FIELD TRIP TO TOAS, SAN CARLOS AND ZAPARA ISLANDS

RUDOLF BLASER, Compañía Shell de Venezuela, and ARTHUR N. DUSENBURY, Jr., Creole Petroleum Corporation, Sociedad Geológica de Venezuela Occidental, Guidebook N° 2-3 de Abril de 1960.

Introduction

This guide book provides the plan and topical outline second field trip of the Sociedad Geológica de Venezuela Occidental. Toas Island is its principal destination and it is scheduled for Sunday, April 3, 1960. The most important sections and localities will be visited, although it should be realized that not everything of interest on this geologically complicated island can be seen in part of one day.

This book may serve in the future for individual or group excursions to Toas Island. If launches are not available, such excursions can proceed by automobile from Maracaibo north to the town of San Rafael de Moján, whence a launch ferry service carries passengers to and from the town of El Toro there are several taxis which can be hired for Bs. 10 per hour.

For the scheduled trip of the Sociedad Geológica de Venezuela Occidental, members and guests will assemble at the Mene Grande Oil Company's dock in Maracaibo at 7:00 A.M. on Sunday, April 3, 1960. Each participant should wear stout boots, as the limestone terrain is rugged and prickly pear cactus is quite common. It is also advisable to bring a hat along, since shade is very scarce on Toas Island. Geological hammers, pocket magnifying lenses, geological compasses and bottles containing hydrochloric acid should all prove to be of use.

Excursionists should bring their own lunches clearly labeled with their names. Beer and soft drinks will be provided through the courtesy of Schlumberger Surenco S.A. Launches and crews will be supplied by Creole Petroleum Corporation, Compañía Shell de Venezuela, Phillips Petroleum Company, Sun Oil Company and Superior Oil Company of Venezuela.

Access to the docks of the Mene Grande Oil Company, the Instituto Nacional de Canalizaciones and the Compañía Anónima Venezolana de Cementos was granted through the kindness of Mr. Robert Baldwin, Dr. Bernardo Rodríguez d'Empaire and Sr. Eduardo Pantín Herrera respectively.

Because of the complications of Toas Island geology and the varying details of its interpretation, the authors decided to insert three different maps on the island's areal geology in this guide book. The Compañía Shell de Venezuela has contributed a hitherto unpublished map prepared by J. D. de Jong in January, 1949. The Creole Petroleum Corporation has supplied a hitherto unpublished map based on field work in 1942 and 1943 by A. N. Dusenbury Jr. and J. Más Vall, and revised after additional field work by A. N. Dusenbury, Jr. in October, 1959. It was also decided to reproduce the map of Toas published by Emile Rod and H. Faist in 1950 by Rod and H. Faist. In addition to the maps, cross sections interpreting the structure of the island were obtained from the last two sources. We thank the companies, individuals and association concerned for permission to publish these maps and cross sections.

**CREOLE PETROLEUM CORPORATION TOAS ISLAND**

**SECTION A-A’**

**SECTION B-B’**

**LEGEND**

![Map of Toas Island](http://www.pdvsa.com/lexico/excur/exc-60.htm)

**FIG. 3 TOAS ISLAND**

**FIG. 3 FROM EMILE ROD’S "STRIKE SLIP FAULT TO OF NORTHERN VENEZUELA" (1950, SHELL, AMER. ASSOC. PETROL. GEOL., VOL. 46, P. 461, FIG. 3)
It will be noted that the stratigraphical nomenclature varies somewhat among the three maps referred to above. For the reader's convenience, a table comparing the three systems of nomenclature employed is here made available.

<table>
<thead>
<tr>
<th>Shell</th>
<th>Creole</th>
<th>Atlantic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eocene</td>
<td>Mostrencos</td>
<td>Mostrencos</td>
</tr>
<tr>
<td>Guasare</td>
<td>Guasare</td>
<td>Guasare</td>
</tr>
<tr>
<td>Colón</td>
<td>Colón</td>
<td>Mito Juan-Colón</td>
</tr>
<tr>
<td>Cogollo</td>
<td>Cogollo</td>
<td>Cogollo</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>Rio Negro</td>
<td>Rio Negro</td>
</tr>
<tr>
<td>La Quinta</td>
<td>Le Quinta</td>
<td>Mamoncito</td>
</tr>
</tbody>
</table>

We also thank Dr. Alirio Bellizzia, Secretary of the Third Venezuelan Geological Congress, for permission to reproduce three figures from John B. Miller's paper on tectonics in the Sierra de Perijá and adjacent areas of Venezuela and Colombia. Mr. E. A. Doe of Creole has provided assistance in describing the islands, channels and currents of the Lake Maracaibo bar. The Instituto Nacional de Caracas has kindly allowed us to reproduce three photographs taken during the dredging of the ship channel and the building of the breakwater. Don David Bellisso Rossell and Mr. Jesse J. Howard have supplied historical data concerning the pirate attacks on Maracaibo.

EXCURSION PROGRAM

7:00 A.M.

The launches will leave the Mene Grande Oil Company's dock at the Mene Grande de Camp on the shore of Lake Maracaibo just north of the Hotel del Lago.

Toas Island, some 6 km. long and 1½ km. wide, is situated in Tablazo Bay, the northern extension of Lake Maracaibo, about 35 kms. to the north of the city of Maracaibo. As soon as the launches leave the dock and get out into the ship channel, the island may be seen on a clear day in rugged profile against the northern horizon. It constitutes the only high land in the islands or along the shores of Tablazo Bay. The Spanish word Toas means tow ropes.

Politically, Toas Island forms part of the District of Mara. The largest village on the island is El Toro, situated along the shore of a small bay on the north coast. At the time of the 1950 census, its population was 688. The inhabitants of Toas Island are mostly fishermen and quarrymen. The economical importance of Toas lies in the fact that its Cretaceous limestone is the nearest source of easily exploitable raw material for the cement and construction industries of the State of Zulia. With the cement manufactured from the limestone of Toas the oil industry manufactures the concrete piles and caissons that support the derricks that drill the lake, and constructs the docks, offices, shops, schools, hospitals and homes for its workers. The housing and road construction industries of all of Zulia employ the limestone of Toas in the forms of cement and gravel. The great jetty which helps to keep the 37-foot dredged channel across the Lake Maracaibo bar from filling up with sand transported by the longshore currents was built with blocks of limestone from Toas. The new bridge over the narrows connecting Lake Maracaibo with Tablazo Bay will require 206,000 cubic meters of concrete made of limestone from Toas, and the causeway at its eastern end in constructed of blocks of the same material. This large and ever-increasing consumption of Toas Island limestone threatens the gradual destruction of the most imposing part of a geologically unique natural monument.

Large scale quarrying operations began only some twenty years ago, but already the topography of the southwestern part of the island has been greatly altered, as reference to the maps of ten or twenty years ago will readily demonstrate.

As the launches approach the south coast of Toas Island, most of the large quarries will become visible. They are situated in an eastwest trending belt of light gray brownish gray massive, thick-bedded limestone belonging to the Apón formation of the

It will be noted that the stratigraphical nomenclature varies somewhat among the three maps referred to above. For the reader's convenience, a table comparing the three systems of nomenclature employed is here made available.

