Mariantes Castro

PDVSA / BP WORKSHOP 1992

BARINAS - APURE

FIELD TRIP GUIDE

27th August, 1992

REPUBLICA DE VENEZUELA
MINISTERIO DE ENERGIA Y MINAS
DIRECCION DE GEOLOGIA
DIVISION REGION LOS ANDES
SERVIGEOMIN

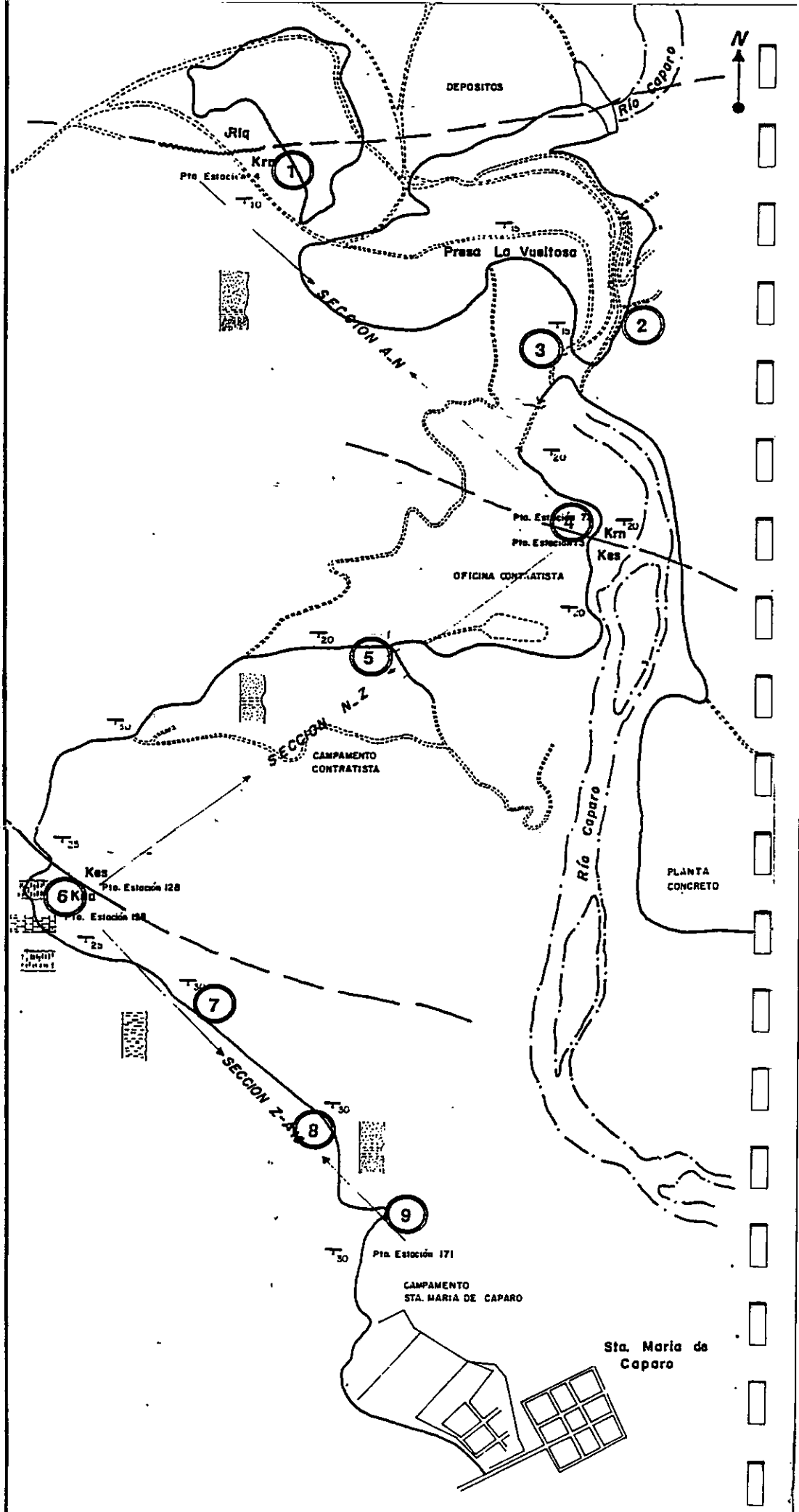
PLANTA DE LAS SECCIONES DE "BORDE SECO" (Río Camburito) y " LA VUELTOSA" (Río Caparo)

SIMBOLOS GEOLOGICOS

- FALLAS
- CONTACTOS
- DISCORDANCIAS
- RUMBO Y BUZAMIENTO DE LA ESTRATIFICACION
- Pto. Estación 208 — PUNTO DE ESTACION DE LA SECCION GEOLOGICA.
- A – J — SECCIONES LEVANTADAS

SIMBOLOS TOPOGRAFICOS

- RIOS
- QUEBRADAS
- CARRETERAS ASFALTADAS
- CARRETERA SIN ASFALTAR
- POBLACIONES



Caparo Dam
Geological Basemap

PDVSA / BP WORKSHOP 1992: Barinas - Apure

Field Trip Guide

1. Objectives of Field Trip

* Compare Sequence Stratigraphic Model to lithostratigraphy
* Identify systems tracts and sequence boundaries in outcrop, compare with electric well logs
* Seismic tie to outcrop location
* Examine play concepts using outcrop data

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2. Itinerary / Format

The purpose of this field trip is to examine the sequence stratigraphy and systems tract development in the Cretaceous (Caparo Dam area), and if time permits to look briefly at the early Tertiary foreland stratigraphy in the Barinas mountain front area, Santa Domingo road section.

The field party will leave the Hotel Bristol by bus at 6.00am and is expected to return to hotel by 6.00pm.

We will visit 8 field localities at the Caparo Dam section and one locality on the long drive back to Barinas.

For each locality this guide gives a brief introductory paragraph, describing the geological setting and specific objectives of the field stop.

After reading this introduction and studying the outcrop a series of key questions are then proposed. We will try to answer these questions by group discussion at the outcrop. Course leaders will bring examples of seismic, well and published reference material to facilitate these discussions.

Attachments

- Caparo Dam basemap
- Well Log : Burgua-3
- Tectonosequence Chart
- Harland Time scale

3. Field Trip Details

STOP 1: Rio Negro Formation - SB132 and MFS 118

This stop has three objectives: -

1: To establish the general field location at the base of the Cretaceous section within the Rio Negro Formation

2: To examine the Rio Negro sandstone facies overlying the SB132 boundary

3: To examine the MFS - 118 marine transgressive systems tract

At this stop the published logged field section by Useche and Odreman, 1986, should be annotated with sequence boundary (SB) and Maximum Flooding Surface (MFS) picks. The field section should also be sub-divided and annotated by systems tracts and vertical facies trends (prograding, retrograding and aggrading).

