ESPAÑOL	ENGLISH
Geochronologic Terms	
(tiempo)	(time)
edad	age
época	epoch
período	period
era	era

Es deber y tarea de la Asociación estudiar estos términos equivalentes en español y ponerse de acuerdo tanto sobre el significado de los términos como sobre la selección de una sola palabra en los casos donde existen dos posibilidades. Se propone enviar los resultados del estudio a la sub-comisión del Congreso para tenerla al corriente sobre las necesidades e ideas de los geólogos en Venezuela.

GAY

ARTICULO

CONTRIBUTION TO THE GEOLOGY OF NORTH-CENTRAL VENEZUELA[1]

by Gustavo Feo-Codecido[2]

ABSTRACT

The mapped region comprises a part of the Cordillera de la Costa and the Serranía del Interior, in north-central Venezuela, between longitudes W 66°00' and W 66°48', being bordered on the north by the coast line of the Caribbean Sea and on the south by latitude N 10°00'. It covers an area of approximately 5,810 square kilometers consisting of pre-Cretaceous? metamorphic Villa de Cura group (about 25%), Lower Cretaceous? metamorphic Caracas group (about 40%), Upper Cretaceous semi-metamorphic Paracotos formation and Upper Cretaceous-Lower Tertiary Santa Anita group (about 10%), and Upper Tertiary and Quaternary deposits (about 25%).

These rock units are described briefly as to name, type locality, areal distribution, lithology, thickness, stratigraphic relationships, paleontology, petrography, age and correlation.

On a large scale, the geologic structure of the region is relatively simple, but in detail is extremely complex because of minor tectonic disturbances. Broadly speaking, the northern part of the area is characterized by a large east-west trending anticline, plunging eastward, at the core of which appears the Peña de Mora formation (the oldest unit of the Caracas group). This unit constitutes, in part, the backbone of the Cordillera de la Costa and is bounded on the north and south, respectively, by two parallel systems of steeply dipping and east-west striking faults. This is followed to the south by an east-northeast trending fault-bound syncline with the Paracotos formation occupying the axial portion. Farther south is the Villa de Cura group forming the major part of the Serranía del Interior; against this unit, the rocks of the Caracas group are in fault contact. Along the southern margin of the map area, a thrust fault separates the Villa de Cura group from the Santa Anita group on the south. In the metamorphic rocks, three structural sedimentary depressions are present, which are named the Guatire, Santa Lucía and Tuy basins.

[1] Manuscript received 11 April 1962. Published with the permission of the Compañía Shell de Venezuela.

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RESUMEN

La región indicada en el mapa adjunto incluye una parte de la Cordillera de la Costa y de la Serranía del Interior, en Venezuela nor-central, entre las longitudes O 66°00' y O 66°48'. Limita al norte con la costa del Mar Caribe y al sur con la latitud N 10°00'. Dicha región comprende un área de unos 5.810 kilómetros cuadrados y se halla constituída aproximadamente por 25% de rocas metamórficas del grupo Villa de Cura (pre-Cretáceo?), 10% de rocas metamórficas del grupo Caracas (Cretáceo Inferior?), 40% de rocas semi-metamórficas de la formación Paracotos (Cretáceo Superior) y sedimentos del grupo Santa Anita (Cretáceo Superior-Terciario Inferior), y 25% de depósitos del Terciario Superior y Cuaternario.

Estas unidades se describen brevement en lo que respecta a nombre, localidad tipo, distribución regional, litología, espesor, relaciones estratigráficas, paleontología, petrografía, edad y correlación.

Regionalmente, la estructura geológica de la zona es relativamente sencilla, pero en detalle es en extremo compleja debido a disturbios tectónicos menores. A grandes rasgos, la parte septentrional del área se caracteriza por un extenso anticlinal de rumbo este-oeste e inclinación axial hacia el este, en el corazón del cual aparece la formación Peña de Mora (la unidad más antigua del grupo Caracas). Esta unidad constituye, en parte, el espinazo de la Cordillera de la Costa y limita al norte y al sur, respectivamente, con dos sistemas de fallas paralelos de buzamiento fuerte y rumbo este-oeste. Hacia el sur le sigue un sinclinal de rumbo este-noreste, limitado por fallas, con la formación Paracotos ocupando la porción axial. Más hacia el sur se encuentra el grupo Villa de Cura formando la mayor parte de la Serranía del Interior y contra el cual las rocas del grupo Caracas están en contacto de falla. A lo largo de la margen meridional de la región, una falla de corrimiento separa al grupo Villa de Cura del grupo Santa Anita que aflora en el sur. En las rocas metamórficas se observan tres depresiones sedimentarias estructurales que constituyen las cuencas de Guatire, Santa Lucía y Tuy.

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ILLUSTRATIONS

Plate I. Feo-Codecido. General compilation map of north-central Venezuela showing the geology and topography of the region.

INTRODUCTION

This paper serves as an explanation of the geological data compiled on the accompanying map (Plate I), principally on the basis of published and unpublished literature and private reports. The map is complemented by a photogeological study of about 600 aerial photographs and field observations by the writer.

The formation names used here are in accordance with the nomenclature established in the Stratigraphical Lexicon of Venezuela (1956) and in subsequent publications.

Field observations were carried out largely along the different highways and jeep roads, and a total distance of about 1,000 kilometers was travelled.

The geological data were plotted on a topographical base map, scale 1:100,000, prepared by the Topographical Department of the Compañía Shell de Venezuela and on aerial photographs from the Dirección de Cartografía Nacional, Ministerio de Obras Públicas, at approximate scales of 1:20,000, 1:25,000, 1:35,000 or 1:45,000.

About 80 outcrop samples were collected and examined, paleontologically by H.M. Bolli and petrographically by the writer. However, most of these samples were barren of fossils and only a very few from Upper Tertiary deposits yielded undiagnostic and poorly preserved shallow water assemblages.

The compilation was done, with some interruptions, between February and August 1960.