<table>
<thead>
<tr>
<th>Shell</th>
<th>Creole</th>
<th>Atlantic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eocene</td>
<td>Mostrencos</td>
<td>Mostrencos</td>
</tr>
<tr>
<td>Guasare</td>
<td>Guasare</td>
<td>Guasare</td>
</tr>
<tr>
<td>Colón</td>
<td>Colón</td>
<td>Mito Juan-Colón</td>
</tr>
<tr>
<td>Cogollo</td>
<td>Cogollo</td>
<td>Cogollo</td>
</tr>
<tr>
<td>Rio Negro</td>
<td>Rio Negro</td>
<td>Rio Negro</td>
</tr>
<tr>
<td>La Quinta</td>
<td>Le Quinta</td>
<td>Mamoncito</td>
</tr>
</tbody>
</table>

We also thank Dr. Alirio Bellizzia, Secretary of the Third Venezuelan Geological Congress, for permission to reproduce three figures from John B. Miller's paper on tectonics in the Sierra de Perijá and adjacent areas of Venezuela and Colombia. Mr. E. A. Doe of Creole has provided assistance in describing the islands, channels and currents of the Lake Maracaibo bar. The Instituto Nacional de Caracas has kindly allowed us to reproduce three photographs taken during the dredging of the ship channel and the building of the breakwater. Don David Bellisso Rossell and Mr. Jesse J. Howard have supplied historical data concerning the pirate attacks on Maracaibo.

EXCURSION PROGRAM

7:00 A.M.

The launches will leave the Mene Grande Oil Company's dock at the Mene Grande de Camp on the shore of Lake Maracaibo just north of the Hotel del Lago.

Toas Island, some 6 km. long and 1½ km. wide, is situated in Tablazo Bay, the northern extension of Lake Maracaibo, about 35 kms. to the north of the city of Maracaibo. As soon as the launches leave the dock and get out into the ship channel, the island may be seen on a clear day in rugged profile against the northern horizon. It constitutes the only high land in the islands or along the shores of Tablazo Bay. The Spanish word Toas means tow ropes.

Politically, Toas Island forms part of the District of Mara. The largest village on the island is El Toro, situated along the shore of a small bay on the north coast. At the time of the 1950 census, its population was 688. The inhabitants of Toas Island are mostly fishermen and quarrymen. The economical importance of Toas lies in the fact that its Cretaceous limestone is the nearest source of easily exploitable raw material for the cement and construction industries of the State of Zulia. With the cement manufactured from the limestone of Toas the oil industry manufactures the concrete piles and caissons that support the derricks that drill the lake, and constructs the docks, offices, shops, schools, hospitals and homes for its workers. The housing and road construction industries of all of Zulia employ the limestone of Toas in the forms of cement and gravel. The great jetty which helps to keep the 37-foot dredged channel across the Lake Maracaibo bar from filling up with sand transported by the longshore currents was built with blocks of limestone from Toas. The new bridge over the narrows connecting Lake Maracaibo with Tablazo Bay will require 206,000 cubic meters of concrete made of limestone from Toas, and the causeway at its eastern end in constructed of blocks of the same material. This large and ever-increasing consumption of Toas Island limestone threatens the gradual destruction of the most imposing part of a geologically unique natural monument.

Large scale quarrying operations began only some twenty years ago, but already the topography of the southwestern part of the island has been greatly altered, as reference to the maps of ten or twenty years ago will readily demonstrate.

As the launches approach the south coast of Toas Island, most of the large quarries will become visible. They are situated in an eastwest trending belt of light gray brownish gray massive, thick-bedded limestone belonging to the Apón formation of the
Excursión a las Islas Toas, San Carlos y Zapara (Abril 1960) "http://www.pdvsa.com/lexico/excursio/exc-60.html"

Crescentia cujete

The calabash tree, is a near relative. Walk down the small path which leads in a northwesterly direction to the quarry where the Eocene shales are exploited as one of the raw materials for the manufacture of cement. The Eocene section consists here mainly of gray blue and greenish shales with thin bands of intercalated sandstones. The shales often contain concretions of iron oxides, some carbonaceous matter and fossils of selenite. Black shales are less abundant. The Eocene shales are in fault contact with limestones of the Copollo group. Looking eastward toward the opposite side of the quarry, one can see the fault surface on the Apón limestone. The striations on the fault surface are horizontal or subhorizontal and indicate the transcurrent character of this northwest-southeast trending fault. The northern limit of the Eocene sequence is not overturned, since the succession of microfloras is normal rather than reversed. Both Creole and Atlantic correlate this predominantly shale section with the upper Aptian of the Cogollo group. Identification of the following fossils indicates a Lower Cretaceous (upper Aptian) age and a shallow-water marine environment.

Crepolinius tama (Romer), Lower Aptian to middle Albian

Foraminifera:

Order: Uvigerinacea

Genus: Uvigerina appendiculata, O'Brien, Lower Cretaceous

Order: Foraminifera

Genus: Orbitolina texana, Lower Cretaceous

Order: Foraminifera

Genus: Gazinella cupulli, Lower Cretaceous

Order: Foraminifera

Genus: Parahoplites

Order: Foraminifera

Genus: Parahoplites

Order: Foraminifera

Genus: Quinqueloculina

Order: Foraminifera

Genus: Triloculina

Order: Foraminifera

Genus: Spiroloculina

Order: Foraminifera

Genus: Triloculina

Order: Foraminifera

Genus: Orbitolina texana, Lower Cretaceous

Most of the Aptian portion of the Copollo group appears to be missing at the fault contact with the Eocene, although Rul found a thin sliver of beds containing the microfauna of the Aptian uppermost sequence north of that contact at the southeast end of Cerro Caribe. The zone of Cheloniceras, Miscelania, and other ammonites of the uppermost Aptian to lowermost Albian, where the Eocene shales are observed at and east of Taparo. They formerly were the property of Juan E. Paris. The hills formed by the Apón limestone in the southwest part of the island are the highest in all of Toas. From west to east they are named Cerro Caribe (originally 110 m.), Cerro Guada (100 m.), Cerro Amazon (85 m.), Cerro Picacho (85 m.), Cerro Picacho (85 m.), Cerro El Hato (50 m.). On the top of Cerro Vigía, the highest point on Toas Island, stand the twin towers of the station that relays television programs from Caracas to Maracaibo.

8:30 A.M.

The launches will tie up to the dock of the Compañía Anónima Venezolana de Cementos at Taparo on the south coast of Toas Island and the party will go ashore. The taparo (Crescentia cujete) is a tree with yellow flowers and fleshy three inch long having hard brittle hulls used as containers.

9:00 A.M.

Return to dock and board the launches, which will run westward along the south shore of the island past the other three previously mentioned quarries, and, rounding Punta Arenas, the western termination of Toas Island, will head for the dock of the quarry operated by the Instituto Nacional de Canalelaciones and situated only three hundred meters west of the little fishing village of Caribi. Half way between Punta Arenas and the dock, on what was formerly the northeast slope of Cerro Caribe, is the locality from which the ammonites Cheloniceras and Parahoplites were obtained. This locality has not yet been destroyed by the encroachment of the quarries.

