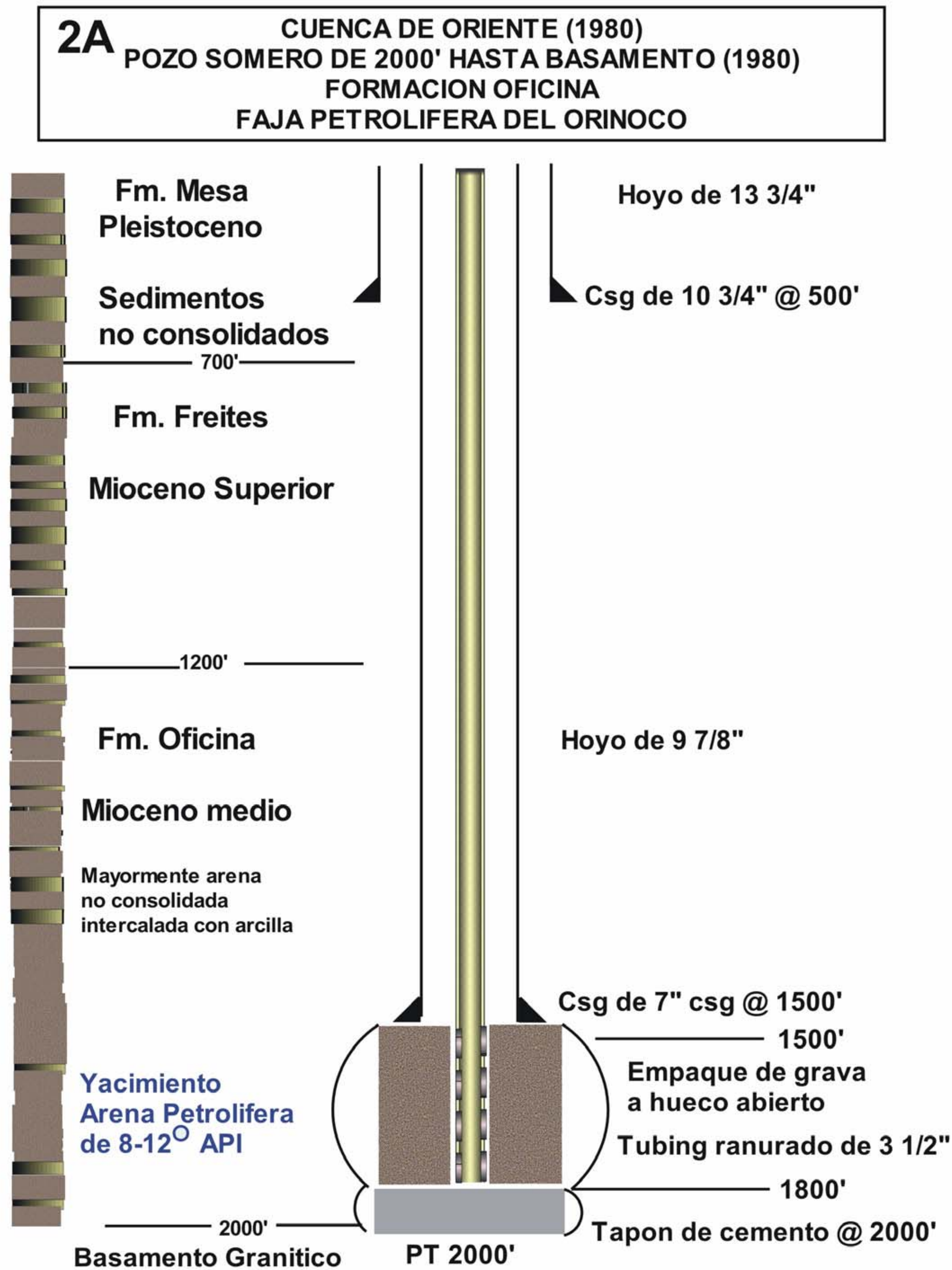


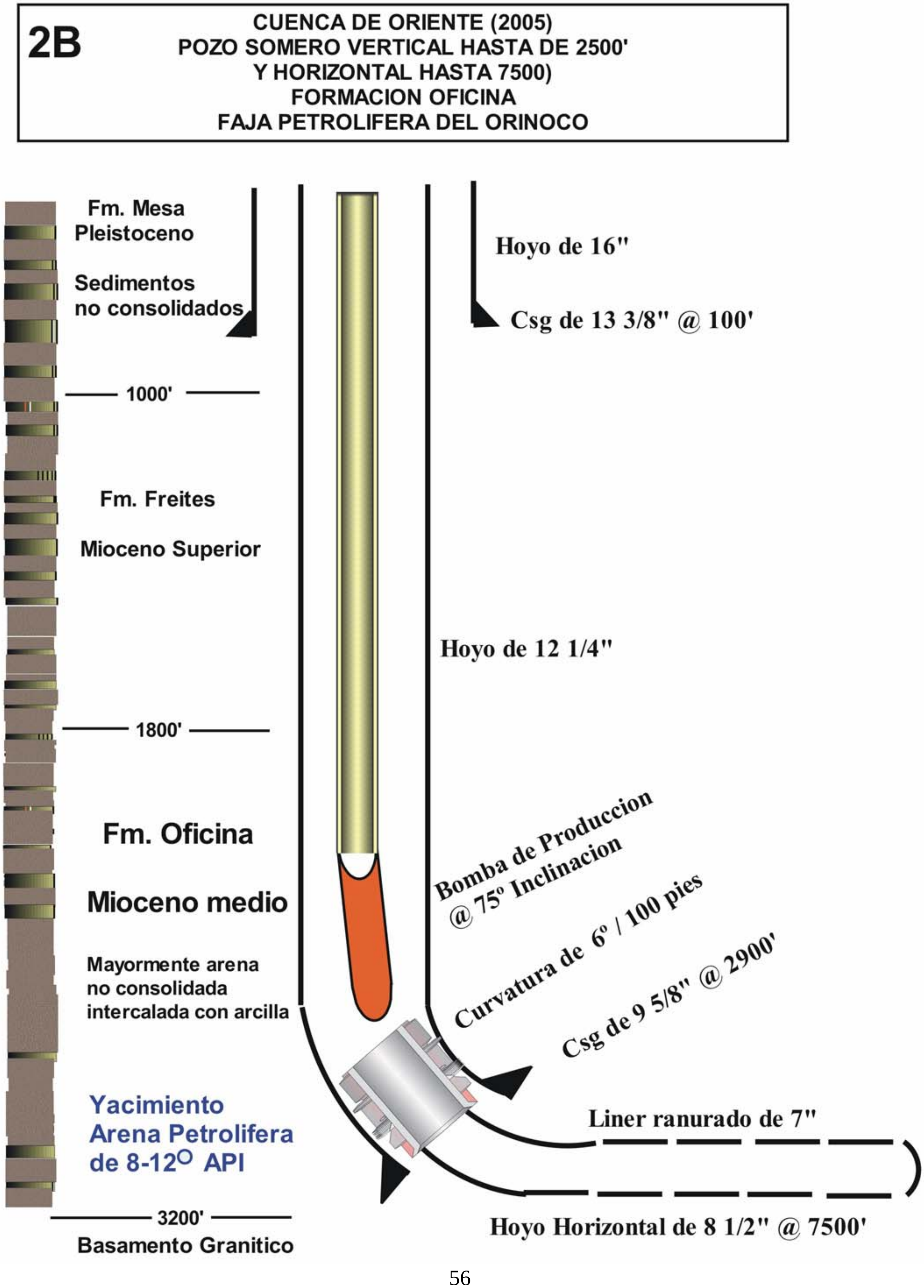
EASTERN VENEZUELA BASIN
Example Well Location

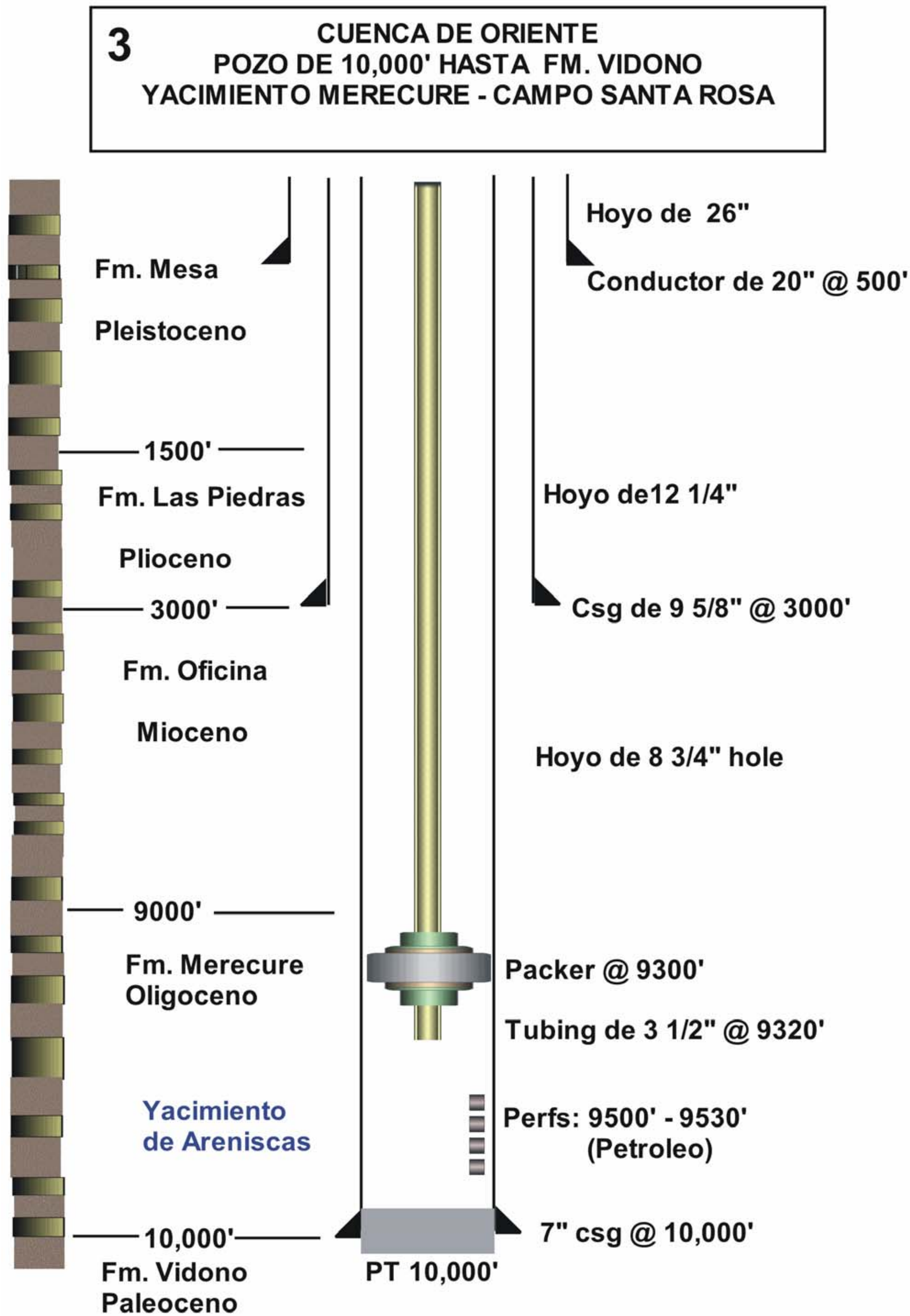


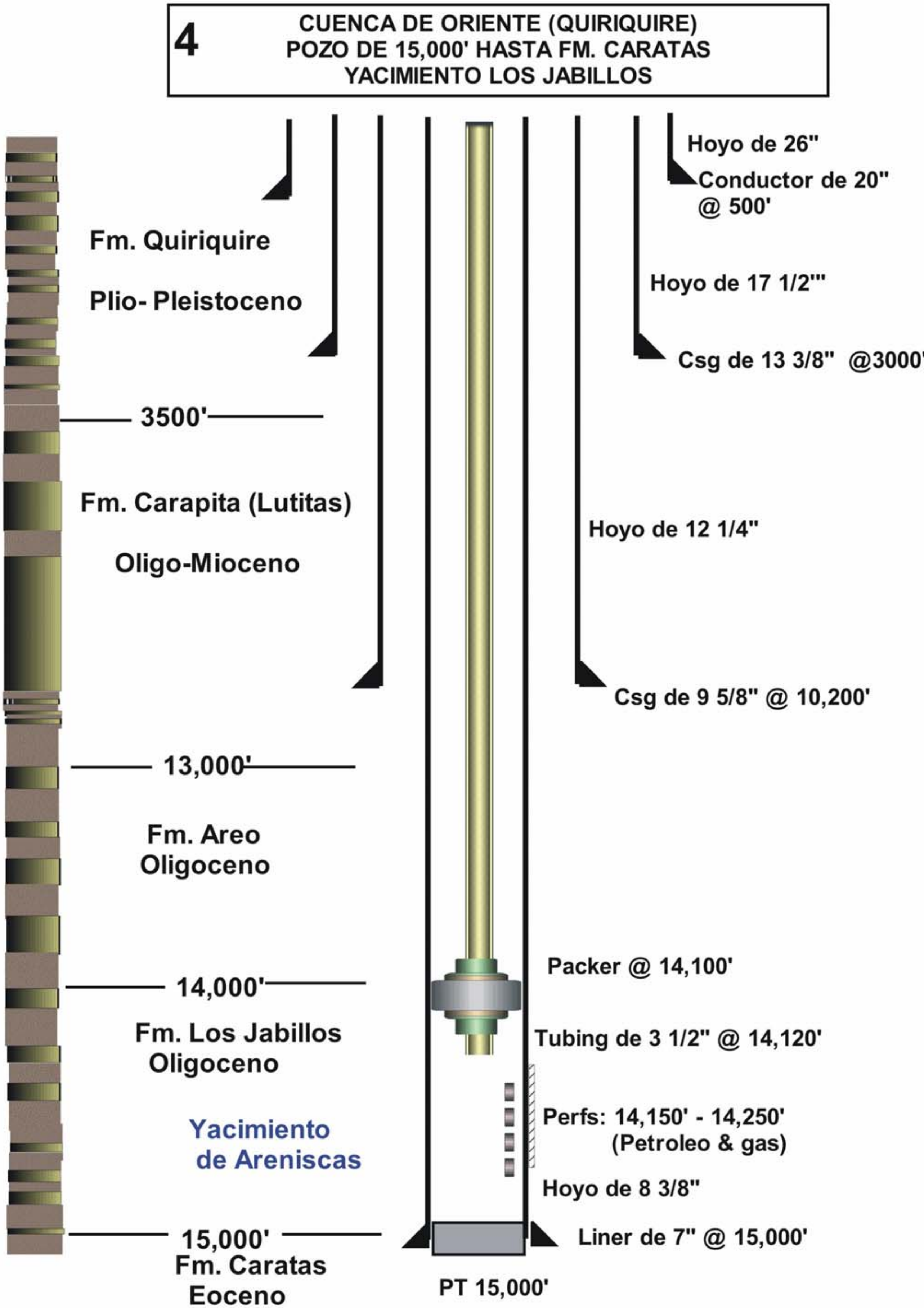
1. YUCAL PLACER FIELD (GUARICO SUB-BASIN)
2. HEAVY OIL BELT (ZUATA AREA)
3. SANTA ROSA FIELD (OFICINA AREA)
4. QUIRIQUIRE AREA (MATURIN SUB-BASIN)
5. PUNTA PESCADOR (BLOCK 9)
6. DELTA CENTRO (BLOCK 10)

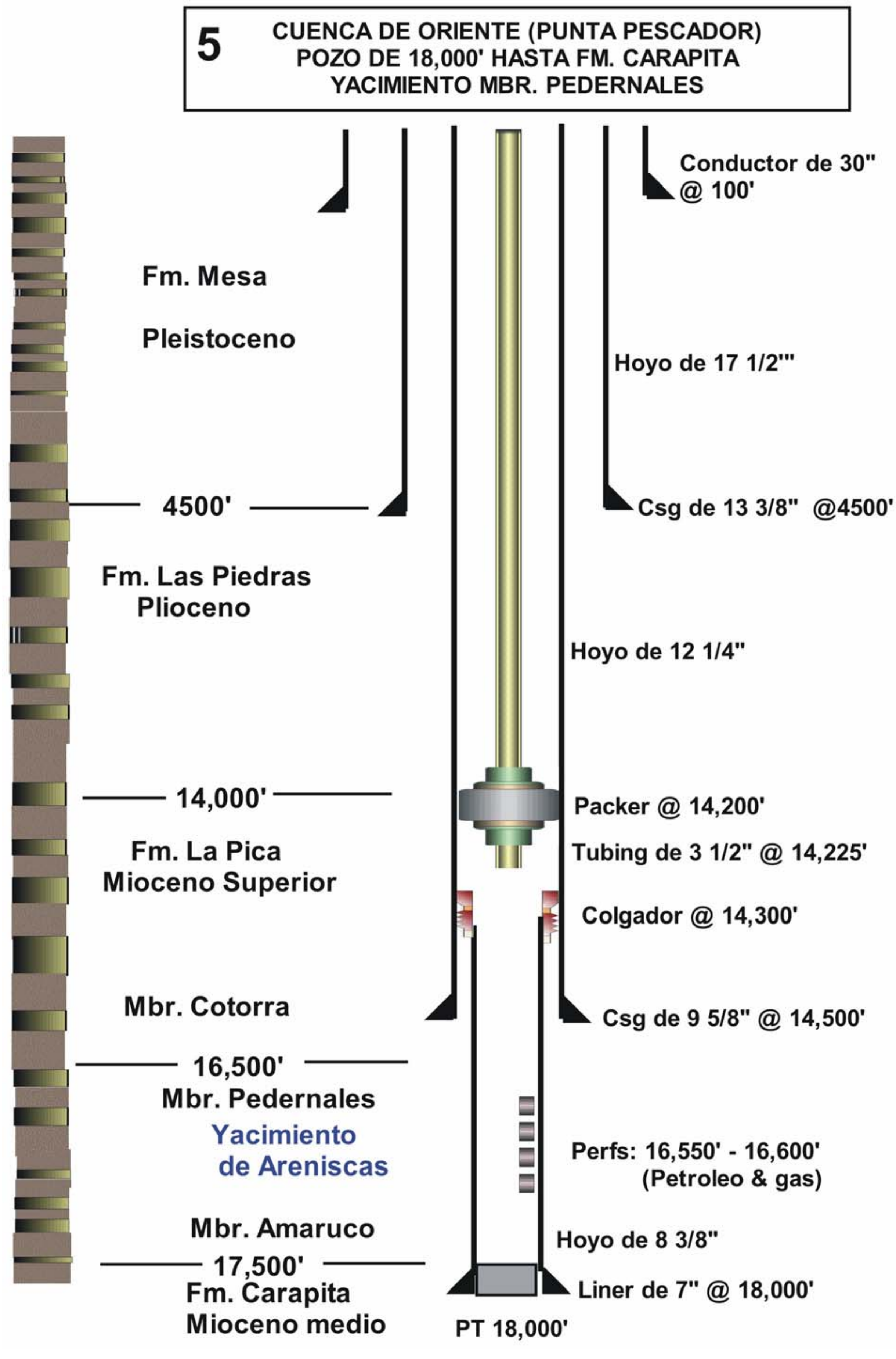

1
CUENCA DE ORIENTE
SUBCUENCA DE GUARICO
POZO HASTA 12,000'
YACIMIENTO LA PASCUA
CAMPO YUCAL-PLACER
Hoyo de 26"
Conductor de 20" @ 500'
Plio-Pleistoceno
Hoyo de 17 1/2"