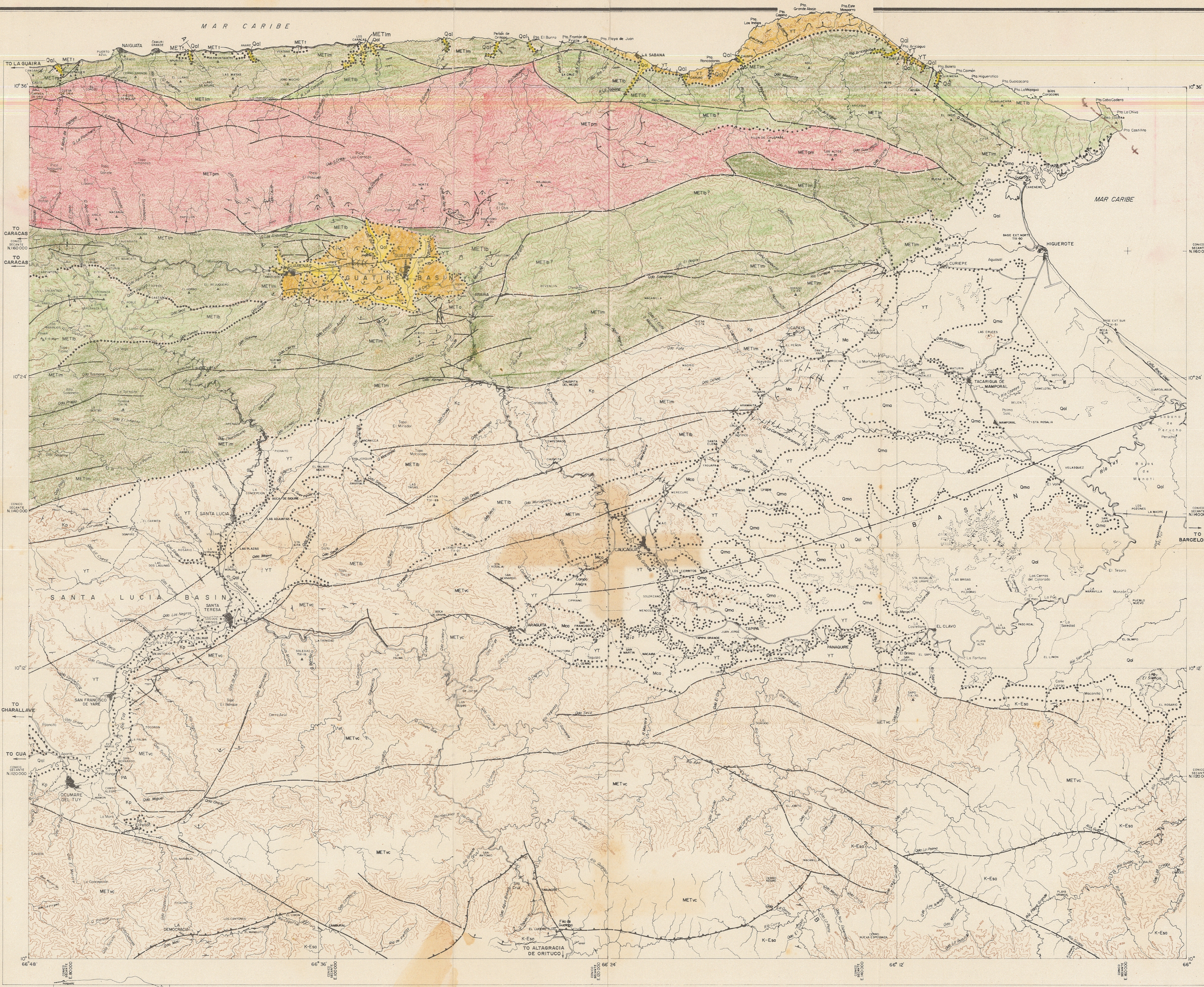
ACKNOWLEDGMENTS

Grateful acknowledgment is given to Compañía Shell de Venezuela for permission to publish this paper and to Creole Petroleum Corporation, Minas y Exploraciones Compañía Anónima and Ministerio de Minas e Hidrocarburos for allowing the release of surface information. Particular thanks are extended to H.P. Schaub, H.H. Renz, W.A. Mohler, J. W.B. van Bertsbergh and K.C. Short for valuable criticism and advice. Field trips to the region were made in the company of V.M. Seiders (who has finished his Ph. D. thesis on the geology of the Santa Teresa - Caucagua area for Princeton University) and E. von der Osten. O. Renz aided in the interpretation of the aerial photographs. However, the author alone is responsible for the opinions expressed and the conclusions reached.

PREVIOUS WORK

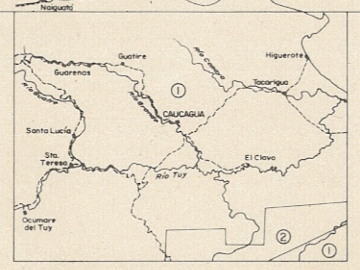
In connection with the Caribbean Research Project of Princeton University, detailed geological mapping in the last decade has focused attention on the metamorphic rocks of the mountain ranges between San Carlos and Caucagua (Hess, 1960) and excellent accounts in publications dealing with the geology of northern Venezuela have been compiled during the course of these investigations (cf. Dengo, 1953; Smith, 1953; OXBURGH, 1960[1]; Shagam 1960). Aguerrevere and Zuloaga (1937) did the first regional study of the metamorphic rocks in north-central Venezuela; on this basis, Dengo (1953) and Smith (1953) carried out detailed investigations of the metamorphic units in the

[1] References in capitals indicate unpublished Ph. D. theses, Princeton University, as mentioned in the bibliography at the end of this article.



COORDINATES REFER TO:

GOVERNMENT'S COMPENSATED CONICAL SECANT PROJECTION



SOURCES OF DATA

1. Maps 1:25000 Cartografía Nac. (New roads Shell Odograph)
2. Creole Slotted Template Maps 1:50000

STRIKE AND DIP SYMBOLS

< 1°	50° – 69°
1° – 4°	70° – 89°
5° – 9°	90°
10° – 29°	Overturned
30° – 49°	

SOURCES OF GEOLOGICAL INFORMATION

DENGO, G.	(1953)	Geologic Map, Caracas-Los Teques Region (Northern Half). Geol. Soc. Am., Bull., Vol. 64, Pl. 1
FEO-CODECIDO, G.	(1960)	Photogeological study and field observations.
HESS, H.H. & DENGO, G.	(1949)	Mapa Geológico, Guarenas-Guatire-Colonia Bolívar. Unpub. Report, Ministerio de Minas e Hidrocarburos. C.S.V. (Caracas) Explor. Report No. 1665.
MIRANDA RUIZ, L.	(1958)	Plano Geológico, Los Caracas-Higuerote. Unpub. Report, Minas y Exploraciones Compañía Anónima. C.S.V. (Caracas) Explor. Report No. 1650.
NICKLAS, M.	(1953)	Mapa Geológico, Región Guarenas-Guatire. Soc. Cienc. Nat. La Salle, Mem., Tomo 13.
NICKLAS, M.	(1957)	Mapa Geológico, Curso Inferior del Río Lagartijo. Ibid., Tomo 17.
SMITH, R.J.	(1953)	Geologic Map, Caracas-Los Teques Region (Southern Half). Geol. Soc. Am., Bull., Vol. 64, Pl. 1.
WOLCOTT, P.P.	(1940)	Base Map D-8. Unpub. Report, Creole Petroleum Corporation. C.S.V. (Caracas) Explor. Report No. 12 Cr.

QUATERNARY

RECENT	Qal	Alluvium
PLEISTOCENE	Qma	Mamporal formation

TERTIARY

UPPER MIOCENE AND/OR PLIOCENE	YT	Undifferentiated
MIDDLE MIOCENE	Ma	Aramina formation
	Mca	Cumaca formation

UPPER CRETACEOUS--LOWER TERTIARY

MAESTRICHTIAN-LOWER EOCENE ?	PA	Paleocene reef limestone facies
	K-Esa	Undifferentiated Santa Anita group

UPPER CRETACEOUS

CAMPANIAN ? – MAESTRICHTIAN	Kp	Paracotos formation (semi-metamorphic)

LOWER CRETACEOUS ?

	METt	Tacagua formation	Caracas group (metamorphic)
	METlm	Las Mercedes formation	
UNCERTAIN	METa	Antímano formation	
	METlb	Las Brisas formation	
	METpm	Peña de Mora formation	

PRE-CRETACEOUS ?

UNCERTAIN	METvc	Undifferentiated Villa de Cura group (metamorphic)

FOSSILIFEROUS LOCALITIES IN METAMORPHIC ROCKS:

- Mollusks
- Foraminifera

CONTOUR INTERVAL 100 METERS

C.S.V.	CARACAS	EXPLOR. DEPT.

GENERAL COMPILATION MAP

NORTH-CENTRAL VENEZUELA

0 2 4 6 8 Km.

COMPILED BY: G. Feo - Codecido | DATE: August 1960

PLATE 1

Caracas and Los Teques-Cúa regions, respectively. However, published reports on the geology of the mapped region are of local and generalized character, as the papers by Winkler (1953), Nicklas (1953; 1957), Young et al. (1956), Feo-Codecido (1957) and Patrick (1959).

GEOGRAPHY

The Cordillera del Caribe (Caribbean Mountains) is an important mountainous massif across northern Venezuela, averaging some 80 kilometers wide from north to south and extending about 800 kilometers from the Barquisimeto-Acarigua depression in the west to the end of the Península de Paria in the east; eastward, it continues as the Northern, Central and Southern ranges of Trinidad. The Cordillera del Caribe separates the Caribbean Sea from the Llanos region. In north-central Venezuela, following Dengo's (1953, p. 9) concepts, it consists of two nearly continuous and parallel east-west striking ranges, physiographically and geologically different, which are divided by a topographic depression formed, from west to east, by the Lake Valencia and Río Tuy basins, respectively. The mountains north of this division are known as the Cordillera de la Costa (Coast Range) and those to the south as the Serranía del Interior (Inner Range). Physiographically, the former is characterized by a main high divide (Fila Maestra) instead of numerous lower narrow divides which are typical in the latter.