9:30 A.M.

The launches will tie up to the dock of the Instituto Nacional de Canalelaciones and the party will land. Lunche will be left aboard. As soon as the party goes ashore, the launches will continue their way around the north side of the island to the public dock at El Toro. The field trip party will walk the 300 meters to Caripi and another 300 meters beyond it along the
road to El Toro. Here the road swings to the left and a good outcrop of basement granite can be seen just off the road on the right.

This will provide the first opportunity to observe the vegetation of Toas Island, which is typical of the arid areas along the Caribbean coast of Venezuela. The many xerophytic plants consist almost entirely of the prickly pear cactus or tuna (Opuntia ficus-indica), the organ cactus or cardinal cactus (Echinocereus viridescens), and the chunch tree or Euphorbia clavata. A few common plants (Guaica suffruticosa) grow along the road to El Toro.

Along the Toas beaches the most abundant shell by far is that of the brickish-water pearlypeled Veneraes granatina, a species that was originally described from Lake Maracaibo and may perhaps be restricted to it. A few shells of the mangrove oyster Pronooda philippinarum (Guilding) and the green mussel Chama magnifica (Lamarck) are quite rare. Barnacles are frequently seen attached to rocks at the shore line.

9:45 A.M.  Stop 2

Stop at granite basement. The stratigraphically lowest and apparently the oldest formation on Toas Island is a massive, rather coarse-grained granite. When fresh, it looks pink because of the orthoclase, and it is dotted with dark crystals of biotite in the form of thick bundles of thin plates. On weathering, which it does rather readily, the granite changes in color from pink to gray and the biotite becomes a golden brown. The rock becomes soft and crumbly and is easily eroded. For this reason the granite core of the western half of Toas Island forms a topographically low flat valley between ridges of Apón limestone. In the smaller eastern part of the island, which is joined to the western part by Recent beach sands and lagoon deposits at and south of El Toro, the granite has been intruded by dikes of rhyolite, which are generally more resistant to erosion and form the cores of low hills, the highest of which, Cerro La Cruz, rises about 50 meters above the level of the lake. Half way between El Toro and Caroni is an area where basic rocks have intruded the granite and have in turn been intruded by rhyolite dikes. The contact between the granite basement and the overlying La Quinta formation is usually hidden by talus but is almost certainly an erosional one. No contact metamorphism and no changes of the granite in the La Quinta have ever been observed. Nodules, cobbles and even small boulders of a biotite granite similar in composition to that of the basement occur in conglomerate bed of the La Quinta on the north side of the island in the saddle between Cerro Blanco and Cerro Corral.

Return along the road to Cariral, where a fairly good section of the La Quinta formation can be studied in the gullies south of the village (see sketch). A mass of dark red to brownish red, weathered rocks lies at the base of the La Quinta section in the gully above the maenonyol torrent to the west of the gully. Thin sections of specimens collected from this locality indicate that at least part of this body consists of pyroclastic rocks. Tuffs of intermediate composition (probably dacitic to andesitic) have been determined by Shell petrographers. About 10 meters of whitish to greenish coarse arkosic sandstones interbedded with brownish red siltshales weathering to clays follow the pyroclastics after a short covered interval. A second short covered interval separates this 10-meter sequence that is quite similar except that the sandstones are pink and may include a few small pebbles. A bed dark violet red rock about 40 centimeters thick, probably tuff like similar mass below, caps the second sandstone and shale sequence. This bed is overlain by 8 meters of brownish red shale that is weathered to clay, interbedded with a few thin sandstones and is partly covered. Several feet of whitish to greenish siltstone and fine sandstone occur at the top of the formation. The La Quinta of Toas Island appears to be completely unfossiliferous and to consist probably of continental deposits. At its type locality in Tachira the La Quinta is considered to be Upper Triassic to Jurassic in age on the bases of stratigraphic position and fragmentary remains of a primitive species of the ganoid fish Lepidotus found in coprolites of some unknown predator. Lanschecki ranges from the Upper Triassic to the Lower Cretaceous and has been encountered in both fresh-water and marine sediments. The contact of the La Quinta with the overlying basal Cretaceous Río Negro formation is unconformable. Just to the west of El Toro, in the south shore of the Rio Negro bay, we may be seeing directly on the granite basement with the La Quinta missing. In fact, the only known La Quinta south of the granite is in the Cariral area. Here the base of the Rio Negro is probably marked by a stratum of coarse conglomeratic sandstones with gravels and pebbles reworked from the La Quinta red beds. This sandstone is exposed near the heads of the gullies. The rest of the formation is locally covered by soil and talus, but occasional blocks of a fairly clean, whitish to cream-colored arkosic sandstone are scattered about amid the more numerous and conspicuous blocks and boulders of the more resistant Apón limestone. Cross-bedding is not uncommon in the Rio Negro. The formation is unfossiliferous on Toas Island, as it is in most of western Venezuela. It appears to cross time lines and to accompany the gradual transgression of the Cretaceous seas. It is believed that Toas Island was in a topographically high area at the beginning of the Cretaceous and that consequently the Rio Negro is here not only much thinner but also considerably younger than at its type locality in the Machiques trough. The basal Cretaceous Río Negro sediments are overlain conformably by the Apón limestones of the Cogollo group. At Cariral these limestones form the escarp at the top of the hill south of the houses. The lowest limestones are platy and interbedded with sandstones and a few dolomitic layers. Shallow-water marine pelecypods, including the genera Ostrea and Exogyra, are visible in cross sections but are difficult to identify; specific identification have not yet been made. This basal sequence is overlain by dense microcrystalline, gray to brownish gray, thick-bedded limestone with sometimes a few thin intercalations of gray shale or yellowish brown marl. nowhere on Toas Island have a complete section of the Apón been discovered. The maximum thickness of the portion preserved is about 75 meters in the southern ridge and much less than that in the northern ridge, because faults have cut so much of the normal section. The fossils previously listed indicate that at least part of the section is upper Aptian in age and correlative with the middle Apón of the western coast. However, between the locality where the diagnostic upper Apón ammonites were found and the conformable base of the formation there should be room for some lower Aptian beds. At Cariral and elsewhere along the north slope of the southern ridge the dips average about 25° and vary from south to southwest in the Mesoico sedimentary section. On the south slope the dips range from a maximum of about 45° at the west end of the island to a minimum of 20° near Manganillo. Most geologists now seem to agree that Toas Island should be regarded as an elongated upwound fault block or wedge which, at least superficially, was compressed to from an anticlinal structure. The section at Cariral in on south flank of the deeply eroded anticline. In addition to the east-west major faults that bound the Toas block to the north and south, there are many minor cross faults. On the southern limb of the anticline most of these cross faults trend northwest and southeast. In the subsidiary blocks thus formed, the dips may be south, south-southeast or southwest. In the block south of Cariral the dip is to the southeast.
10:30 A.M. Walk from Carrizal across the alluvial plain, which occupies the center of the valley eroded in the granite, to Cerro Blanco, a hill 50 meters high, which forms the west end of the northern ridge. Because of a reed-bordered marshy inlet it is impossible to follow the shore by the most direct route. Incidentally, the name Carrizal is a Spanish word meaning an area where reeds grow. A short detour inland must be made, following at first the road from Carrizal to El Toro for almost a kilometer. Then cross the dry wash and turn black westward to the coast at the southwestern slope of Cerro Blanco. As you near the coast, you will see outcrops of the La Quinta red beds on your right.