Csg de 13 3/8" @ 1500'
2000'
Fm. Chaguaramas
Mioceno Medio
Hoyo de 12 1/4"
6000'
Fm. Roblecito
Oligoceno
Contiene areniscas gasiferas
7500'
Csg de 9 5/8" @ 7500'
Fm. La Pascua
Mioceno Inferior
Packer @ 7750
Tubing de 2 7/8" @ 7800'
8000'
Yacimiento gasifero
de Areniscas
Perfs:8000 - 8250'
(Gas)
10,000'
Tope Cretaceo
Hoyo de 8 3/4"
Mbo. Guavinita
Fm. Tigre
Mbo. Infante
Mbo. La Cruz
7" csg @ 12,000'
Fm. Canoa
Cretaceo Medio
PT 12,000'

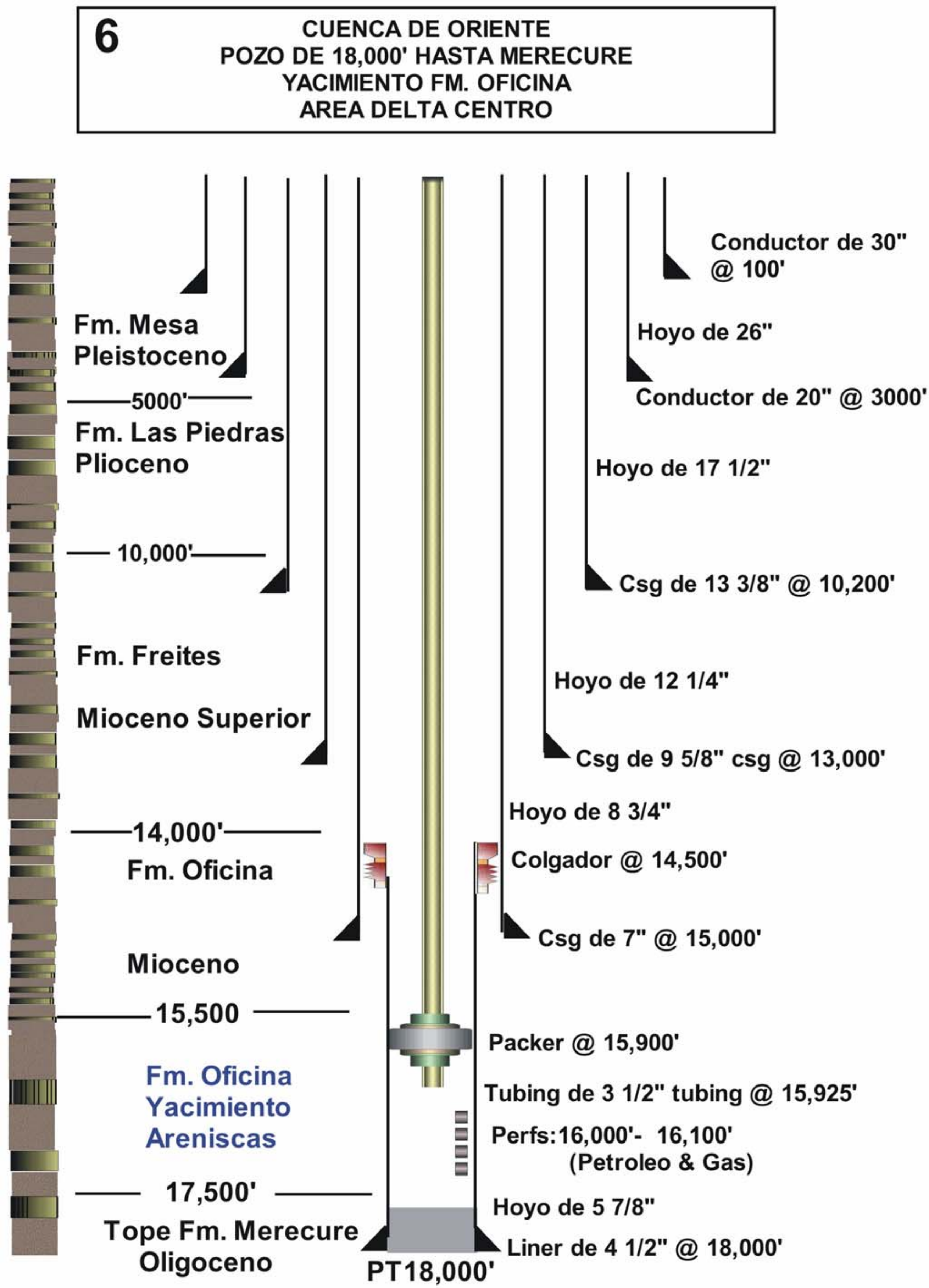

2A
CUENCA DE ORIENTE (1980)
POZO SOMERO DE 2000' HASTA BASAMENTO (1980)
FORMACION OFICINA
FAJA PETROLIFERA DEL ORINOCO
Fm. Mesa
Pleistoceno