In the mapped region, the Cordillera de la Costa rises abruptly from sea level to a maximum height of 2,765 meters at the Pico Naiguatá. The Serranía del Interior constitutes a lower range with elevations as high as 1,400 meters and relief between 500 and 600 meters.

The present map comprises a part of the Cordillera de la Costa and the Serranía del Interior between longitudes W 66°00' and W 66°48', being bordered on the north by the coast line of the Caribbean Sea and on the south by latitude N 10°00'. These boundaries enclose a rectangle of approximately 5,810 square kilometers, roughly limited by the towns of Ocumare del Tuy, Petare, Naiguatá, La Sabana, San José de Río Chico, Guatopo and La Democracia. It is located in north-central Venezuela, forming the major part of the State of Miranda and the eastern portion of the Federal District.

The region is drained principally by the Río Tuy, which flows from west to east and empties directly into the sea. Important tributaries of the Río Tuy are the Guaire, Grande, Merecure, Urape and Capaya rivers, which originate in the Cordillera de la Costa, and Súcuta, Lagartijo, Taguaza and Cuira, from the Serranía del Interior. These streams commonly cut deep V-shaped valleys into the mountains. In the lower Tuy valley the streams flow along a broad fertile flood plain.

The term Tuy area is here applied to the portion of the Tuy valley which is bordered on the east by the Caribbean Sea and on the west by a line from Charallave to Cúa, some 10 kilometers west of the map area. Its wedge-shaped lower part between the sea and the town of Aragüita is called the Barlovento region. The upper part or Alto Tuy region is confined to the portion beyond the Tuy and Guaire rivers to the west. Both regions are separated by a north-east- southwest belt of hills, some 20 kilometers in width, in which the Tuy valley is very narrow.

GEOLOGY

Outline of the stratigraphy

The stratigraphic relationships between the metamorphic units in this region are uncertain because of the fact that they are generally in fault contact.

The oldest unit exposed in this region appears to be the Villa de Cura group, which is dominantly a sequence of schistose green rocks (metavolcanics and associated metasediments). This series is referred to in this report as belonging tentatively to a pre-Cretaceous basement complex. It appears to contain no fossils and the problem concerning its age has been and continues to be a matter of considerable discussion, conjecture and speculation. The alternatives are either that these rocks constituted a metamorphic basement upon which Cretaceous deposition took place or they were originated by metamorphism of Cretaceous rock units (Shagam, 1960). OXBURGH (1960), who made an extensive analysis of the age possibilities in the light of recent information, and Renz (1955, p. 52-53), Short (1955, Shell private rept.) and Feo-Codecido (1956, p. 996) are inclined to consider the Villa de Cura group as probably pre-Cretaceous. For these reasons and since no detailed study has been carried out by the writer on these rocks they are shown on the accompanying compilation map as probably pre-Cretaceous. Under this assumption, above the Villa de Cura group is the Lower Cretaceous? metasedimentary Caracas group, consisting from bottom to top of the Peña de Mora, Las Brisas, Antímano, Las Mercedes and Tacagua formations and in which intrusive igneous rocks are present. In an ascending order, the Senonian is represented by slightly metamorphosed but locally fossil-bearing sediments of the Paracotos formation, as it has been redefined in Shagam's (1960) report and in the Stratigraphical Lexicon of Venezuela (1956). These rocks are followed, stratigraphically, by Maestrichtian to possibly lower Eocene unmetamorphosed strata of the Santa Anita group and associated limestone reefs ("morros") of Paleocene age. No Oligocene is known in the area of the present map. The middle Miocene is represented by the laterally equivalent fresh water deposits of the Cumaca and shallow marine Aramina formations. These formations rest with an angular unconformity upon the Villa de Cura and Caracas groups and lie unconformably beneath Upper Tertiary deposits of upper Miocene and/or Pliocene age, which in turn are unconformably overlain by the Pleistocene Mamporal formation in the Tuy basin. Recent alluvium is found in the streams and lowlands of the region.

The present compilation map consists approximately of 25% Villa de Cura group, 40% Caracas group, 10% Upper Cretaceous and Lower Tertiary units, and 25% Upper Tertiary and Quaternary deposits.

Description of the rock units

Most of the litho-stratigraphic and structural concepts on the metamorphic rocks in the north-central ranges of Venezuela, established in a generalized way by Aguerrevere and Zuloaga (1937; 1938), Liddle (1946) and Bucher (1952), and locally in more detail by Dengo (1947; 1953), Smith (1953; 1957), MACKENZIE (1954); Aguerrevere (1955), KONIGSMARK (1958), MacLachlan et al. (1960), OXBURGH (1960) and Shagam (1960), are also applied to the mapped region. Of interest also are the considerations of Hedberg (1942; 1950), Mencher (1950) and Mencher et al. (1953).

For further details on the unmetamorphosed units in the sedimentary basins of the region (Guatire, Santa Lucía and Tuy basins) the reader is referred principally to the quoted papers by Patrick and Young et al., and also to the Stratigraphical Lexicon of Venezuela (1956).

In the following pages, the rock units will be discussed briefly in order of decreasing age. As a general guidance, reference is made to the accompanying Figure 1, on which is shown the litho-stratigraphic sequence of the studied region.

AGE		ROCK UNITS		REMARKS
QUATERNARY	Recent		Alluvium	Fluviatile and marine deposits: stream sands and gravels, sand dunes, salt flats and sea shore sands.
	Pleistocene		Mamporal formation ± 120m	Continental facies: clay, sand and gravel beds, practically horizontal.
TERTIARY	Pliocene-upper Miocene		Undifferentiated (Guatire formation in Guatire, Santa Lucía and Tuy basins. Tuy formation, including Pichao basal conglomerate, in Santa Lucía basin. Miocene-Pliocene sediments along the coast) ± 1,000m	Loosely consolidated sandstones and conglomerates, laminated siltstones and marly clays. Fresh water gastropods, plant and fish remains, mammal bones and some reworked Miocene Foraminifera.
	Middle Miocene		1,656m Aramina formation / Cumaca formation ± 100m	Aramina: Interbedded clay - shales, clays and sandstones with silty limestones in the lower part. Basal conglomerate. It is the shallow marine lateral equivalent of the Cumaca formation. Marine fossils. Cumaca: Shales and clay - shales with sandstones and occasional clay, siltstone and limestone layers. It consists of fresh water deposits with undescribed species of palecypods and gastropods.
	Lower Eocene?-Maestrichtian	SANTA ANITA GROUP	Morros limestone	Paleocene coastal reef facies: marbly limestone with pseudo-oölitic structure. Algae, corals and small Foraminifera.
			Undifferentiated	Interbedded shales, siltstones and sandstones with limestones and conglomerates. Shaly portions are usually fossiliferous elsewhere.
CRETACEOUS	Maestrichtian-Campanian?		Paracotos formation 200-600m	Phyllitic shales or slates, metagraywackes, conglomerates and limestones. Radiolaria and small Foraminifera.
	Uncertain, possibly Lower Cretaceous	CARACAS GROUP	Tacagua formation	Metavolcanic rock: sericite-epidote schist. In the lower part alternates with calcareous schists.
			Las Mercedes formation (Los Colorados "phase" or member and Charallave conglomerate in the lower part)	Calcareous schists and schistose limestones with graphitic, micaceous and sandy zones. Marbly limestones and conglomerate in the lower part. Occasional chlorite schists and intrusive serpentinites. A single occurrence of unidentifiable recrystallized ?Radiolaria.
			Antímano formation ±50m	Lenticular crystalline limestone.
			(Zenda "phase" or member in the upper part) Las Brisas formation	Quartz-muscovite schists and feldspathic gneisses with quartzitic sandstones. Limestones, especially in the upper part. Metavolcanics. A single occurrence of fossil mollusks.
			Peña de Mora formation	Augen to banded gneiss, in part migmatitic. Lit-par-lit injections.
			?	
PRE-CRETACEOUS?	Uncertain	VILLA DE CURA GROUP	Undifferentiated	Metavolcanic rocks and associated metasediments: interbedded chlorite schists, spilitic basalts and metatuffs. Intrusive serpentinites.