11:00 A.M. The southern and eastern slopes of Cerro Blanco display good outcrops of the La Quinta red beds. At the bottom of the southeast slope the dark red shales contain dikes of purple diabase basalt composed 50% of the feldspar labradorite, 35% of the pyroxene augite and 15% of magnetite, according to a petrographic study for Creole by José Más Vall. The term diabase basalt is used for rocks that look like basalt to the naked eye but reveal diabasic texture in thin section under the petrographic microscope. These dikes are cut by small veins if granite pegmatite composed of moderately large grains of white quartz and pink orthoclase. Still later, joints were formed and the fissures were filled by calcite or by clay, principally the latter. Some diabase basalt dikes may be observed at the foot of the west slope of the hill behind the houses that occupy the narrow strip of shore. There the pegmatite veins are absent. On the west slope of Cerro Blanco, the Río Negro Cretaceous sandstone is found in contact with the intruded La Quinta red beds and with the Copolco limestone. Dips in the Copolco range from 25 to 55 degrees to the southeast and average about 45 degrees. It will be noted that Shell has mapped the Cretaceous at Cerro Blanco as a faulted normal sequence, while Creole has mapped the same beds as a faulted overturned sequence. Rod (1956, Bull. Amer. Assoc. Petrol. Geol., vol. 40, n° 3, p. 463, fig. 3) also has interpreted the section on Cerro Blanco as overturned but has located his faults quite differently. If the sequence on Cerro Blanco is normal, then the boundary between the Cretaceous and the La Quinta to the north is a fault contact, but, if the Cretaceous formations are overturned, the usual unconformable relationship between the La Quinta and overlying Río Negro should occur.

11:30 A.M. Proceed to the summit of Cerro Blanco for a view of an interesting panorama. To the west across the northeast angle of Tablazo Bay lie the houses of San Rafael del Moján, often called San Rafael or El Moján for short. This town of 3,587 people, according to the census of 1955, is the capital of the District of Mara. Moján is an Indian word meaning doctor or shaman and was probably the original name of the village before the Spaniards arrived. The Spaniards renamed it San Rafael and the two names have been combined according to custom in order to distinguish this particular San Rafael from others of the same name. As mentioned before, launchas, running about once an hour during the daytime, ferry passengers back and forth between San Rafael del Moján and El Toro, the principal village of Toas Island. Punta Reina is the headland 4 kilometers southeast of El Moján, and 4 kilometers northwest of El Moján. Punta Cabecita can be seen at the mouth of the Río Limón. The Limón is a large river formed by the confluence of the Río Socuy and the Río Guasare about two kilometers west of Carrasquero. It is the boundary between the District of Mara and the District of Páez throughout its length. From its mouth the boundary turns north up the Caño Paijana, which separates the island of San Carlos from the mainland. On the horizon behind El Moján, The Montes de Oca, which form the northern end of the Sierra de Perijá, are visible on a clear day. The Montes de Oca rise to an altitude of about 3,500 feet and continue the northeasterly trend of the somewhat higher Serrania de Valledupar, from which they are separated by a distinct saddle. They extend for a length of about 30 kms. to the northeast and then at a second saddle swing eastward for another 25 kms. The eastward swing, called the Fila de Majuyura, was explained by John B. Miller in a paper given last year before the Third Venezuelan Geological Congress (see his fig. 13) as an anticlinal horst within a fault zone, the main fault extending in an east-west direction and bounding the horst on the north. The similarity of this structure to the one at Toas Island seems apparent. Both the fault zone and the main fault are generally known as the Oca fault, misspelled "Oau" by the originator of the name,
Excursión a las Islas Toas, San Carlos y Zapara (Abril 1960) http://www.pdvsa.com/lexico/excursio/exc-60.html

of Toas Island the Ocoa fault loses its individuality and becomes a fault zone extending almost due east half way across the State of Zulia. However, on page 615 they state: "Eastward, the fault belt continues the "Oca" fault zone eastward along the coast, but only for a short distance to the Zulia-Falcón boundary, where it ends it abruptly and is again replaced farther east by the folded mountains of Falcón and is again replaced farther east by the fold system of the Caribbean Mountains".


Dufour (1957, Geol. Rundsch., vol. 46, n° 5, p. 494) called it "the Oca or Fäzes fault". In order to clarify the confusing terminology and render it more precise we propose that the junior synonym Fäzes fault zone and Fäzes fault, and the erroneous spelling Oca fault be suppressed, that the name Oca fault be restricted to the major fault which runs along the northern foot of the Montes de Oca near the Venezuelan-Colombian boundary and that this name be retained only as far as the direct continuation of this specific fault can be ascertained. Faults which run parallel or subparallel to this fault should be given different names. But, together with the Oca fault, they may be grouped under the term Oca fault zone. This latter term should be restricted to only those faults not more than ten kilometers apart from the Oca fault on either side.

From its type locality at the Montes de Oca fault zone extends eastward across the base of the Guajira Peninsula to the Caribbean coast of Colombia, along which it may continue westward, forming the northern boundary of the triangular Santa Marta massif. From the Montes de Oca the Oca fault zone extends east-southeast to the Rio Limón about seven kilometers north of Carrasquero, according to Rod's Figure 2, and continues in this direction through the Laguna de Sinamaica to the south of the Rio Limón. The river does not follow the fault zone but winds back and forth across it and then empties into Talajon Bay. The published literature shows differences in opinion on the course of the Oca fault between the Laguna de Sinamaica and the mouth of the Limón. Rod (1956, loc. cit., p. 495, fig. 2) has his "Oca fault" drawn as a fault zone about two kilometers wide with its north edge at the north bank of the mouth of the Limón and its south edge a kilometer south of the south bank. An air photograph of the area clearly indicates recent vertical movement along a fault running east-southeast across the Pleistocene Sinamaica beaches and disappearing in the mangrove swamps more than a kilometer north of the mouth of the Limón. It is in this fault which Miller (Fig. 14) termed the Oca fault, and he also showed a somewhat more dubious unnamed fault subparallel to the Oca fault about a kilometer to the south between the Oca fault and the north bank of the Limón.