Key Questions:

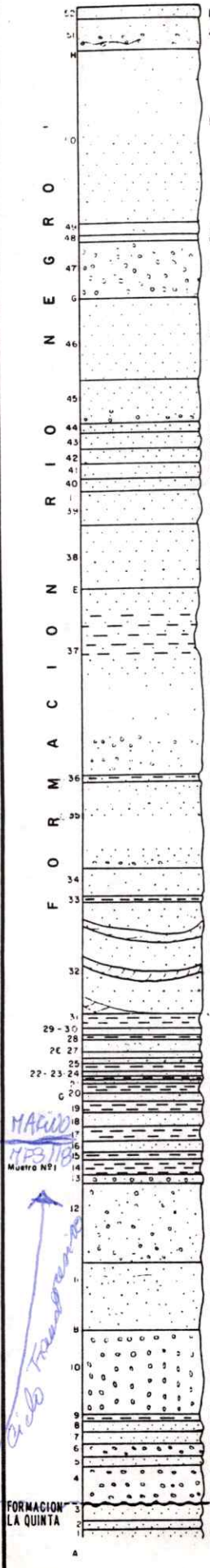
*** What do the coarse conglomerates and vari-coloured mudstones indicate about the nature of the Rio Negro / La Quinta contact?**

*** What is the depositional environment of the basal conglomerates and sands?**

*** What is the depositional environment of the overlying shaly zone?**

*** What could be the significance of the dark mudstone band in the overlying cliff section?**

OUTCROP SECTION



STOP 1

From: Useche and Odreman, 1986

STOP 2: Facies sub-division within the Rio Negro Formation

At this stop we will examine the criteria for sub-dividing the overall sand-dominated Rio Negro Formation into sequence stratigraphic packages.

Starting at the sharp erosional base of the thick sandstone package draw a simple sketch below showing the observed vertical changes in stratification types, palaeo-current directions and facies as you walk up section.

Key Questions:

- **What depositional environments / system tracts are observed?**
- **What correlation, if any, is possible to the dark mudstones seen on the opposite cliff section?**
- **What additional data could improve outcrop correlation in this systems tract?**

La máxima incursión del mar la representa la última glauconita (MFS)
Se observó materia orgánica
Se observaron capas intensamente bioturbadas

STOP 3: Origin of mottled horizon

This stop allows a quick examination of a "mottled" horizon. We will discuss its possible origins and implications, if any, for the geological setting of the Rio Negro Formation.

Draw a simple sketch of the observed section below, and make notes on the mottled horizon

STOP 4: Base Escandolosa (sequence boundary + MFS tie)

At this stop we will examine the abrupt influx of glauconitic sandstones, which on the published field section is taken to define the base of the Escandolosa Formation.

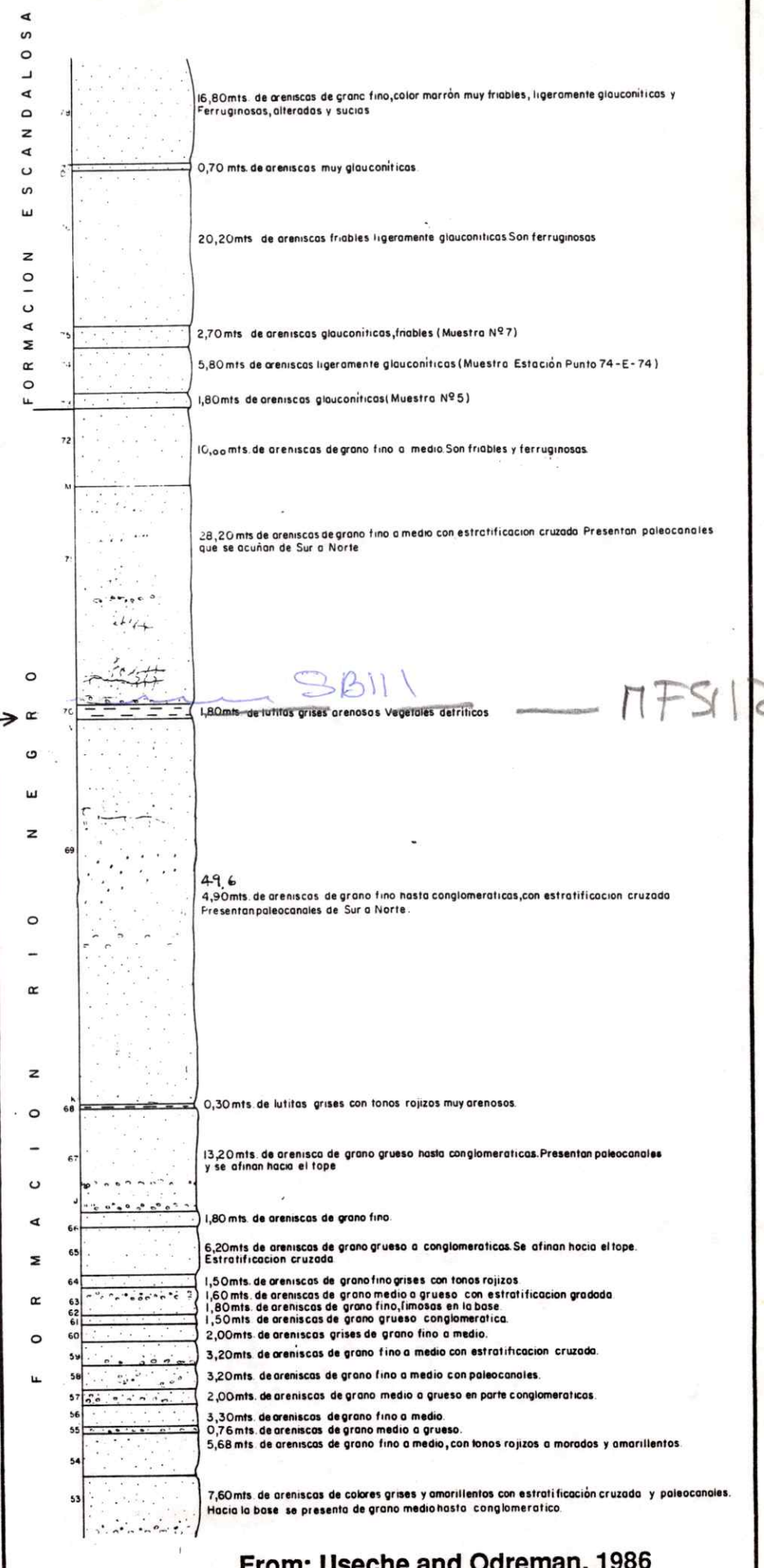
We will examine what system tracts are visible across this boundary and suggest what sequence stratigraphic surfaces are seen.

Draw a simplified sketch of the contact below and annotate the published field section opposite with the sequence stratigraphic surfaces observed.

Key Questions:

- **How many significant surfaces are observed?**
- **What is the possible tie to the sequence stratigraphic model?**
- **What formation in the Maracaibo Basin could be equivalent to the glauconitic sandstones, seen here?**

OUTCROP SECTION



From: Useche and Odreman, 1986

STOP 5: Sequence Boundary Recognition

At this stop we will examine local truncation and onlap surfaces associated with a major influx of sandstones.