Note: Figures indicate formation thicknesses in meters.

Fig. 1 Feo-Codecido. Litho-stratigraphic sequence in

Pre-Cretaceous? Villa de Cura Group

Aguerrevere and Zuloaga (1937, p. 17-19; 1938, p. 257) gave the name Villa de Cura Group to a complex association of rocks exposed in the vicinity of Villa de Cura, State of Aragua. Subsequently, the name was redefined and applied by Shagam (1960, p. 257) to a more or less schistose greenstone series which crops out in central Aragua. In the present report, the name Villa de Cura group is used in the same manner as proposed by Shagam.

This unit constitutes the major portion of the Serranía del Interior in the southern part of the region and is clearly discernible in the aerial photographs; it is characterized by a typical steep and highly dissected topography.

As a whole, the Villa de Cura Group consists of a thick sequence of green metavolcanic rocks and associated fine grained metasediments, characterized chiefly by interbedded chlorite schists, spilitic basalts and metatuffs. In this region, its thickness has never been measured, but certainly a great part of it is due to repetition by complex faulting and folding. In central Aragua, it seems to be more than 3,000 meters thick (Shagam, 1960, p. 259). Although this group appears to include several formations, no subdivisions have been made in this region because of the inaccessibility of its area of exposure and also because it is in general deeply weathered and covered by dense vegetation. A fault contact separates the Villa de Cura group from the presumably overlying Caracas group.

At several places near Ocumare del Tuy and Caucagua, the Villa de Cura group is intruded by sheared sheets of antigoritic serpentinites.

Thin section analysis: A few samples of chlorite schists collected from the vicinity of Caucagua and Fila de Jorge show usually a well developed foliated to schistose contorted structure, made up largely of a fine aggregate in varying proportions of chlorite, sericite, epidote, zoisite, clinozoisite and quartz; these minerals are noted intimately associated and limonite matter completes generally the assemblage. Spilitic basalts from the La Democracia area exhibit a holocrystalline to hypidiomorphic-granular texture, consisting chiefly of altered albite, pyroxene and amphibole porphyroblasts in a fine grained and saussuritized groundmass of minute feldspar laths, quartz, epidote, zoisite, chlorite, sericite and calcite. Finally, a specimen of metatuff from the Quebrada Casupa is finely laminated, moderately contorted and aphanitic, and consists of minute altered feldspar grains and quartz in a pseudo-isotropic groundmass of unidentifiable nature; pyrite, graphite, chlorite and limonite matter are also sporadically observed.

The Villa de Cura Group appears to have been formed under conditions of the greenschist facies of Eskola (1939) - that is, at low temperature and moderate pressure.

Lower Cretaceous? Caracas Group

The Caracas Group was named by Aguerrevere and Zuloaga (1937, p. 12-19; 1938, p. 258-259) to designate a sequence of metasediments in north-central Venezuela. Later, Dengo (1953) modified the group, principally in respect to the concept of the Las Brisas formation as a basal conglomerate, and included two new formations (Antímano and Tacagua).

These rocks constitute a large portion of the Cordillera de la Costa; on lithological grounds, they are remarkably homogeneous along a great lateral extent striking N 60°-70°E.

The Caracas Group has not been dated with certainty and the alternatives consider a Jurassic or Cretaceous age. However, on the basis of meager fossil evidence (Wolcott, 1943, p. 1632. Dusenbury and Wolcott, 1949, p. 22-23) and lithologic similarity to unmetamorphosed Cretaceous rocks elsewhere, many geologists (cf. Aguerrevere and Zuloaga, 1937. Bucher, 1952. Dengo, 1953. Smith, 1953. KONIGSMARK, 1958) favor a possible Early Cretaceous age for the Caracas Group, although a Late Jurassic age for the Las Brisas formation is not impossible (OXBURGH, 1960).

The grade of metamorphism in the rocks of the Caracas Group seems to vary between the greenschist facies and the epidote-amphibolite facies of Eskola (1939) - that is, the rocks were apparently subjected to conditions of low and medium grade progressive regional metamorphism. In a general way, the metamorphism increasesfrom south to north, both downward and laterally in the stratigraphic column.

Peña de Mora formation

The Peña de Mora augen gneiss was named by Aguerrevere and Zuloaga (1937, p. 8) from its exposures at Peña de Mora, on the old road Caracas - La Guaira. Subsequently, Dengo (1953, p. 14-15) used the name in a wider sense and raised the unit to formation rank.

The formation is an important constituent of the high mountain massif along the northern part of the region and may be clearly traced on the aerial photographs. However, the area contains only few roads and over large parts access is difficult.

In hand specimen, the augen gneiss is a medium to coarse grained rock composed of alternating light and dark bands of felsic and mafic minerals, respectively, with augen chiefly consisting of feldspar aggregates. Quartz and aplite veins are seen generally in the form of lit-par-lit injections, with the development of migmatitic zones. Higher in the section,the gneiss becomes uniformly banded and contains quartzite layers. In its upper part the gneiss is garnetiferous, grading laterally and upward into a garnet-muscovite schist of the Las Brisas formation. (Aguerrevere and Zuloaga, 1937, p. 8. Dengo, 1953, p. 14).

Thin section analysis: A typical sample of augen gneiss collected at the Río Botuco headwaters, south of Los Caracas, consists of quartz which together with feldspars accounts for about 75% of the rock. Next in abundance are muscovite, green biotite, epidote, zoisite, clinozoisite and chlorite, plus minor proportions of garnet, pyrite, and titanite. The rock is medium grained and shows a banded to poorly augen gneissic structure. The augen consists of aggregates of quartz and feldspars, and the specimen is seen to be completely recrystallized.

Las Brisas formation

The Las Brisas formation was named by Aguerrevere and Zuloaga (1937, p. 13-14; 1938, p. 259) from its type locality at Las Brisas, on the Caracas - Charallave road, to designate a sequence of metasedimentary rocks consisting largely of conglomerates, microcline gneisses, limestones and sericitic schists directly on the granitic Sebastopol basement complex of possible pre-Cambrian age. Lenticular conglomeratic limestones in the upper part of the formation

were named Zenda "phase". Based on detailed investigations by Dengo (1953) and Smith (1953), the Las Brisas formation was redefined and described as consisting essentially of a thick succession of quartz-muscovite schists and feldspathic gneisses with conglomeratic layers and crystalline limestones.

Exposures of the Las Brisas formation are principally confined to large isolated zones, up to 35 kilometers long and about 6 kilometers in width, along the northern half of the mapped region.

In the present region, a major portion of the formation is made up of a medium grained quartz-muscovite schist, which toward the base becomes coarser grained, feldspathic and garnetiferous. Impure quartiztic sandstones and recrystallized limestone lenses are occasionally interbedded in this sequence. In addition, Miranda Ruiz (1958, unpub. rept., Minas y Explor. C.A.) reports the occurrence of a green metavolcanic rock between Los Caracas and Chirimena.

Between Caucagua and Aragüita, in some streams that descend from the northern hills there are boulders of diorite, but the rock has not been noted in situ. According to V.M. Seiders (personal communication), it appears to intrude the Las Brisas and possibly Las Mercedes and Paracotos formations. A similar occurrence was observed by Smith (1953, p. 55-56) in his Paracotos formation of the Los Teques-Cúa region.

Thin section analysis: The schists and gneisses are usually fine to medium grained and typically banded. Quartz and muscovite occur abundantly in alternating layers with subordinate amounts of chlorite, sericite, garnet, feldspars, glaucophane, titanite, zoisite, clinozoisite, iron oxides and graphite, but in general the proportions between these minerals vary considerably; thus, garnet, feldspars and glaucophane become conspicuous in samples for the northern part of the area. Quartz occurs generally as recrystallized grains with sinuous interlocking borders, and wavy extinction is characteristic under crossed nicols. Cataclastic effects are common. The distinction between the schists and the gneisses depends upon the foliated structure exhibited by these rocks, which is coarser in the gneisses than in the schists, but all gradations exist between them. A specimen of limestone collected near Lira consists of about 70% completely recrystallized calcite with accessory amounts of quartz, iron oxides, pyrite and muscovite. The sandstones are generally schistose, equigranular and quartzitic, and consist predominantly of quartz and muscovite with occasional chert fragments, graphite, pyrite, chlorite and feldspars in a calcareous to siliceous groundmass.