The current consensus of informed opinion is that Miller has correctly picked the true Oca fault and that Smith's "Fäzes fault zone" (loc. cit.) consists of a single subparallel fault distinct from the Oca fault itself but part of the Oca fault zone. The Shell geologists have renamed this fault the north Moján fault. The question at once comes to mind is what relationship these mainland faults may have with those on Toas Island. It is interesting to note what happens when the traces of the mainland faults, as published in the literature, are prolonged eastward without deviation from their known courses. The true Oca fault prolongation would appropriately follow the southern shore of San Carlos Island and the north Moján fault prolongation would tie into the east-west faults on the north side of Toas Island. It thus appears quite probable that, although the Toas Island block undoubtedly forms part of the Oca fault zone, the main Oca fault may pass well to the north of it.

What becomes of the Oca fault zone east of Toas Island is a question that has elicited many diverse answers. J. L. Anderson (1945, Bull. Amer. Assoc. Petrol. Geol., vol. 29, n° 8, p. 1079, fig. 1) and Young, Bellizzi, R. Renz, F. Johnson, Ruble and Max Vall (1956, Bol. Geol., pub. Esp. 2, Ministerio de Minas e Hidrocarburos, Caracas, p. 21-28, figs. 6-12) agree in continuing the fault zone northeastward along the rather straight coast of Falcon. According to the latter publication, movement along the main Oca fault zone began in the Paleocene, continuing the fault zone northeastward along the rather straight coast of Falcón. According to the latter publication, movement along the main Oca fault zone began in the Paleocene, but movement along its continuation on the shore of Falco did not begin until the cretaceous at the end of the Eocene. No evidence is provided to substantiate these hypotheses. Sutton (1946, loc. cit., p. 1719, fig. 7) also continues the "Oca" fault zone eastward along the coast, but only for a short distance to the Zulia-Falcón boundary, where it ends abruptly for no stated reason. Miller, Edwards, Wolcott, Ancisardi, Martin and Anderson (1958, Habitats de Oil, Amer. Assoc. Petrol. Geol., Symposium, p. 615, 619) agree in continuing the eastward continuation of the Oca fault zone somewhat south of the coast line approximately in the vicinity of the village of Quirao and then Northwards, either abrupt or with a pair of question marks immediately east of Toas Island. On p. 492-493 he asserts: "East of Toas Island the Oca fault loses its individuality and is resolved in several en echelon faults, the eastward continuation of which is not clearly defined. Fault very likely crosses the folded mountains of Falco and is again replaced farther east by the strike-slip fault system of the Caribbean Mountains". Dufour (1957, loc. cit., p. 751, fig. 2; p. 771, fig. 4) indicates a southeastward offset of the Oca fault zone by a single cross fault, with his fig. 4 showing a greater distance of offset than his fig. 2. Although he makes no mention of it, the fault zone bounded by the El Mene de Mauroa fault on the south and the La Cumbre fault on the north falls within the range between his two figures, and he may have intended to propose the theory that the El Mene de Mauroa fault is the dextral continuation of the Oca faults. On the other hand, Alberding and Young (1958, Asoc. Venezolana Geol. Min. Pet., Bol. Inform., Caracas, vol. 1, n° 1, p. 13, fig. 17) postulate a N. 30° E. Dislocation which would offset the Oca fault an unspecified distance by means of two parallel cross faults and place its eastward continuation somewhere in the Gulf of Venezuela.

It seems obvious that there has been both vertical and longitudinal displacement along the Oca fault zone. The upheaval of the Toas Island block is evident. At the north end of the Montes de Oca it seems clear that the south side of the Oca fault is upthrown and the north side relatively downthrown. The eastward curve of the Tigre fault and of the en echelon zone in the eastern foothills of the Montes de Oca as they approach the Oca fault zone (Rod, 1956, fig. 2) can best be explained as drag resulting from right lateral displacement along the type of fault variously known as strike-slip, transcurrent or wrench. Dufour (1957, p. 755) suggests that this displacement may be of the order of 50 kilometers on the theory that the Central Cordillera, the Santa Marta block and the Guajira Peninsula originally formed a single elongate massif. However, even if this theory were correct, it is not necessary to assume that the entire displacement of 50 kilometers took place along the Oca fault zone. The authors believe that the Oca fault zone is a part of the Oca block only a few of the subparallel, potentially transcurrent, east-west faults in the region between the Guajira massif and the Maracaibo platform, and that the total theoretical lateral displacement should be shared among all or most of these many different faults. Miller has recently described the latest movement at true Oca

http://www.pdvsa.com/lexico/excursio/exc-60.htm
fault between the Laguna de Sinamaica and the mouth of the Río Limón in southeastern Distrito Páez. Here the fault runs east-southeast, cutting through Quaternary beach deposits termed the older, middle and younger Sinamaica beaches. Still younger beach deposits called the San Carlos beaches lie to the northeast along the shore of the Gulf of Venezuela. The trace of the fault can be clearly seen in an air photograph, crossing the older and middle Sinamaica beaches, but the younger Sinamaica beaches mostly disappear beneath the mangrove swamps on the north bank of the Limón, and the fault trace is thus almost entirely concealed. The north side has been downthrown at least one meter where the fault crosses the middle Sinamaica beaches, with the result that the beach ridges increase both in width and height immediately south of the fault. Where the fault crosses the older Sinamaica beaches, a large area of sand flats south of the fault contrasts with an area of mangrove swamp north of it. According to Miller, there is no lateral displacement visible, but it is in unlikely that a small lateral displacement would show up distinctly on the air photograph, which is on the scale of 1:140,000.

Looking from Cerro Blanco toward the northeast, one sees San Carlos Island across the waters of the northeastern part of Tablazo Bay. This island is separated from the mainland of the Sinamaica area by a narrow natural channel, the Caño Paijana, which, as previously mentioned, forms the boundary between Distrito Páez on the mainland and Distrito Mara on San Carlos. Because the Caño Paijana is so narrow, the island of San Carlos somewhat resembles a peninsula extending to the southeast and separating the waters of the west half of Tablazo Bay from those of the Gulf of Venezuela. There are no roads or bridges across the swamp-bordered Caño Paijana and all transport to and from San Carlos Island is by boat.

The Quaternary deposits which cover the flat terrane around the towns of El Moján and Sinamaica and on San Carlos Island consists mainly of a series of beach deposits. The older of these beaches have been called the Sinamaica beaches by Miller and are presumably Pleistocene in age. On aerial photographs a great number of parallel to subparallel, rather narrow, linear beach ridges can be observed in the vicinity of the town Sinamaica, all of them striking in an approximately northeast-southwest direction. The middle ridges are by far the most prominent, while the older island and younger seaward beaches are not so prominent and are separated by wide areas of sand flats. This has caused Miller to classify them as the older, middle and younger Sinamaica beaches. Some eight to ten kilometers southeast of Sinamaica these beach ridges are interrupted by the broad mangrove swamp that border both banks of the Río Limón near its mouth. Their seawardly continuation is encountered in the vicinity of El Moján, which is situated amid the younger Sinamaica beaches. The Sinamaica beach ridges are the tramps of former shore lines and were formed one after another by seaward accretion to the land area. They may have originated as barrier islands separated from the mainland to the southwest by lagoons, which were later almost completely filled up by the delta deposits of the Río Limón. The large quantities of sand which were deposited in all of these Quaternary beaches were transported by means of longshore currents flowing north-southward.