Draw a simple sketch below of the vertical facies changes and depositional geometries seen in the two roadside exposures.

On the published field section opposite, show the vertical arrangement of systems tracts and pick a candidate sequence boundary.

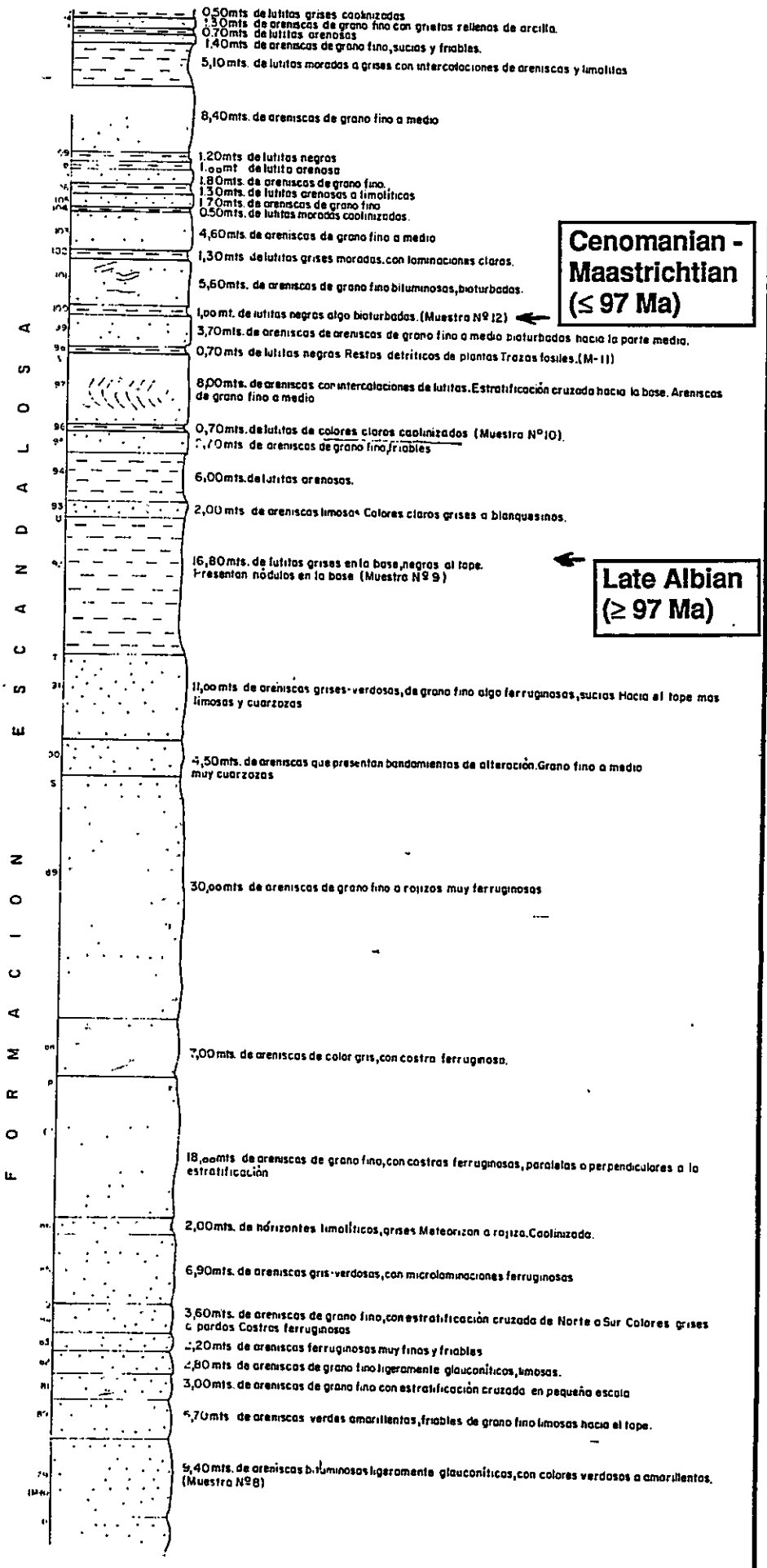
Key Questions:

- **What is the overall vertical facies change from Stop 4 upwards across this interval?**
- **What causes the local truncation / onlap events seen?**
- **From the biostratigraphic data, what horizon does this level represent in the sequence stratigraphic model?**
- **How does this horizon tie to the Burgua-3 well?**

OUTCROP SECTION

STOP 5

LV-4



From: Useche and Odreman, 1986

STOP 6: Fossiliferous Limestones

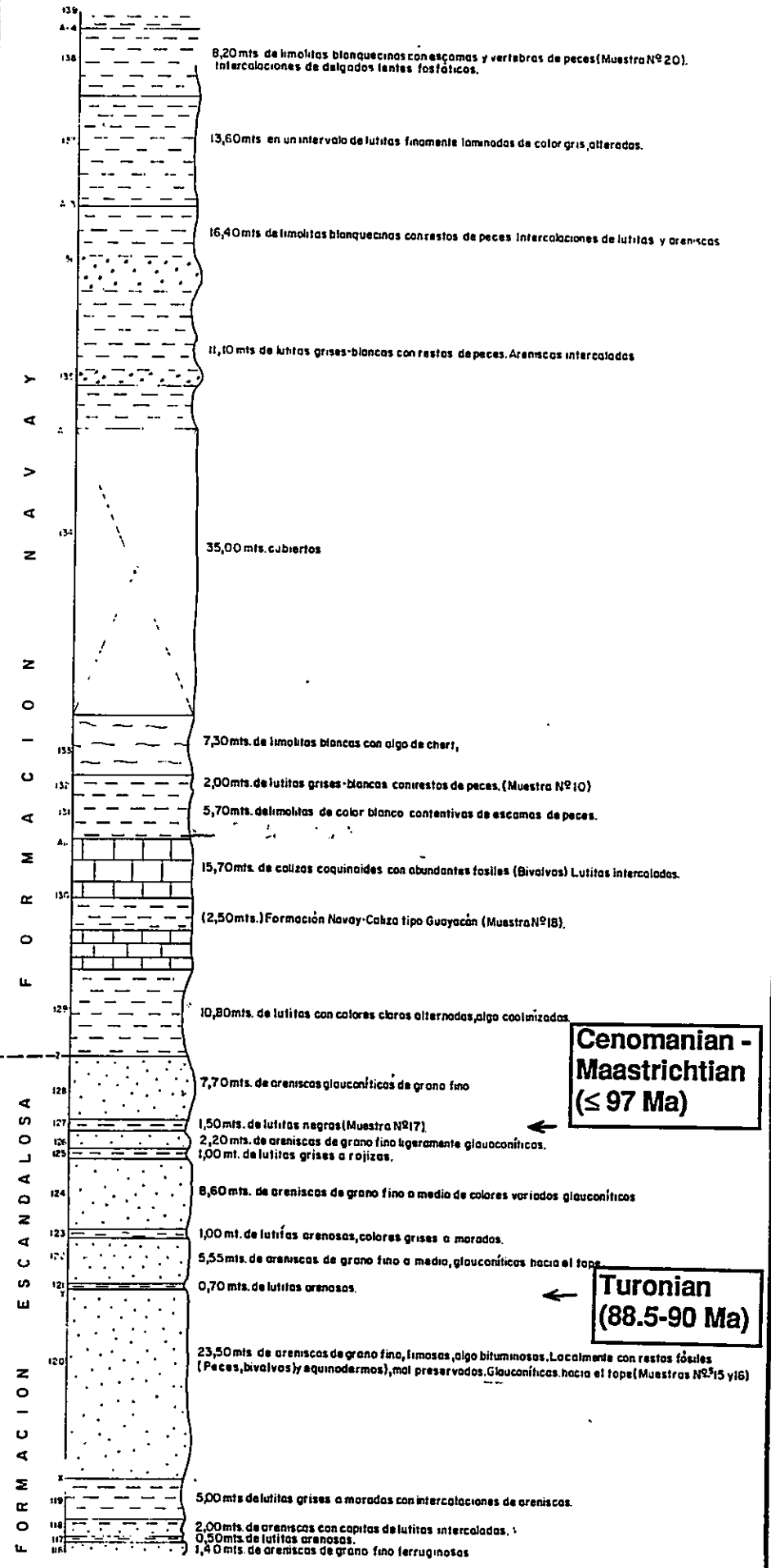
This quick stop will allow us to examine the fossiliferous limestones which in the field section lie within the lower Navey Formation. In well Burgua-3 the limestones are placed within the uppermost Escandolosa Formation.