Sedimentos
no consolidados
700'
Fm. Freites
Mioceno Superior
1200'
Fm. Oficina
Mioceno medio
Mayormente arena
no consolidada
intercalada con arcilla
Yacimiento
Arena Petrolifera
de 8-12° API
2000'
Basamento Granitico
Hoyo de 13 3/4"
Csg de 10 3/4" @ 500'
Hoyo de 9 7/8"
Csg de 7" csg @ 1500'
1500'
Empaque de grava
a hueco abierto
Tubing ranurado de 3 1/2"
1800'
Tapon de cemento @ 2000'
PT 2000'


2B
CUENCA DE ORIENTE (2005)
POZO SOMERO VERTICAL HASTA DE 2500'
Y HORIZONTAL HASTA 7500)
FORMACION OFICINA
FAJA PETROLIFERA DEL ORINOCO
Fm. Mesa
Pleistoceno
Sedimentos
no consolidados
Hoyo de 16"
Csg de 13 3/8" @ 100'
1000'
Fm. Freites
Mioceno Superior
Hoyo de 12 1/4"
1800'
Fm. Oficina
Mioceno medio
Bomba de Produccion
@ 75º Inclinacion
Curvatura de 6º / 100 pies
Mayormente arena
no consolidada
intercalada con arcilla
Csg de 9 5/8" @ 2900'
Yacimiento
Arena Petrolifera
de 8-12º API
Liner ranurado de 7"
3200'
Basamento Granitico
Hoyo Horizontal de 8 1/2" @ 7500'


3
CUENCA DE ORIENTE
POZO DE 10,000' HASTA FM. VIDONO
YACIMIENTO MERECURE - CAMPO SANTA ROSA
Hoyo de 26"
Fm. Mesa
Conductor de 20" @ 500'
Pleistoceno
1500'
Fm. Las Piedras
Hoyo de12 1/4"
Plioceno
3000'
Csg de 9 5/8" @ 3000'
Fm. Oficina
Mioceno
Hoyo de 8 3/4" hole
9000'
Fm. Merecure