The younger Quaternary beach deposits, probably Holocene in age, are quite well developed on San Carlos Island and cover the northern two-thirds of it. For this reason they have been named the San Carlos beaches Miller. They continue in a slightly narrower belt along the mainland coast northwesterly past Sinamaica. Strangely enough, the younger San Carlos beaches are not as well preserved as the older Sinamaica beaches. On the east end of San Carlos Island these younger beach ridges have been truncated by marine erosion. Everywhere on the island they are in the process of destruction by wind erosion and of obliteration by linear sand dunes, which are oriented parallel to the direction of the prevailing northeast trade winds. The Sinamaica beach ridges, partly covered by vegetation and located farther back from the exposed coast, are very much less affected by the trade winds, most of the erosion being recent and confined to the younger Sinamaica beaches, where is the least vegetation cover. One possible explanation might be that the trade-wind climatic zone lay farther to the south during the Pleistocene glaciation and the deposition of the Sinamaica beach ridges, and that it did not move north to its present position until post-glacial time and the period of the deposition of the San Carlos beach ridges. The southern third of San Carlos Island consists of dense mangrove swamp, plainly seen from Cerro Blanco. The Castillo and Village of San Carlos lie together on the eastern tip of the island, hidden from the observer on Cerro Blanco by another much smaller mangrove-covered island variously known as the Isla del Diablo or the Isla de Pájaros. This smaller island is separated from San Carlos by a channel that is navigable to small boats, although quite narrow, and is called the Caño San Carlos.

Cerro Blanco may be recognized to the southeast and south lie the limestone hills of the south flank of Toas structure, toppled at their highest point by the television relay station. The steep scarp slope is in full view across the deeply weathered granite of the axial topographic depression. With the exception of the Cerro Pua, the rocks of the La Quinta formation are missing along the southern flank of the Toas Island structure, so that the Río Negro formation overlies unconformably the granitic core of the island.
Proceed down the eastern slope of Cerro Blanco to the topographical saddle between Cerro Blanco and Cerro Corozal, the next hill to the east in the northern range. According to Shell's interpretation, a thin zone of Río Negro formation occurs between Cerro Blanco and the saddle. On Creole's map the Cogollo group is in fault contact with La Quinta formation. At the slope between the saddle and the lake shore to the north of it, an interesting section of La Quinta formation some 25-30 meters thick can be studied. As this locality the La Quinta section is composed mainly of olive green and rusty red, weathered, coarse and gritty arkosic sandstones, brown red silty clays and several intercalations of thick conglomerate beds. The pebbles of the conglomerates sometimes exceed 10 centimeters in diameter and consist of granites, porphyritic and/or pyroclastic rocks, quartzes and, occasionally, limestones. According to O. Renz (oral information), fusulinids have been found in a few of the limestone pebbles. This information indicates that the pebbles were probably produced by the erosion of limestones in the Permian Palmarito formation, which is not exposed on Toas Island. The stratigraphic position of this succession within the La Quinta formation is uncertain, since it was not found at Carrizal and because the section may be in fault contact with the Cretaceous.
12:30 P.M. Go eastward on path which follows the shore line, between La Conserve and El Corozal; the cliffs to the south of the path consist of strongly broken limestones of the Cogollo group. In this area the northern flank of the Toas structure appears to be overturned and local imbrication adds to its structural complexity. Impregnations of residual oil are reported to occur at some places in fractured limestones.

Step 7 At El Corozal the slope of the hill is composed of dark grey shales at least 15 meters in thicknoss. These shales contain assemblages of upper Senonian small foraminifera and are, therefore, considered to correspond with parts of the Colón and La Paz shales of the Mara-Maracaibo area.

Step 8 Just before reaching the houses of Las Playitas, at the rocky point where the shoreline bends towards the northeast, there is a small outcrop of Guasare formation. This is the type locality of the Toas limestone, an obsolete junior synonym of the Guasare formation. From the shore to some ten meters higher up, alternating beds of impure, olive green, soft, glauconitic sandstones, of sandy shales and of thick-bedded, light brown and partly glauconitic Ostracina and Venericardia limestones occur. The Paleocene age of these rocks was mainly determined on the basis of the lamellibranch species Cardina rusti Woods and Venericardia (Venericardia) loeii Dusek-Dachs. The species Venericardia loeii was also found in the Berriasian Capitularis formation of Peru. The second is characteristic of the basal limestone development of the Guasare formation in other parts of western Venezuela where undisturbed sections are present, e.g., in the Río Cachiri and the Caño Frio in western Mara or in the Monay Basin near Casa del Zinc in northeastern Trujillo. The Paleocene age of this interval is corroborated by the finding of diagnostic small foraminifera in some of the thin weathered layers at the surface of the sandy limestones. See Sutton, 1946, p. 19659, for the complete faunal list.

A narrow belt of black carbonaceous shales, which locally contain thin sandstones and coal layers, extends along the coast from Las Playitas towards the east in fault contact with the Cogollo limestones to the south. In earlier days coal was exploited from these beds and used to fire the local lime kilns. The Paleocene age of these coal layers was recently established on pollen evidence. Lithologically, the section can be compared with part of the Maracina formation (an equivalent of the lower part of the Paoli Diablo formation) of the Río Guasare area.

1:00 P.M. Arrive at Las Playitas. Lunch will be eaten in the shade of the palm trees. Luncheos, beer and soft drinks will be brought from the launches at El Toro by taxi and distributed.

2:00 P.M. Proceed southeastward to the road which leads to El Toro, follow the road eastwards to El Toro to embark on launches.

2:30 P.M. The launches depart from El Toro, proceed directly northeast across Tablazo Bay to the Caño San Carlos and enter this narrow channel between the Isla de San Carlos on the left and the Isla de Pazos on the right. The barges carrying the limestone blocks from the quarries on the west end of Toas Island for the construction of the breakwater to protect the channel across the Lake Maracaibo bar were towed to their destination through the Caño San Carlos. After navigating the length of the Caño, the launches arrive at the village and fort of San Carlos.

3:00 P.M. The party will go ashore at the Castillo de San Carlos.

Step 9 Permission to do this and the services of a guide were obtained through the courtesy of the Instituto Nacional de Canalizaciones. The village of San Carlos is inhabited principally by fishermen and had a population of 667 in 1950. The Castillo next to it was originally built to protect the entrance to Lake Maracaibo against pirate rafts but has been used as a prison since colonial days. It was particularly infamous for the detention and torture of political prisoners under the dictatorship of Juan Vicente Gómez from 1908 to 1935. Eustóquio Gómez, the dictator’s brother by adoption and a convicted murderer, was released from prison, when Juan Vicente Gómez seized power, and was placed in charge of the Castillo de San Carlos during 1909 and early 1910. In May, 1910, there was an uprising of the prison guards and employees against Eustóquio’s greed and mismanagement. Warned in time, Eustóquio escaped in a fisherman’s boat. Juan Vicente was quite amused by Eustóquio’s greed and mismanagement. The party will visit the prison and walk through the house and guardrooms. The Castillo is now a hotel.