Compare the published section and the Burgua-3 well logs. Identify the likely systems tract for these limestones.

Key Questions:

- **What probably happens to the palaeo-bathymetry across these limestones?**
- **By well-to-outcrop correlation, what facies may lie within the zone of no exposure shown on the published section?**

OUTCROP SECTION



STOP 6

From: Useche and Odreman, 1986

STOP 7: Chert Horizons

During this brief stop we will look for chert horizons within the Navey Formation and try to establish the regional tie of the cherty interval from the outcrop to well Burgua-3 and regionally along the Renz cross-section into the Maracaibo Basin. A copy of Renz's cross-section is shown opposite.

Key Questions:

- **What formation does this interval represent in the Maracaibo Basin?**
- **What is the tie to the sequence stratigraphic model?**
- **In tectonosequence terms, what significant horizon is represented?**

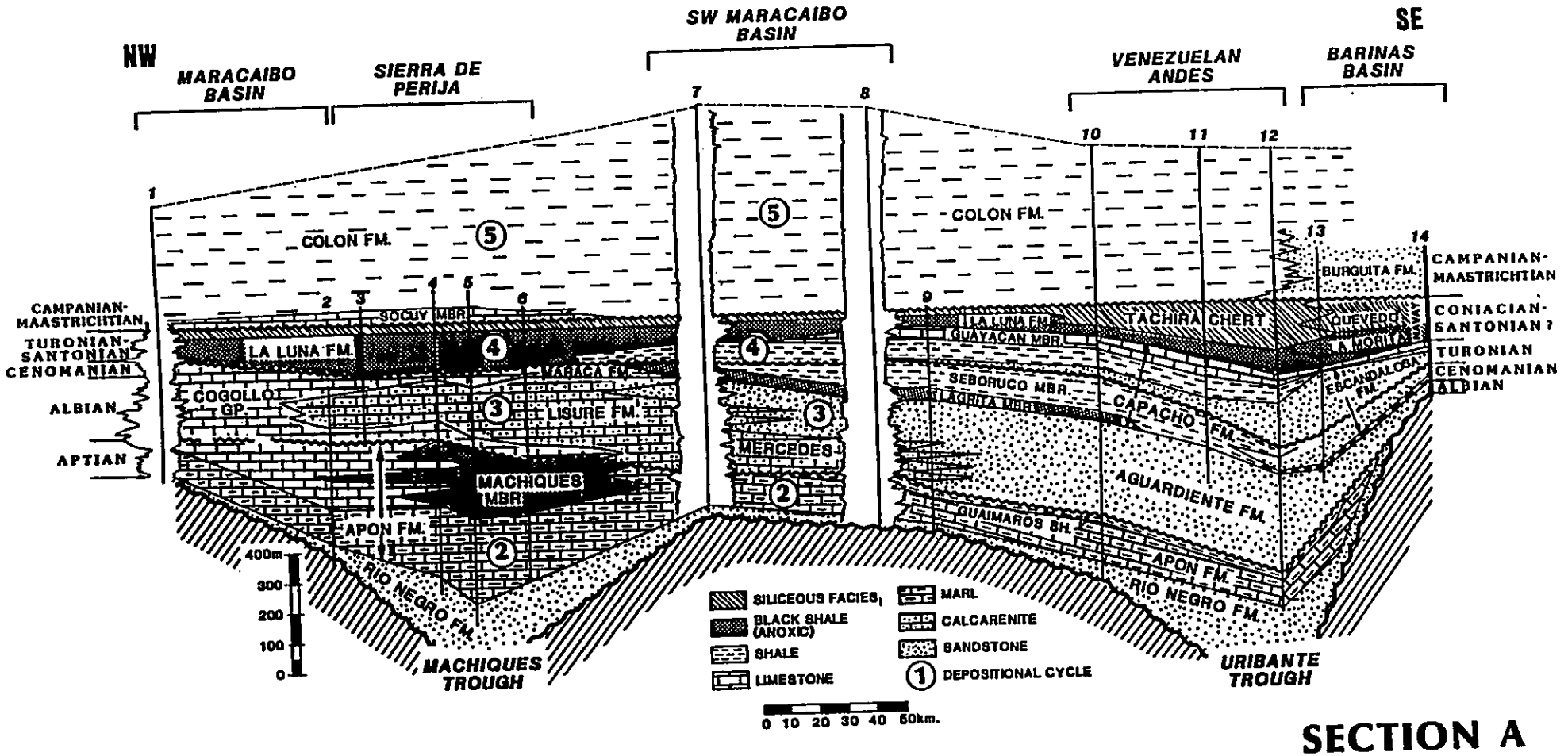


Fig. 12. Stratigraphic section A, modified from Renz (1981); see Fig. 11 for location of section.

STOP 8: Phosphatic shales / sand influx

This stop has two objectives:

1: To look at the white fossiliferous shales.

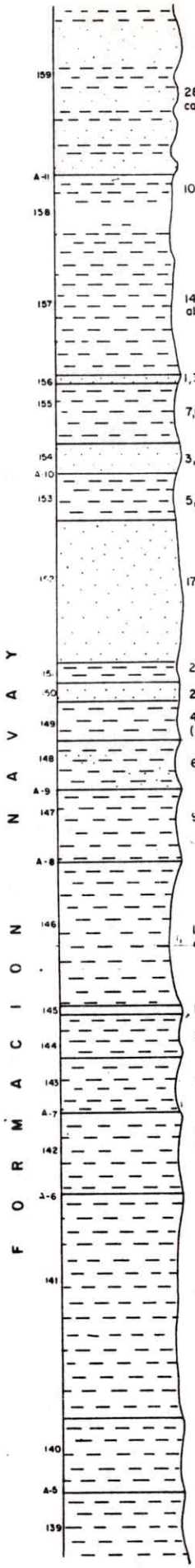
2: To explain the sharp sand influx in terms of the sequence stratigraphic model.