As pointed out in the Stratigraphical Lexicon of Venezuela (1956, p. 314), an important contribution to the age of these rocks was made by Wolcott (1943, p. 1632) who found some Jurassic or Cretaceous fossil mollusks, such as Pholadomya? sp., Cardium sp. or Pecten sp., Meretrix? sp., Plicatula sp., Pecten (Camptonectes) sp., etc., in limestone beds exposed in the Quebrada or Río Cara to the northeast of Guatire. The outcrop was originally considered by Wolcott as belonging to the Las Mercedes formation; later, Dusenbury and Wolcott (1949, p. 22) placed the fossiliferous locality into the Zenda "phase" of the Las Brisas formation. This seems to be actually the only fossil evidence for a Mesozoic age of the Caracas Group.

According to Dengo (1953, p. 16), the Las Brisas formation grades upward into calcareous quartz-muscovite schists of the Las Mercedes formation. This contact may be observed along the Petare - Santa Lucía road.

The thickness of the Las Brisas formation is unknown within the mapped region, but doubtless a great part of the section is repeated by faulting and folding. In the Caracas region, Dengo (1953, p. 14) estimated a minimum thickness of about 800 meters.

Antímano formation

The term Antímano formation was introduced by Dengo (1953, p. 15) to designate a crystalline limestone lenticular unit exposed in the vicinity of Antímano, conformably between the Las Brisas and Las Mercedes formations. Because of its lenticular character, the Antímano formation disappears frequently along the strike. However, according to Smith (1952, p. 357), the lateral variations appear to have a very wide geographic distribution and can be followed from the State of Sucre in the east to the State of Carabobo in the west, for a distance of about 500 kilometers.

The formation seems to be represented within the studied region by an isolated fault-bound exposure along the Quebrada Tapaima of well bedded west dipping limestones, which were assigned tentatively by Nicklas (1953, p. 370) to the Antímano formation. The section is about 50 meters thick and consists of fine to medium grained, dark to light colored and thin to thick bedded crystalline limestones.[1]

Thin section analysis: The limestones are made up of about 90% completely recrystallized calcite with some detrital quartz grains, graphite matter and pyrite. Quartz and calcite veinlets are also noted.

Las Mercedes formation

The Las Mercedes formation was originally described by Aguerrevere and Zuloaga (1937, p. 14-16; 1938, p. 258) from its type locality at the Hacienda "Las Mercedes" (today Urbanización "Las Mercedes", at the east of Caracas) as consisting essentially of a thick sequence of calcareous schists with graphitic, micaceous and sandy zones. The lower part of the formation, characterized by a very closely folded zone of thin bedded schistose limestones, interbedded with micaceous schists and thick lenticular masses of marbly limestones, was named Los Colorados "phase". According to a reconnaissance work by Hess and Dengo (1949, unpub. rept., Ministerio de Minas e Hidroc.) along the Guatire-Caucagua road, the marbly limestones appear to grade laterally and downward into conglomeratic beds of rounded quartz pebbles in siliceous matrix. These beds, called Charallave conglomerate, were described originally by Aguerrevere and Zuloaga (1937, p. 17-18) in the basal part of their Villa de Cura Group. The Las Mercedes formation comprises also a few chlorite schists and along the coast it is intruded by small bodies of antigoritic serpentinites.

[1] It is probable that some limestones assigned in this report to the upper Las Brisas and lower Las Mercedes formations belong rather to the Antímano formation; however, lack of detailed field information made it impossible to differentiate more accurately.

In the vicinity of Cerro Dorado, about 4 kilometers north of Capaya, an iron-ore deposit of certain economic importance was encountered by O. De Sola and H. Garriga (personal communication) associated with limestones in the lower part of the Las Mercedes formation.

Exposures of the Las Mercedes formation can be followed regionally for a great distance, especially along the coast and in the central part of the map area.

Thin section analysis: The calcareous schists and schistose limestones are notably homogeneous in compositon and are seen to be composed largely of recrystallized calcite, quartz and muscovite in varying proportions with subordinate amounts of graphite, chlorite, sericite, pyrite, iron oxides, feldspars, and occasional grains of zoisite and clinozoisite. Quartz and calcite occur also as veinlets and stringers. The schistose structure is due to parallel arrangement of the mineral constituents, and muscovite flakes generally form microfolds. Under crossed nicols, most of the quartz crystals show undulose extinction and calcite is twinned. A sample of chlorite schist collected in Quebrada Merecure exhibits an ultraschistose structure and a composition dominantly of quartz and chlorite in a fine aggregate, with calcite replacing these two minerals, sericite and limonite, and occasional feldspar grains.

Regarding the age of the Las Mercedes formation, Dusenbury and Wolcott (1949, p. 22-23) reported the occurrence of Foraminifera (Gümbelina globulosa Ehrenberg, G. moremani Cushman, Globigerina cretacea d'Orbigny, Hastigerinella moremani Cushman, Globotruncana sp.) and Radiolaria (Amphisphaera sp., Haliomma sp.) in slightly metamorphosed limestones exposed along the Quebrada Yaguapa, some 5 kilometers southwest of Capaya. On this basis, these authors concluded that part of the Las Mercedes formation is as young as Turonian. However, in a recent article by Dusenbury (1960) the original faunal determinations are retracted, leaving the age indefinite, as the described remains are only unidentifiable recrystallized ?Radiolaria and pyrite spherules.

As pointed out by Dengo (1953, p. 17), the Las Mercedes formation is transitional into the overlying Tacagua formation, through a zone where calcareous schists alternate with sericite-epidote schists.

Complex folding and faulting make it impossible to give an approximate thickness for the Las Mercedes formation in this region. The minimum thickness estimated by Dengo in the Caracas region is about 500 meters.

Tacagua formation

The name Tacagua formation was used by Dengo (1953, p. 17) to designate a sequence (150 to 200 meters thick) of fine grained, light green and evenly well foliated sericite-epidote schists exposed in the Tacagua valley, to the north of the junction with the Quebrada Topo. The lower part of the formation is characterized by alternating epidote and calcareous schists, but the upper part is absent due to erosion. According to Dengo, the Tacagua formation represents the youngest unit of the Caracas group; its original material was largely pyroclastic, probably a tuff or a sediment mixed with volcanic ashes.

Exposures of the Tacagua formation are confined to the northwestern corner of the mapped region, where they occur as isolated patches within the Las Mercedes formation.

Thin section analysis: Representative specimens of sericite-epidote schists, collected in the Quebrada de Uría along the road to Los Caracas, consist largely of epidote, zoisite, clinozoisite and quartz, which together make up about 75% of the rock, 15% sericite, and the remainder is calcite, iron oxides, chlorite and occasional feldspars. Quartz veinlets are also present. The samples are fine grained, contorted and uniformly foliated. Other samples collected farther east, along the road to Los Caracas, contain up to 20% calcite.

Upper Cretaceous

Paracotos formation

The name Paracotos formation was applied by Smith (1952, p. 363; 1953, p. 52) to a considerable sequence (2,300 and 3,500 meters thick in the Spanish and English editions, respectively) of phyllitic rocks exposed in the Los Teques-Cúa region. The name was given after the village of Paracotos. In central Aragua, the formation was redefined by Shagam (1960, p. 278) who "believes that a part of the total succession defined by Smith is better relegated to the Tucutonemo formation and proposes that the name Paracotos formation be restricted to the upper Paracotos of Smith, which crops out near Paracotos". The name Paracotos formation as restricted by Shagam is used in this report.

In the map area, the most extensive exposures of the Paracotos formation occur across the central part, in an east-northeast trending zone about 40 kilometers long and varying from one-half to five kilometers in width. Additional outcrops are found in a continuation of this zone some 10 kilometers to the west of Santa Lucía and in the vicinities of Santa Teresa and Ocumare del Tuy.