Across the entrance to Lake Maracaibo lies a string of shoals and barriers islands which, together with the shallow depths of Tablazo Bay, is known generally as “The Maracaibo Bar”. The name “outer Bar” has traditionally been applied to the section of shifting sand banks immediately north of the Isla de San Carlos which was crossed by the original ship channel, known as the Canal Zaparita.
coast of Falcon by longshore currents. Clays and clits occur in significant proportions in the sediments of Tablazo Bay and also further offshore in the Gulf, but apparently have been selectively removed from the material accumulated in the Outer Bar by the action of waves and currents. San Carlos and Zapara Islands are characterized by spectacular sand dunes caging in height up to 100 feet. Mangroves cover the low-lying shoreline along the south side of San Zapara, most of Pájaros, the east end of Zapara, Barbosa, and Punta Oribono. San Bernando is an artificial island formed from the material dredged from the new navigation channel.

Zapara Island provides an interesting example of the migration of sand under the influence of prevailing winds. In the east central portion of the island there are two rows of cuspatate dunes, technically known as barchans, that are oriented parallel to each other and normal to the mean direction of the wind. With the northeast trade wind is blowing, continual tiny sand slides can be seen on the leeward slopes. These start as a few grains, break away from the dune and "flow" in a steadily widening stream of sand to the bottom of the dune. The dunes on the windward and upper surfaces present an endless variety of patterns apparently associated with the texture of the sand, its moisture content, and the local configuration of the dune. Between the two rows is a depression about 100-150 meters wide, which is lined with ridges running parallel to the rows of dunes.

These ridges are of the order of a foot high and 15 feet apart, and seem to have formed in the following way (hypothesis of J. H. Germeraad). During the rainy season this low-lying area holds rain water, which allows vegetation, mostly grasses, to become rooted along the bottom edges of the dunes. The windward edge of each dune then retains as a vegetation-anchored ridge when the rest of the sand migrates onward during the ensuing dry season. Thus the distance between the ridges provides a convenient measure of the distance which the dune has migrated during any of the years represented, carrying this hypothesis a step further, one may infer the occurrence of a cycle of dune formation from the existence of the two rows and associated low areas. Starting from near the south shore of the island and walking northeast, one encounters in succession the first row of dunes, the first set of ridges, the second row of dunes, the second set of ridges, an finally, just above the beach of the Gulf shore, a row of very small dunes apparently in the earliest stage of formation.

The recession of the Gulf shore and cyclic extension of the Outer Bar area, in this and the following paragraphs, is based primarily on the comparison of older maps, sailing directions, and oral and written descriptions, it is possible to trace the general trends which are characteristic of the Outer Bar area. These trends might be classified under two general headings; recession of the Gulf shore and cyclic extension of the Outer Bar.

"1. The recession of the Gulf shore is first illustrated by the comparison of older maps. The survey of 1794 indicates a fort on the eastern end of Isla de Zapara, whereas the 1864 survey shows this fort as rock reef or shoal (Roca de Barbosa) some distance from shore. Recent-may maps show this Roca de Barbosa. The reduction in size of the Roca de Barbosa from earlier maps also is to be noted. Hence regardless of the doubtful cartography of the earlier maps, it is evident that Isla de Zapara receded 1.6 miles during the period 1794 to date. Recent maps corroborate the fact that erosion is taking place. The Roca de Barbosa was surveyed in 1935 and again in 1937, and the recession of the northern shore of this island was clearly shown by a comparison of the two maps. Another fact which bears out this point is the recession of the northern shore of Isla de Zapara from 1925 to date.

"2. The second outstanding trends is the cyclic extension of the Outer Bar. This has its counterparts in the cyclic position and controlling depth of the Bar Channel, in the development of the incipient Eastern Channel, and in the movement of the bed material along the Outer Bar is unquestionably not only the prevailing orientation of the Outer Bar is in a like direction, but present a measure of its rate of extension. As the Outer Bar is moved further to the westward, and the depth in the Bar Channel are decreased. As the Bar Channel moves westward, the slope at ebh tide through this channel becomes less. This decrease in slope results in a corresponding decrease in the velocity of flow, and channel shoaling ensues. As the main portion of the flood flow into the lake crosses the Bar between Isla de Zapara and the Eastern Channel, the changes at the outer end of the Outer Bar do not affect this flow, and hence the tidal prism, the ebh flow is not particularly affected. With a relatively constant tidal prism, the ebh flow is relatively constant; and, therefore, as the Bar Channel becomes less efficient, due to its decreased slope and crosssection, more of the ebh flow is diverted across the Bar to the eastward, thus developing any potential channel in that area. A point is finally reached where sufficient ebh flow is passing over the Bar to cause a break out of a new channel, and the beginning of a new cycle. The former outer end of the Outer Bar is then relieved of the greater part of the pressure of the ebh flow on its southwest side, and, under the action of pressure of the wave, is moved shoreward and finally becomes a part of this shore.
These channels were tortuous, constantly shifting, and had limiting depths of the order of 12 feet. The consequent problems for navigation led first to the improvement and maintenance of the natural channel, which was dredged in stages to 22 feet, and finally to the dredging and maintenance of the new channel, which is one of the world's great canal projects. Responsibility for this work rests with the Instituto Nacional de Canalizaciones.

The breakwater (malecón) which protects the landward end of the outer channel can be seen extending north from the west end of Zapara Island. It is 3.1 kilometers long, and contains 1,190,000 metric tons of rock which was obtained from the Cogollo limestone quarries at the west end of Toas Island. The outer channel extends 16 kilometers north from San Carlos. It is 305 meters wide and has been dredged to a depth of 37 feet. The inner channel extends 22 1/2 kilometers to the north, to reach the 43-foot contour line in the Gulf. It will also call for dredging to the same depth between Icotea Point (Cabimas) and Punta de Palmas del Sur.

Since the opening of the new channel in 1955, considerable effort has been required to maintain the depth. In the outer channel this due presumably to the transport of sediments by transverse currents associated with the tides and the net longshore current. The breakwater affords partial protection in the region of maximum wave action where the problem would be expected to be more serious. In Tablazo bay the tidal currents tend to follow a curved path fairly well delineated by the old channel, which was presumably formed and maintained by the scouring action of the currents. A considerable amount of the water now follows the broad, deep, straight new channel, but nevertheless enough still follows the old route to cause considerable deposition of sediment where its path crosses or converges with the channel.

The guns of the Castillo de San Carlos have dominated for centuries the shifting natural channel which used to be the sole navigable entrance to Lake Maracaibo, before the present fort was erected in the latter part of the seventeenth century. Maracaibo was attacked no less than six times by the buccaneers. The Dutch freebooters, called by the Spaniards ‘bucaneros’, captured both Maracaibo and Gibraltar, now little important at the south end of the lake but then a rich and thriving town from the export of sugar and cacao.