Compare the published field section with well Burgua-3.

Key Questions :

- **What fossil types are observed?**
- **What is the likely paleo-bathymetry?**
- **In what systems tract do the fossiliferous shales lie?**
- **What horizon does the sand influx tie to in the Burgua-3 well?**
- **What is the reservoir potential of this unit?**

OUTCROP SECTION



STOP 8

STOP 7

Cenomanian - Maastrichtian (≤ 97 Ma)

From: Useche and Odreman, 1986

STOP 9: Bioturbated sands / Wrap-up summary

At this stop we will look at some highly bioturbated sands at the top of the Caparo Dam section, and if possible we will look for the phosphate beds shown on the published field section.

Compared the published field section with the Burgua-3 well logs.

Key Questions:

- **What systems tract do these sands lie in?**
- **What do the degree of boturbation and increase in sand content indicate?**

OUTCROP SECTION

REPUBLICA DE VENEZUELA
MINISTERIO DE ENERGIA Y MINAS
SERVIGEOMIN

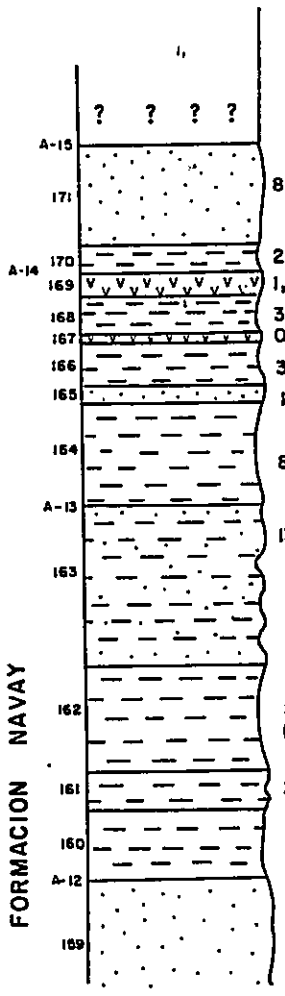
COLUMNA GEOLOGICA (A-A15) REGION DEL RIO CAPARO (LA VUELTOSA - STA. MARIA DE CAPARO)

PREPARADO POR: A. USECHE Y O. ODREMAN
ESCALA 1:500

Leyenda

A-B-C	SECCIONES MEDIAS
172-173	PUNTO ESTACION
	LITOLOGIA
	ESPACIOS CUBIERTOS
——F	FALLA
	DISCORDANCIAS
——	CONTACTOS

LV-1



8mts. de areniscas de grano fino, friables, algo fosfáticas.

2,00 mts. de lutitas grises laminares (Muestra Punto-Estación 169)

1,80 mts. de arenisc fosfática.

3,00 mts. de lutitas laminadas (Muestra Estacion-Punto 167).

0,60 mts. de areniscas fosfáticas

3,50 mts de lutitas grises (Muestra Punto-Estación 165)

1,70 mts. de areniscas finas friables

8,10 mts. de lutitas grises a negras, piritosas.

13,00 mts. de areniscas blanquecinas con intercalaciones de lutitas.

8,50 mts. de lutitas grises laminadas.
(Muestra Punto-Estación 162).

3,00 mts. de areniscas con lutitas intercaladas en capitas de 0,20 mts. de lutitas grises laminadas

5,80 mts. de lutitas grises laminadas, con restos de peces.
(Muestra Punto-Estación 160)

STOP 9

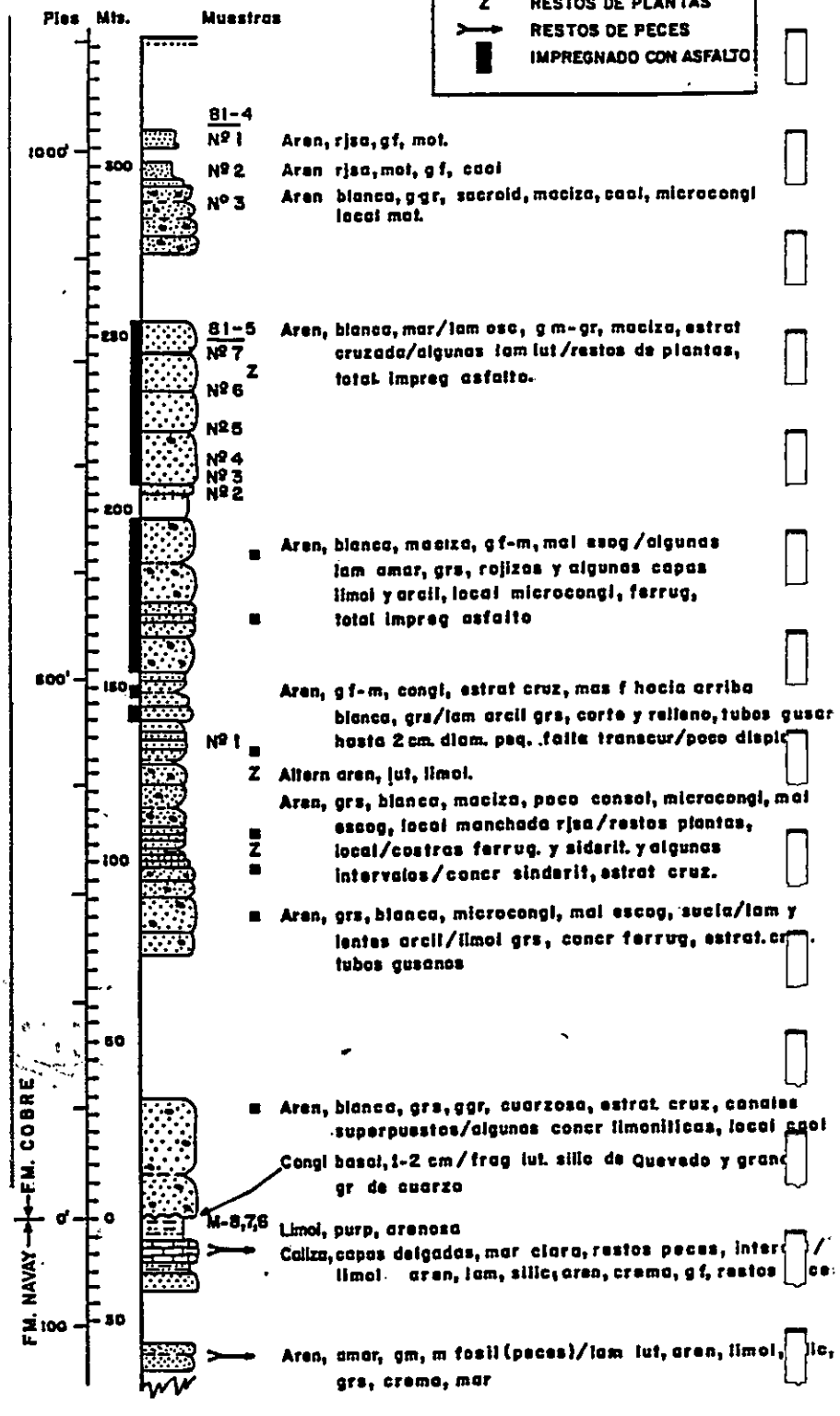
STOP 10: Cobre Formation Seeps

At this last field stop we will look at the oil-stained Cobre Formation sandstones, exposed along the Barinas - San Cristobal road.