In this region, the formation consists largely of brown phyllitic shales or slates, metagraywackes, conglomerates, greenish slaty limestones and dark gray marbly limestones.

Thin section analysis: A specimen of phyllitic shale, collected along the Curiepe-Birongo road, consists of minute and aligned shreds of sericite, interstitial clay matter, chlorite and quartz, with limonite and carbonaceous streaks; their relative proportions are unknown and the section is typically foliated. The graywackes are poorly to moderately well sorted and consist of large particles of quartz, feldspar, muscovite, biotite, pyrite, chert and schist fragments in a matrix of sericite, chlorite, epidote, limonite, carbonaceous matter and clay minerals, with occasional calcite, quartz and feldspar grains. Samples of conglomerates, collected along the Ocumare del Tuy-La Democracia trail, show an unsorted heterogeneous mixture of subangular to angular rock fragments up to 2 mm long (especially basalt, chert and limestone) and grains of intermediate plagioclase, orthoclase, calcite, quartz, amphibole and iron oxides in a matrix of chlorite, sericite, epidote, zoisite, calcite and comminuted quartz and feldspars. The limestones range from feebly altered argillaceous types to partly recrystallized pure limestones.

In connection with the above, it should be mentioned here that a few samples from outcrops and auger holes of semi-metamorphic rocks (slaty and conglomeratic types) and greenschists collected by Nicklas (1957) from the Río Lagartijo area were tentatively assigned by Feo-Codecido (1957, p. 93) to the Paracotos formation of Smith. However, in the light of recent information, the writer believes now that the semi-metamorphic rocks and greenschists belong rather to the redefined Paracotos formation and Villa de Cura group, respectively, as used in this paper.

Limestone lenses in the Paracotos formation usually contain fossils of Maestrichtian age (KONIGSMARK, 1958. OXBURGH, 1960. Shagam, 1960). According to the Stratigraphical Lexicon of Venezuela (1956, p. 429), an identification made by Sellier de Civrieux in limestone samples collected by R. Laforest along the Guatire - Caucagua road, approximately at kilometer 23, showed a microfauna consisting of Radiolaria, Globigerina, Bulimina cf. prolixa and Dentalina?; in another limestone from a road cut, 2.5 kilometers east of the Santa Teresa iron bridge, he found Radiolaria, Gümbelina, Globigerina and Globotruncana.

On account of the above paleontological data, a Campanian? to Maestrichtian age is assigned to the Paracotos formation.

The Paracotos formation is everywhere in fault contact with rocks of the Villa de Cura or Caracas Groups. Because of tectonic complexities, no definite estimates can be made regarding its thickness; however, in the central part of the area it is probably more than 200 meters and less than 600 meters.

These rocks were formed under conditions of rather rapid subsidence and deposition; subsequently, they underwent a low-grade metamorphism.

Upper Cretaceous-Lower Tertiary Santa Anita Group

As pointed out by the writer in the Stratigraphical Lexicon of Venezuela (1956, p. 536-537), the Santa Anita formation was named by Hedberg (1937, p. 1994-1955), at the suggestion of C. González de Juana, after the Paso Santa Anita, a crossing of the Río Querecual in the State of Anzoátegui. The term was originally used as a formation name to designate the sediments between the top of the Cretaceous Guayuta Group and the base of the upper Eocene Merecure formation exposed on Río Querecual. The formation was later divided in northeastern Anzoátegui into a lower San Juan sandstone, a middle Vidoño shale and an upper Caratas member (Hedberg and Pyre, 1944, p. 12-15). Subsequently, the Santa Anita formation was raised by Hedberg (1950, p. 1193) to the rank of group and its respective members to formations.

According to Hedberg (1950, p. 1193-1194), the Santa Anita Group forms a more or less continuous series of outcrops along the southern border of the Serranía del Interior, from Puerto La Cruz, in the State of Anzoátegui to the Río Guayuta, in the State of Monagas. The group is missing in the Barcelona gap, between Píritu and Barcelona, but westward from the vicinity of Río Unare it can be traced along the southern flank of the Serranía del Interior as far west as San Francisco de Macaira, in northernmost Guárico.

Within the boundaries of the area concerned, the Santa Anita Group occurs along the crest and south flank of the Serranía del Interior, largely in fault contact with rocks of the Villa de Cura Group, but isolated exposures are also noted along the northern flank. No attempt was made to subdivide the Santa Anita Group in this region because of the inaccessibility of its exposure area. Also, due to the strongly weathered condition of the samples collected, no fossils were encountered in these rocks and none were suitable for petrographical analysis.

According to the meager lithological data obtained from this region, the Santa Anita Group consists largely of interbedded shales, siltstones and sandstones with occasional limestones and conglomerates. Prominent limestone hills or "morros", such as those at El Peñón and San Bernardo in the vicinity of Ocumare del Tuy, are included by Hedberg (1950, p. 1196) within the Santa Anita Group, probably representing a coastal reef development in sediments of Paleocene-Eocene? age (Caratas). Compared

to Hedberg's type section, the Santa Anita Group in this region exhibits certain facies changes. Southwest of the mapped area, in the San Juan de los Morros - San Sebastián region, it grades laterally from south to north into a Maestrichtian volcanic-sedimentary sequence, described by Renz (1955, p. 52-54; 1957, p. 742-743) as the Escorzonera formation. Southward, in the Altagracia de Orituco - Camatagua region, the Santa Anita group appears to be represented by Short's (1955, Shell private rept.) Late Cretaceous to Paleocene Guárico formation. In addition, Sellier de Civrieux (Stratigraphical Lexicon of Venezuela, 1956, p. 407-410) considers that his Upper Cretaceous Ortiz formation, which is exposed north of a line that runs approximately from San Francisco de Cara in the west to the Laguna de Unare in the east, is equivalent to the Santa Anita Group; and Evanoff (1951, p. 244-245 and in Stratigraphical Lexicon of Venezuela, 1956, p. 344-345) believes that his Upper Cretaceous-Lower Tertiary Macaira Group, exposed in the Altagracia de Orituco region, is also equivalent to the Santa Anita Group. In spite of the facies changes noted in the Santa Anita Group, the writer prefers to retain Hedberg's terminology, until a more accurate stratigraphic correlation is established along the southern border of the Serranía del Interior between the States of Guárico and Anzoátegui.

In the Barcelona area, paleontological evidence indicates an uppermost Cretaceous (Maestrichtian-Danian) to lower Eocene (Ypresian) age for the Santa Anita Group (Hedberg, 1950, p. 1195. Bolli, 1957, p. 62. Stanley, 1960, p. 626).

In limestone samples collected at El Peñón, Sellier de Civrieux (Stratigraphical Lexicon of Venezuela, 1956, p. 336) identified Algae (Griphoporella sp. and others), corals and small Foraminifera which he considers indicative of the Paleocene. In this connection, Sellier de Civrieux is not in agreement with Hedberg's proposal of including the Paleocene reef limestones within the Santa Anita Group, as the sedimentary cycle comprising the bioherms appears restricted to the Paleocene and furthermore, as pointed out by Renz (1955, p. 52), it is underlain with a slight unconformity by the Maestrichtian Escorzonera formation in the San Juan de los Morros - San Sebastián region.

The Santa Anita Group was laid down in a marine environment with favorable conditions for the development of reefs.