By that time a fort sixteen cannon had been constructed in order to defend the entrance through the bar. When the pirates landed to assault the fort, its commander sent a platoon to ambush...
then, but the ambush was discovered and the platton was completely wiped out. The pirates advanced to the Castillo and fought a three-hour battle without quarter, finally gaining possession, seizing everything of value including the cannon, and demolishing the walls to ensure their subsequent safe retreat. After two months of slaughter, torture, destruction and looting at Maracaibo and Gibraltar, they again crossed the bar on their way back to Tortuga.

Two renegado Spaniards accompanied l’Ollonais on this raid, Pedro el Picardo and Miguel El Vascongado. The next year, 1667, Miguel El Vascongado returned to take Maracaibo for the fourth time with a mere 40 men in three small boats. He knew that the soldiers killed, the weapons removed and the fort destroyed by the previous expedition had not yet been replaced by the slow-moving Spanish authorities and that he could easily compel the city of Maracaibo to pay a ransom without opposition. A small ransom was collected from the wealthier citizens and the pirates departed. Meanwhile, Pedro el Picardo, the other Spaniard who had been with l’Ollonais, and who not only knew the environs of Maracaibo but spoke good English as well, had contacted the notorious English buccaneer, Sir Henry Morgan, in Jamaica. Morgan had wanted to take Cartagena, the biggest prize on the Spanish Main, but this project was soon discarded as Cartagena was too heavily fortified. Perhaps Pedro el Picardo had a great influence in persuading Morgan to set sail for Maracaibo instead. They both realized that Maracaibo and Gibraltar would be easy to take due to the destruction by l’Ollonais a few years before. So, early in 1669, they set sail from Jamaica, landing for a short while on the island of Aruba, where they took on fresh water and good meat, which they obtained from friendly Indians. Two days later they came upon the reconstructed Castillo at the entrance of Lake Maracaibo and cannonaded it all day.

When the night fell, Morgan discovered that the Spanish troops had evacuated the fort, leaving behind a lighted fuse to blow it up. The pirates extinguished the fuse, carried-off the artillery, but foolishly neglected to destroy the walls. They then captured Maracaibo, seized about a hundred of the richest inhabitants, robbed, tortured and killed for three weeks, and then repeated the horrid routine at Gibraltar, the principal port at the south of the lake. Finally, ransoms were obtained from 150 prisoners and from the two captured cities, but, on preparing to depart for Jamaica, Morgan learned that the Spanish admiral, Don Alonso del Campo y Espinoza, had blocked the entrance with a fleet of three large vessels of 36, 30 and 24 guns each, superior to any of Morgan’s boats, and had occupied the Castillo. Caught in a trap, Morgan buried part of his loot, prepared a fire ship by equipping a merchant ship, captured at Gibraltar, with a dummy crew and guns and with the necessary combustibles, and, on April 30, 1669, sailed out in a desperate effort to break the blockade. The fire ship, grappled with the admiral’s flagship, was put to the torch and abandoned by its crew. The rue was eminently successful and the 36-gun “Magdalen” was destroyed when the flames reached its powder magazine. The second Spanish ship fled, ran aground near the Castillo, and was burned and scuttled by its own crew, which then sought refuge in the fort. The third Spanish ship fought stoutly but was badly outnumbered and had to surrender. Don Alonso had escaped to the Castillo and there bravely beat off the assault of the pirates, who lost 60 men. Morgan retired and after nightfall succeeded in getting past the Castillo, whereupon he set sail for Jamaica with the remainder of his loot, amounting to 250,000 pieces of eight.

In 1678, the French pirate, Francis de Grammont, headed the sixth and final raid of the buccaneers against Maracaibo, which had by the time recovered from the devastation wrought Morgan. The expedition began as an attack by the French from Haiti on the Dutch island of Curacao. The 18 French vessels under the command of the Comte d’Estrees through an error of the pilots ran aground on the reefs of Los Aves with the loss of 300 of the men and the destruction of many of the boats. Grammont collected the survivors of the shipwrecks, carressed and repaired nine of the vessels, and set out with 700 men to re-supply the fleet at the expense of the towns of the lake Maracaibo area. He anchored off San Carlos Island, landed most of his men and besieged the Castillo. The outnumbered garrison of only 70 men fought for two days but finally had to surrender and was allowed to depart unharmed. The artillery and small arms of the garrison were taken aboard, and a number of buccaneers stayed behind to hold the fort. Grammont and the rest of the pirates seized Maracaibo, Gibraltar and Trinidad one after another, terrorizing the inhabitants fleeing before the pillagers and carrying their valuables with them. The pirates obtained so little that they left the lake and attacked Haurcans, La Guaira and Puerto Caballos.

The nomenclature of the islands and forts at the Maracaibo Lake has changed with time. In the preceding account, in order to avoid confusion, the present nomenclature has been employed. However, at the time of the pirate raids the present Isla de San Carlos was called the Isla de las Palomas and the Isla de Sapa was known as the Isla de las Virginias. The fort of the site of the present Castillo de San Carlos was termed El Castillo de la Barra. A high done of Zapara was occupied by a watchhouse, hence the origin of the name Isla de las Virginias. The fort of the site of the present Castillo de San Carlos was named El Castillo de la Barra. A high done of Zapara was occupied by a watchhouse, hence the origin of the name Isla de las Virginias.

In the later part of the reign of Carlos II, after the last of the successful pirate raids, the royal command was given to strengthen the defenses of the lake Maracaibo Bar. A much later fort was erected on the site of the former Castillo de la Barra and was named Castillo de San Carlos after the patron saint of the reigning monarch. At the same time the name of the island was changed from Isla de las Palomas to Isla de San Carlos. Two more forts were constructed on the Isla de Zapara on the east end to guard the shallow channel between the Islands of Zapara and Barbosa. While the Castillo de San Carlos has been occupied almost continuously and kept in repair, the Castillo de Santa Rosa and the Castillo de Zapara were cut off from the Isla de Sapa by marine erosion, which has forced the abandonment of the forts and has leveled them to their foundations. This is the origin of the name Zapara, a Spanish word meaning an underlining of sapping process, and in the present case evidently referring to the marine erosion so characteristic of this island. At low tide the ruins of the Castillo de Santa Rosa may be observed about 100 yards off the west end of Zapara and those of the Castillo de Zapara on a shoal about 1.6 miles north of the Isla de Barbosa. The ruins of a more recent fort occur in the center of the Island of Zapara near the lighthouse.

3:30 P.M. The excursion group will board the launches, which will leave the Castillo and enter the ship channel. They will then turn north along the channel for a short distance in order to view the artificial island of San Bernando on the left and the breakwater, projecting from the west end of the island of Zapara, on the right. With luck the party may see in action one of more of the three dredges which the Venezuelan government keeps in constant operation to maintain the prescribed depth and width of the channel. The launches will then make a 180° turn and reverse their course so as to follow the ship channel south all the way back to Maracaibo.

5:15 P.M. End of trip on arrival back at the dock of the Mene Grande Oil Company in Maracaibo.

* The outcrops along the north coast to the ast of Las Playitas which are indicated as Eocene on Shell’s map are now, in agreement with Creole’s and Atlantic’s interpretation, considered to be of Paleocene age.