The objective of this stop is to note the extent of the oil seep and comment on it's possible origins. We will also briefly examine the depositional facies of the Cobre Formation sandstones.

Key Questions:

- **What is the origin of these prolific seeps (slow source rock seepage or exhumed oilfield)?**
- **What significance is this prolific seep to the hydrocarbon potential of the Capitanejo sub-Basin?**



Sección de referencia, Formación El Cobre, Cerro "CAN V"

From: Kiser, G.D. 1989 Relaciones Estratigraficas de la Cuenca Apure/Llanos con Areas Adyacentes Venezuela Suroeste y Colombia Oriental

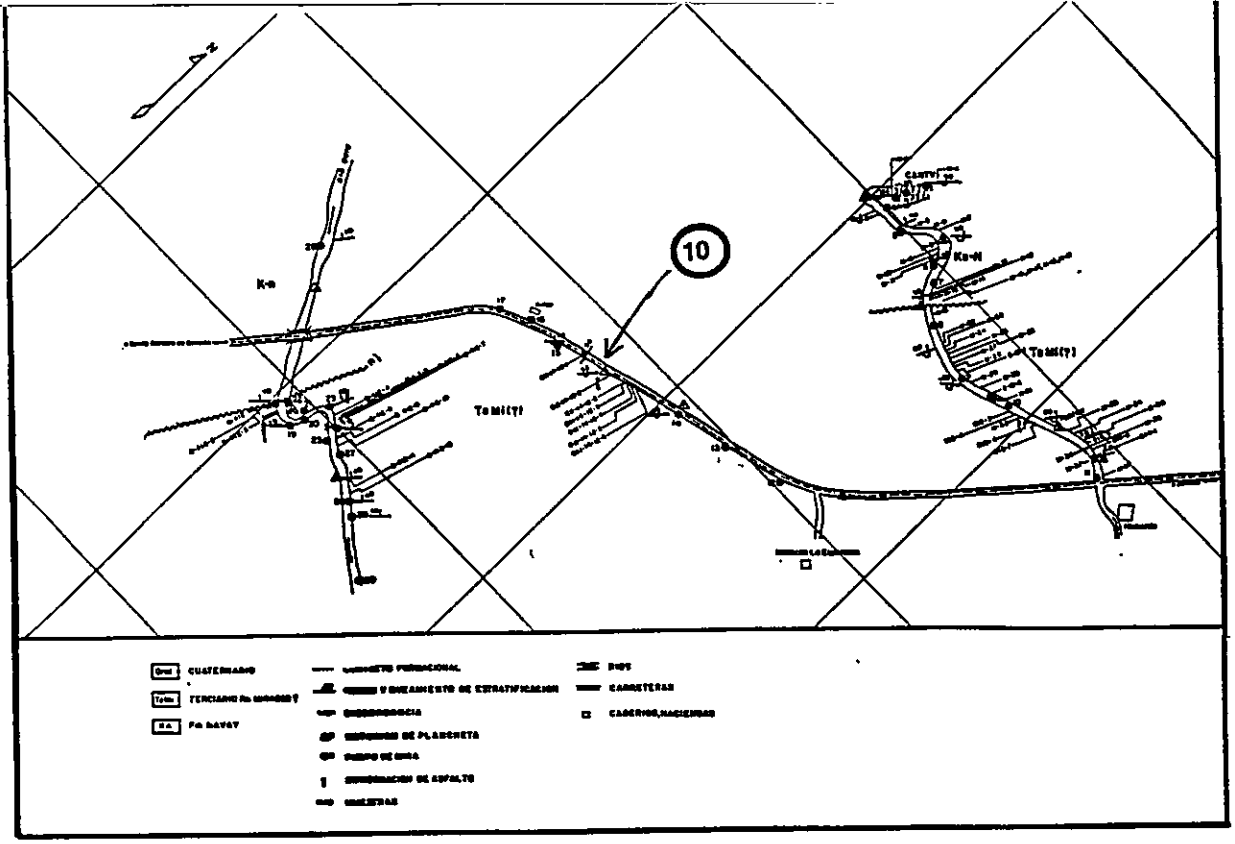


FIGURA 26 - Plano, sección de referencia, Formación El Cobre, Cerro "CANTV".