Tertiary

Cumaca formation

The following account on the Cumaca formation represents essentially an extract of pertinent information given by Dusenbury in the Stratigraphical Lexicon of Venezuela (1956, p. 184-185). The Cumaca formation was named by Wolcott (1940, unpub. rept., Creole Petroleum Corp.) after the Quebrada La Cumaca, which is a northern tributary of the Río Tuy and crosses the road to Aragüita at about 7 kilometers southwest of Caucagua. Additional outcrops exist in the quebradas or ríos Merecure and Urape, in the vicinity of Aragüita, and along the northern flank of the Serranía del Interior from the Río Taguaza to the Río Cuira. The formation is made up predominantly of greenish gray, chocolate brown and black shales and clay-shales with subordinate amounts of greenish gray sandstones, and occasional layers of clay, siltsone and limestone. The maximum observed thickness was about 100 meters in the Quebrada Merecure section. The unit consists of fresh water deposits laterally equivalent to the middle Miocene shallow marine Aramina formation. These beds overlie unconformably the metamorphic rocks of the Villa de Cura or Caracas Groups and rest unconformably beneath the upper Miocene and/or Pliocene Guatire formation. The fossils are undescribed species of fresh water

pelecypods and gastropods. Although there is no fossil evidence, the age of this formation is considered to be middle Miocene, on the basis of its lateral relation to the Aramina formation.

Aramina formation

The account here presented has been mostly extracted from a description of the Aramina formation by Dusenbury in the Stratigraphical Lexicon of Venezuela (1956, p. 57-58). The Aramina formation was named by Wolcott (1940, unpub. rept., Creole Petroleum Corp.) for its type section at Quebrada Aramina, which is a northern tributary of the Río Tuy and crosses the road to Caucagua at approximately 7 kilometers southwest of Capaya. Its outcrop area comprises a belt, no more than 7 kilometers in width, which extends from the vicinity of Carenero southwestward to the contact with the Cumaca formation at the vicinity of Santa Elena. The formation consists largely of a basal conglomerate, 30 to 50 meters thick and with angular fragments of schists, and a few impure limestone beds. It is followed by interbedded greenish gray clay-shales, clays and sandstones, with occasional silty limestones in the lower part of the section. A maximum thickness of 1,656 meters of section was measured in the Quebrada Aramina. In the outcrop zone, the formation lies unconformably upon the metamorphics of the Caracas Group and is unconformably overlain by the upper Miocene and/or Pliocene Guatire formation. It is the shallow marine lateral equivalent of the fresh water deposits of the Cumaca formation and contains abundant marine microfossils and macrofossils indicative of a middle Miocene age. Diagnostic molluscan fossils comprise Anadara (Larkinia) waringi (Maury), Chione cancellata (Linné), Turritella abrupta Spieker, T. gatunensis Conrad, T. mimetis Brown and Pilsbry, and Oliva cylindrica Sowerby. In addition, Globigerinoides cyclostoma (Galloway and Wissler) and Turborotalia globorotaloidea (Colom) have been reported by Bermúdez (1960, p. 1227, 1321-1322) from exposures of the Aramina formation between Higuerote and Chirimena.

Upper Miocene and Pliocene sediments

Sediments assigned to the upper Miocene and/or Pliocene occur in widely separated localities throughout the mapped region. In the Guatire, Santa Lucía and Tuy basins, they have been referred to by Dusenbury (Stratigraphical Lexicon of Venezuela, 1956, p. 240-241) as Wolcott's Guatire formation. This sequence includes also the upper Miocene sediments of Wolcott's Tuy formation, exposed in the Santa Lucía basin, and possible Miocene-Pliocene strata of conglomerates, sandstones and marly clays which are referred to by Miranda Ruiz (1958, unpub. rept., Minas y Explor., C.A.) as his El Banquito formation and crop out along the northern flank of the Cordillera de la Costa from the vicinity of La Sabana to Chirimena, unconformably upon the Las Mercedes formation.

According to Dusenbury (Stratigraphical Lexicon of Venezuela, 1956, p. 588), the Tuy formation was named after its exposures in the Tuy area, especially along the road from the bridge at Pichao over the Río Guaire southward beyond Santa Teresa and also along the Quebrada Agua Bendita just north of Santa Lucía. At Pichao, the basal portion of the Tuy formation consists of a conglomeratic unit, approximately 120 meters thick, named by Smith (1952, p. 385; 1953, p. 59) Pichao conglomerate and consisting largely of subangular fragments from the underlying unconformable metamorphic rocks of the Caracas Group. Above this conglomerate, follows a section of about 480 meters thick of interbedded clay-shales, clays, siltstones and sandstones. The Tuy formation is unconformably overlain by the Guatire formation. The fossils are largely limited to rare occurrences of undiagnostic fresh to brackish water gastropods and ostracods. Its age is considered by Wolcott as upper Miocene.

As pointed out by Dusenbury (Stratigraphical Lexicon of Venezuela, 1956, p. 240), the Guatire formation was named after the town of Guatire, where well exposed sections can be observed along the road to Caucagua for 6 kilometers east of Guatire as well as along the road to Guarenas. It is also exposed in the Santa Lucía and Tuy basins. This unit consists mostly of poorly consolidated sandstones and conglomerates, laminated siltstones and sandy clays. The maximum thickness is estimated to be 400 meters. The formation is largely unconformable on the Caracas Group in the Guatire basin, on the Tuy and Paracotos formations and Caracas Group in the Santa Lucía basin, and on the Aramina and Cumaca formations as well as on the Villa de Cura and Santa Anita Groups in the Tuy basin. Locally, it is in fault contact with rocks of the Villa de Cura group and Paracotos formation, and in the Tuy basin is in large part covered unconformably by Quaternary sands and gravels. The few fossils encountered consist chiefly of plant and fish remains, mammal bones, very poorly preserved fresh water gastropods and some reworked Miocene Foraminifera. On the basis of its stratigraphic position, the Guatire formation appears to be upper Miocene and/or Pliocene in age.