Oligoceno
Packer @ 9300'
Tubing de 3 1/2" @ 9320'
Yacimiento
de Areniscas
Perfs: 9500' - 9530'
(Petroleo)
10,000'
7" csg @ 10,000'
Fm. Vidono
Paleoceno
PT 10,000'


4
CUENCA DE ORIENTE (QUIRIQUIRE)
POZO DE 15,000' HASTA FM. CARATAS
YACIMIENTO LOS JABILLOS
Hoyo de 26"
Conductor de 20" @ 500'
Fm. Quiriquire
Plio- Pleistoceno
Hoyo de 17 1/2'"
Csg de 13 3/8" @3000'
3500'
Fm. Carapita (Lutitas)
Oligo-Mioceno
Hoyo de 12 1/4"
Csg de 9 5/8" @ 10,200'
13,000'
Fm. Areo
Oligoceno
Packer @ 14,100'
14,000'
Fm. Los Jabillos
Oligoceno
Tubing de 3 1/2" @ 14,120'
Yacimiento
de Areniscas
Perfs: 14,150' - 14,250'
(Petroleo & gas)
Hoyo de 8 3/8"
15,000'
Liner de 7" @ 15,000'
Fm. Caratas
Eoceno
PT 15,000'


5
CUENCA DE ORIENTE (PUNTA PESCADOR)
POZO DE 18,000' HASTA FM. CARAPITA
YACIMIENTO MBR. PEDERNALES
Conductor de 30"
@ 100'
Fm. Mesa
Pleistoceno
Hoyo de 17 1/2"'
4500'
Csg de 13 3/8" @4500'
Fm. Las Piedras
Plioceno
Hoyo de 12 1/4"
14,000'
Packer @ 14,200'
Fm. La Pica
Mioceno Superior
Tubing de 3 1/2" @ 14,225'
Colgador @ 14,300'
Mbr. Cotorra
Csg de 9 5/8" @ 14,500'
16,500'
Mbr. Pedernales
Yacimiento
de Areniscas
Perfs: 16,550' - 16,600'
(Petroleo & gas)
Mbr. Amaruco
Hoyo de 8 3/8"
17,500'
Fm. Carapita
Mioceno medio
Liner de 7" @ 18,000'
PT 18,000'


6
CUENCA DE ORIENTE
POZO DE 18,000' HASTA MERECURE
YACIMIENTO FM. OFICINA
AREA DELTA CENTRO
Conductor de 30"
@ 100'
Fm. Mesa
Pleistoceno
Hoyo de 26"
Conductor de 20" @ 3000'
5000'
Fm. Las Piedras
Plioceno
Hoyo de 17 1/2"
10,000'
Csg de 13 3/8" @ 10,200'
Fm. Freites
Hoyo de 12 1/4"
Mioceno Superior
Csg de 9 5/8" csg @ 13,000'
Hoyo de 8 3/4"
14,000'
Colgador @ 14,500'
Fm. Oficina
Csg de 7" @ 15,000'
Mioceno
15,500
Packer @ 15,900'
Fm. Oficina
Yacimiento
Areniscas
Tubing de 3 1/2" tubing @ 15,925'
Perfs:16,000'- 16,100'
(Petroleo & Gas)
17,500'
Hoyo de 5 7/8"
Tope Fm. Merecure
Oligoceno
Liner de 4 1/2" @ 18,000'
PT18,000'