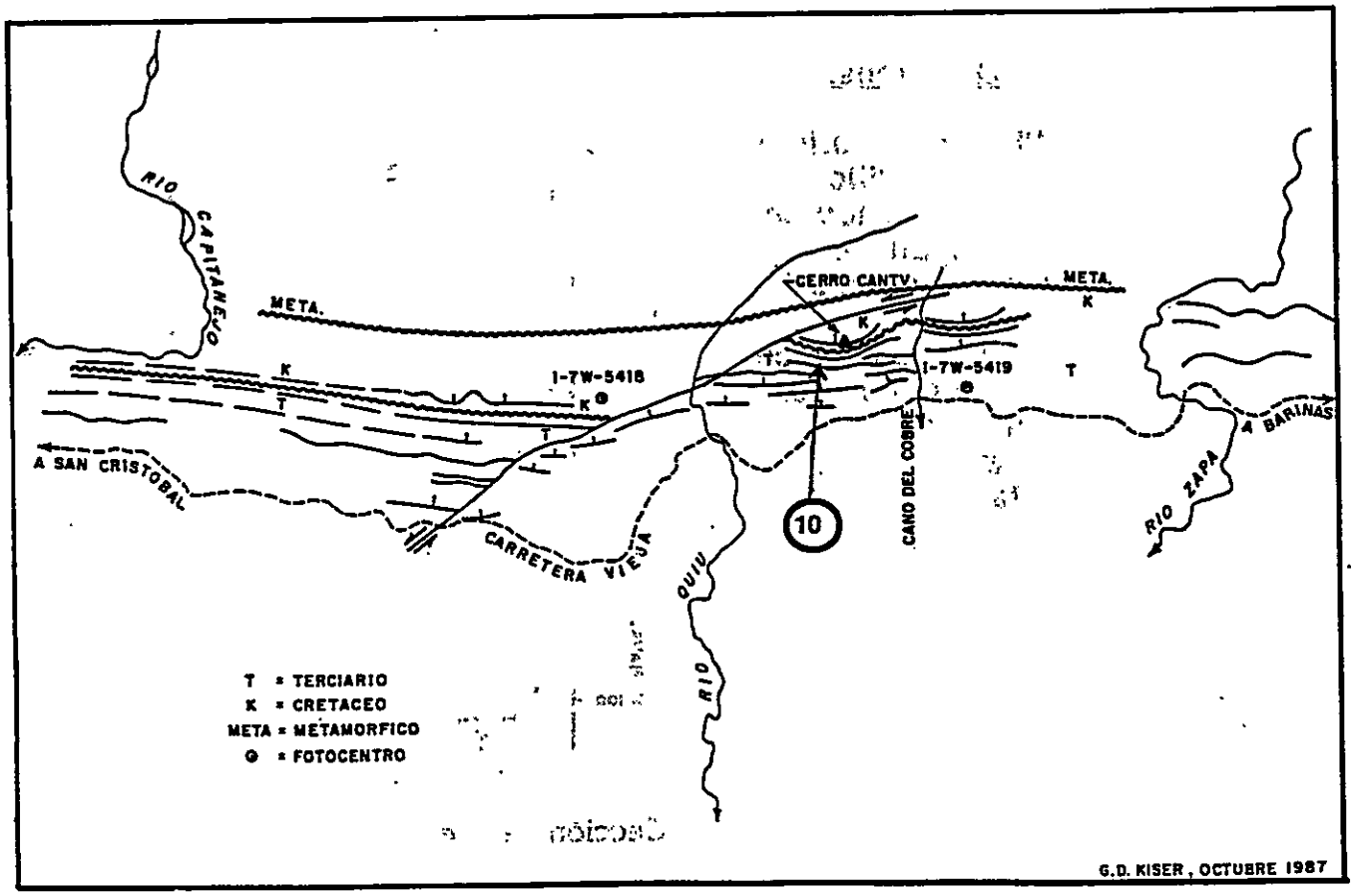
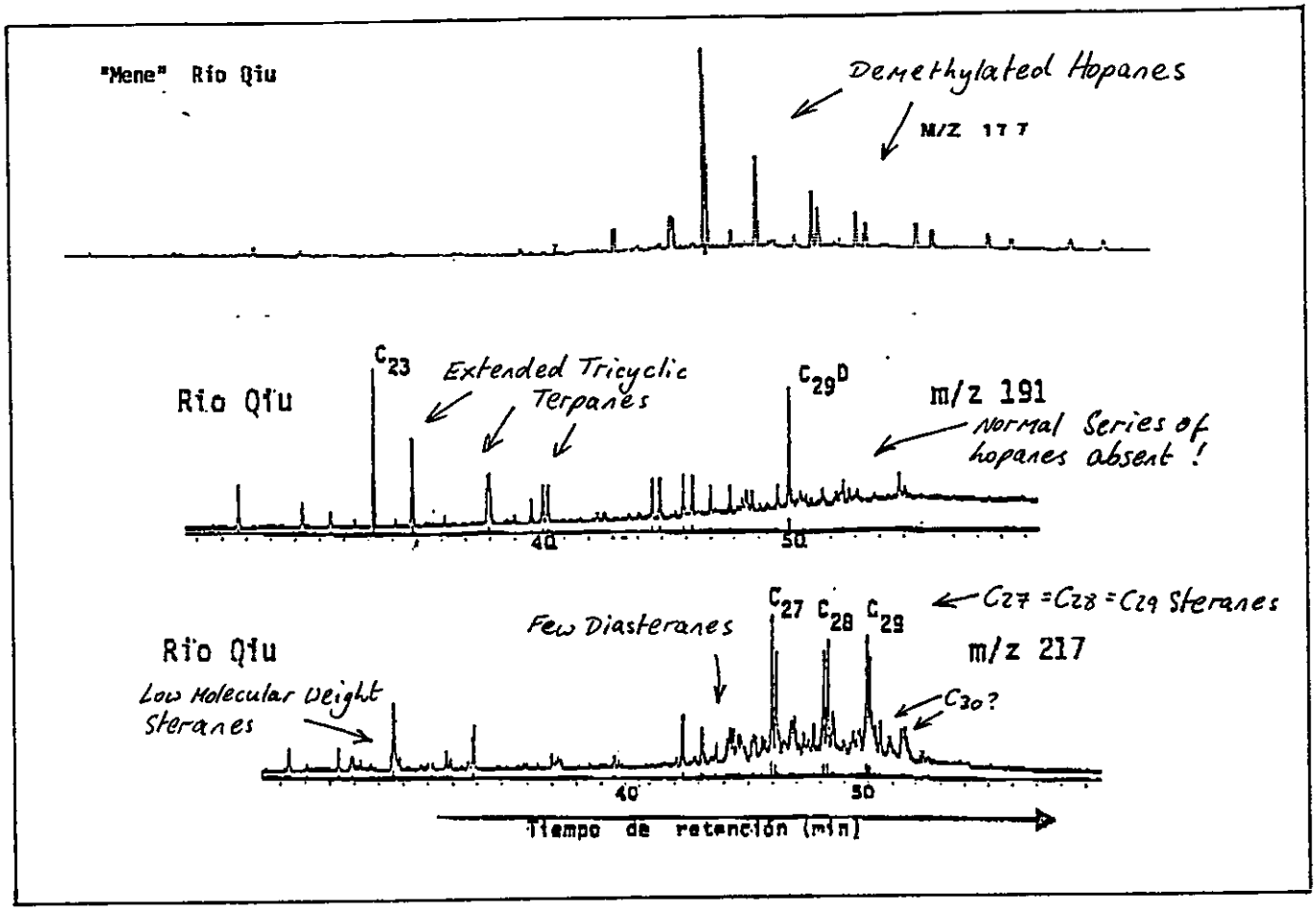


FIGURA 27 - Area río Quiu, fotocroquis geología de superficie.

From: Kiser, G.D. 1989 Relaciones Estratigraficas de la Cuenca Apure/Llanos con Areas Adyacentes Venezuela Suroeste y Colombia Oriental



BIOMARKER DATA FOR THE RIO QIU SEEP

Characteristics of the oil:

- **Biodegraded** - shown by the abundance of demethylated hopanes
- **Marine Non-clastic Source** - shown by the presence of extended tricyclic terpanes, low molecular weight steranes, lack of abundant diasteranes, and proportions of C27, 28, 29 steranes
- **Low Thermal Maturity** - shown by low saturated hydrocarbon content (15%)

Optional Field Stops :

Barinitas - Santa Domingo road section

Two additional field stops are possible, if time permits:-

STOP 11: Paguey Formation

To examine the depositional facies and systems tracts visible in the Paguey Formation at outcrop and on electric well logs: Gavilincita -1