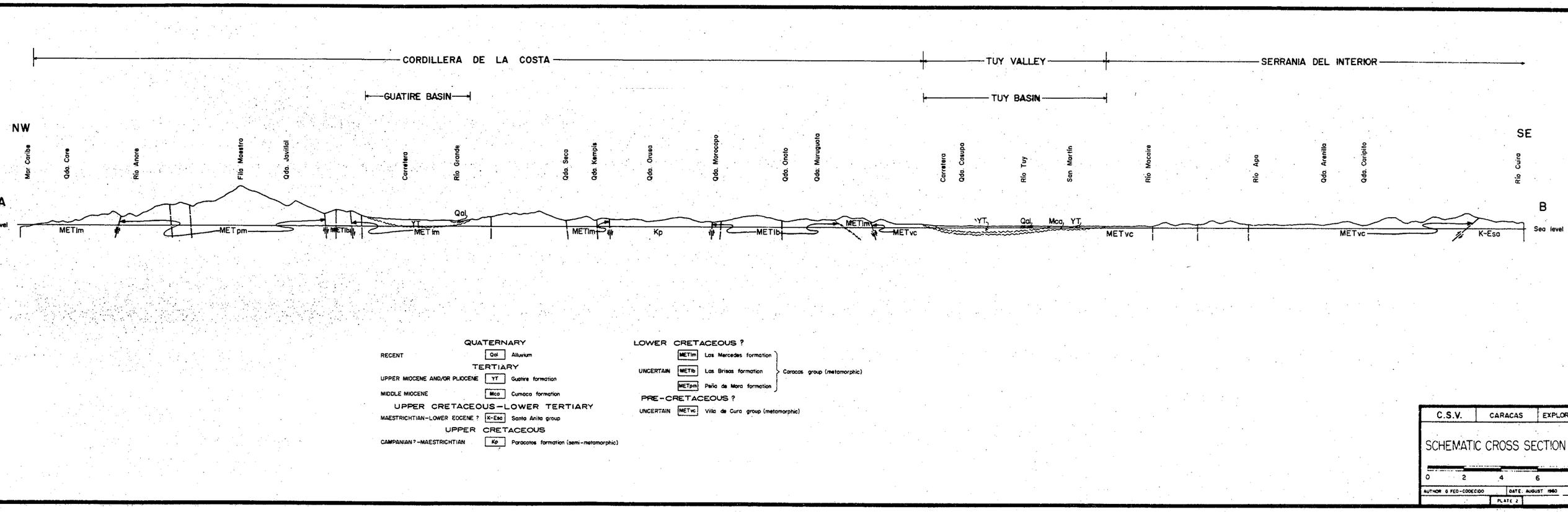
Quaternary

Mamporal formation

The following description of the Mamporal formation has been mostly taken from a publication by Patrick (1959, p. 93-94) on the Pleistocene nomenclature in the Cariaco basin. The name Mamporal formation was proposed by Patrick to designate a series of nearly horizontal, loosely consolidated and poorly bedded lenticular deposits of conglomerates, sandstones and clays exposed in the lower Tuy valley. The name was derived from the village of Tacarigua de Mamporal on the Caracas-Higuerote highway, at about 12 kilometers southwest of Higuerote. Typical exposures are found in the road cuts along the Tacarigua de Mamporal-Higuerote highway and also along the Tacarigua de Mamporal-Río Chico highway to the Río Tuy. They are characteristically red, yellow and gray; the clays are usually mottled and sandy, the sandstones are badly sorted and the conglomerates consist chiefly of quartz, sandstone and igneous pebbles and boulders derived from the nearby mountain ranges. These deposits are of continental origin, appear to contain no fossils, are unconformably underlain by the upper Miocene and/or Pliocene Guatire formation and reach an estimated maximum thickness of 120 meters. The contact with the Guatire formation is exposed along the Caracas-Higuerote highway, at about 5 kilometers west of Tacarigua de Mamporal, and in several localities along the Higuerote-Curiepe highway. The Mamporal formation resembles, and can be correlated with, the Pleistocene Mesa formation of Eastern Venezuela.

Recent alluvium

Fluviatile and marine deposits, consisting mainly of poorly sorted gravels, sands and silts, sand dunes, salt flats and sea shore sediments, are found in the streams and lowlands of the region. In the lower Río Tuy valley, they completely obscure the Upper Tertiary strata over a large flat area, only a few meters above sea level, which represents the raised beach of an emergent coast. In this connection, it is interesting to note that, according to Royo y Gómez (Stratigraphical Lexicon of Venezuela, 1956, pp. 468-470), raised beaches and pronounced cliffs are common along the Venezuelan coast from Cabo Codera as far west as the Península de la Guajira, which is indicative of a coast of emergence, whereas the coast to the east of Cabo Codera as far as the Península de Paria has no raised beaches and shows the typical topography of a sunken coast.



QUATERNARY
RECENT — Qal — Alluvium

TERTIARY
UPPER MIOCENE AND/OR PLIOCENE — YT — Guatire formation
MIDDLE MIOCENE — Mca — Cumaca formation

UPPER CRETACEOUS–LOWER TERTIARY
MAESTRICHTIAN–LOWER EOCENE ? — K-Eso — Santa Anita group

UPPER CRETACEOUS
CAMPANIAN ?–MAESTRICHTIAN — Kp — Paracotos formation (semi-metamorphic)

LOWER CRETACEOUS ?
METlm — Las Mercedes formation
UNCERTAIN — METlb — Las Brisas formation — } Caracas group (metamorphic)
METpm — Peña de Mora formation

PRE-CRETACEOUS ?
UNCERTAIN — METvc — Villa de Cura group (metamorphic)

C.S.V.	CARACAS	EXPLOR DEPT

SCHEMATIC CROSS SECTION A-B

0 2 4 6 8 Km.

AUTHOR G FEO-CODECIDO | DATE: AUGUST 1980

PLATE 2

Fig. 2 Feo-Codecido. Schematic cross-section A-B showing the general structural pattern across the region.

GENERAL STRUCTURAL PATTERN

On a large scale, the geologic structure of the region is relatively simple, but in detail is extremely complex because of minor tectonic disturbances.[1]

Broadly speaking, the northern part of the area is characterized by a large east-west trending anticline, plunging eastward, the core of which is represented by the Peña de Mora formation. This unit constitutes, in part, the backbone of the Cordillera de la Costa and is bounded on the north and south, respectively, by two parallel systems of steeply dipping and east-west striking faults. The apex of this structure is at Pico Naiguatá (2,765 meters), but eastward it decreases in height and width ending at Cabo Codera with pronounced cliffs. This is followed to the south by an east-northeast trending fault-bound syncline, in which the Paracotos formation occupies the axial portion. Farther south is the Villa de Cura group forming the major part of the Serranía del Interior; against this unit, the rocks of the Caracas group are in fault contact. A number of faults has been developed in the Villa de Cura group, the most prominent being a thrust fault which separates this rock unit from the Santa Anita group exposed along the southern margin of the map area.

In the metamorphic rocks, three structural sedimentary depressions occur within the subject area, which are termed the Guatire basin, the Ocumare or Santa Lucía basin, and the lower Río Tuy embayment or simply Tuy basin.

The Guatire basin is a small depression between the towns of Guatire and Guarenas, some 14 kilometers long and 4 kilometers wide. It is filled up largely with the Guatire formation. Further data on this basin may be found in a publication by Nicklas (1953).

The Santa Lucía basin is approximately delimited by the towns of Ocumare del Tuy, San Francisco de Yare, Santa Teresa and Santa Lucía, within the boundaries of the map area; its western edge is present some 400 square kilometers and is filled up mainly with the Tuy and Guatire formations. Further details on this basin have been published by Winkler (1953, p. 89-92) and Young et al. (1956, p. 54-60).

The Tuy basin, with an area of about 1,400 square kilometers, constitutes the easternmost of the three depressions. It is of triangular shape, its top lying near the town of Aragüita and its base extending for a distance of about 90 kilometers along the shore line from Carenero to Boca de Uchire, outside the east limit of the subject map. Within the studied region, this basin is filled up with the Cumaca, Aramina and Guatire formations, as well as with Quaternary strata; however, it is possible that sediments of the Santa Anita group are also present. The Tuy basin represents the western end of the large Tuy-Cariaco sedimentary basin which, extending northeastward under the Caribbean Sea to the islands of Margarita and Coche, covers an area of approximately 14,000 square kilometers. For further details on the Tuy-Cariaco basin the reader is referred to the quoted publication by Young et al.

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[1] As a general guidance, the reader is referred to the accompanying schematic cross section A-B (Fig. 2).

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NOTICIAS

Reunión de la AVGMP

En la reunión mensual de la AVGMP que se efectuó el 24 de mayo, el Sr. Erimar Von der Osten habló y mostró una película que cursó sobre el tema "Actividad volcánica en Hawai."

Asuntos de la AVGMP

En la reunión del 3 de mayo, la Junta Directiva habló de varios asuntos de administración y de organización, y se decidió lo siguiente:

1. Miembros que no han pagado sus cuotas anuales de 1962 son considerados como inactivos y no recibirán el Boletín Informativo de abril.

2. Los presidentes de los comités de la Asociación fueron nombrados (vea pág. 146):

Vice Presidente, Occidente	H. Bailey
Vice Presidente, Oriente	A. Pelak
Comités permanentes	
Excursiones	A. Christiansen
Miembros	V. Winkler
Programas	C. Albrizzio
Representantes	J. Díquez
Reglamentos	G.A. Young
Relaciones Públicas	B.J. Szenk
Agasajos	R.J. Haggerty
Representantes	
OPLE	G.D. Kiser
Comité del Glosario	J. Pantín

XII Convención de la ASOVAC

En la XII Convención de la Asociación Venezolana para el Avance de la Ciencia, se presentaron 242 trabajos realizados por trescientos autores y que constituyen un resumen de la actividad científica durante el último año en Venezuela. En el curso de la semana 6 - 12 de mayo, se celebraron 47 sesiones, dos simposium y dos mesas redondas. Uno de los simposium versó sobre el tema "Estudios hidrológicos y biológicos de la Laguna de Unare." Las mesas redondas se referían a temas de espelelogía. Precisamente, en la Convención fué montada una exposición de unos cristales curiosos encontrados en cuevas venezolanas. El otro punto fué el de la sequía del Lago de Valencia. Entre las novedades de la Convención estuvo una exposición marina flotante en el barco-laboratorio "Guaiquerí" de la Universidad de Oriente.

Junta Directiva de la SVG

Los resultados de la elección para la Junta Directiva 1962-63 de la Sociedad Venezolana de Geólogos fueron los siguientes:

Presidente	Dionisio Zozaya
Vice Presidente	Armando Schwarck Anglade
Secretario	Angel R. Boscán