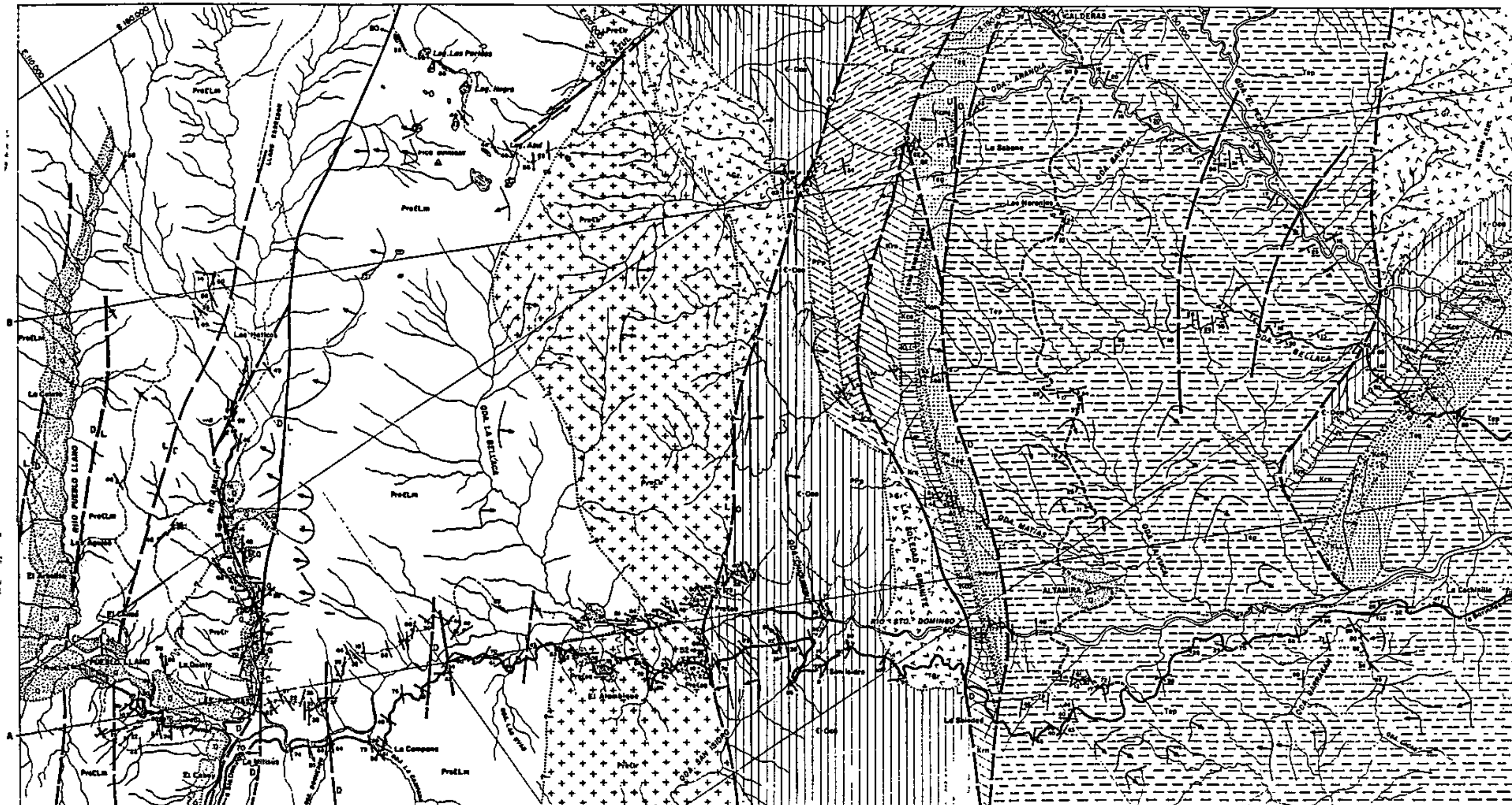
Also to show the tie of the Paguey Formation to the sequence stratigraphic model and to discuss it's significance in terms of the hydrocarbon potential of the Barinas foothills.

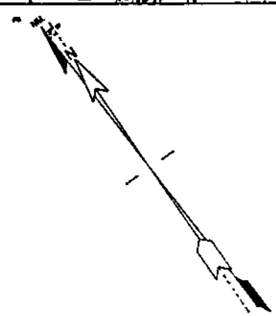
A geological basemap of the Santa Domingo area is included overleaf.

STOP 12: Barinas Foothills viewpoint

This stop is to compare the outcrop geology with the seismic sections across the Barinas foothills. Also to look at the outcrop tie into regional seismic line 2, which runs from Lake Maricaibo to the Merida Andes and across Barinas to the Orinoco river.

The structural style of the Barinas foothills will then be discussed, especially in terms of it's implications for the hydrocarbon potential of the Barinas mountain front

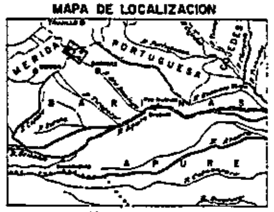




SITUACION RELATIVA

VENEZUELA
ESCALA 1:20.000.000

MAPA DE LOCALIZACION



ESCALA 1:5 000.000

Nota: Parte de la información estructural sobre la Formación Pagüey fué transferida de un mapa preliminar previo, elaborado por: A. Menéndez,(1958). Se incorporó parte de la información de un mapa elaborado por D. Villotta de la C.A.D.A.F.E. (1967)

REPUBLICA DE VENEZUELA
MINISTERIO DE MINAS E HIDROCARBUROS
DIRECCION DE GEOLOGIA

MAPA GEOLOGICO
REGION DE BARINITAS - STO. DOMINGO
ANDES SUDORIENTALES DE VENEZUELA

0 1 2
KILOMETROS

GEOLOGIA: C. SCHUBERT
FOTOGEOLOGIA: A. SABATER
DIBUJADO: R. RAMIREZ R.

TRABAJO DE CAMPO PATROCINADO POR LA DIRECCION DE GEOLOGIA DEL MINISTERIO DE MINAS E HIDROCARBUROS
A. VIVAS RAMIREZ, DIRECTOR
1967
Mapa Base - Creole Petroleum Corporation

LEYENDA

CUATERNARIO		Terrazas Aluvionales
TERCIARIO-Eoceno sup.		Formación Pagüey
		Formación Gobernador
CRETACEO	Sup.	Formación Colón-Mito Juan
		Formación La Luna
	Inf.	Grupo Cogollo
		Formación Río Negro
TRIASICO-JURASICO		Formación La Quinta
PENNSYLVANIANO-PERMICO		Formación Palmarito
		Granito
CAMBRICO-ORDOVICICO (?)		Formación Cerro Azul
PRE-CAMBRICO(?)	Grupo Iglesias	Gneis granítico de La Raya
		Esquistos-cuarcíticos de El Alambique
		Gneises bandeados de La Mitisús

SIMBOLOS GEOLOGICOS

- Contacto.
- Rumbo y buzamiento de la estratificación.
- Estratificación vertical.
- Rumbo y buzamiento de la foliación con dirección y declive de la lineación.
- Foliación horizontal
- Foliación vertical
- Dirección y declive de ejes menores del plegamiento.
- Fallas.
- Fallas probables.
- Anticlinales.
- Sinclinales.
- Posición de laderas en fotografías aéreas.
- Carreteras.
- Posición aproximada de carreteras.
- Caminos

LAMINA I