

A contribution to the Knowledge of the devonian Faunas of Colombia

P. A. MORALES (*)

RESUMEN.—Este es un estudio de la fauna devónica Colombiana recogida por el autor en las regiones de Floresta (Boyacá), Manaure (Magdalena), y Gutiérrez (Cundinamarca). Aunque un total de 72 especies fueron clasificadas y registradas, dentro del trabajo, solamente aquellas que son nuevas para el devónico Colombiano están descritas e ilustradas. El conjunto de fósiles recogidos en cada localidad es discutido separadamente, y correlacionado con aquellos encontrados en otras localidades dentro de Colombia. También se comenta la relación existente entre la fauna colombiana y otras faunas devónicas de Norte y Sur América.

ABSTRACT.—This is a study of the Colombian Devonian Fauna collected by the author in the areas of Floresta (Boyacá), Manaure (Magdalena), and Gutierrez (Cundinamarca). Although 72 species were classified and listed, only those which are new to the Colombian Devonian are described and illustrated. The faunal assemblage found in each locality is discussed separately, and correlated to those found at other localities within Colombia. The relationship between the Colombian and other South and North American Devonian Faunas is also discussed.

RESUME.—Nous présentons une étude de la faune devonienne colombienne, collectionnée par l'auteur dans les régions de Floresta (Boyacá), Manaure (Magdalena) et Gutiérrez (Cundinamarca). Bien qu'un total de 72 especes ont été classifiées et enregistrées dans ce travail, seulement sont décrites et illustrés les especes inconnues jusqu'ici dans le devonienne colombienne. L'ensemble des fossiles collectés dans chaque localité est discuté separement et correlationné avec les fossiles trouvés dans l'autres localities de Colombie. La relation existante entre la faune colombienne et les autres faunes devoniennes d'Amerique du Nord et du Sud est egalement discuté.

TABLE OF CONTENTS

INTRODUCTION

HISTORICAL RESUME OF STUDY OF THE COLOMBIAN DEVONIAN GENERAL STRATIGRAPHY OF THE COLOMBIAN DEVONIAN

General Statement

Type Locality

Other Localities

(*) International Petroleum Ltd., (Intercol, Colombia), Bogotá.

THE FLORESTA FAUNA

Mode of preservation

General Discussion

Age and Relationship

THE MANAURE FAUNA

Mode of preservation

General Discussion

Age and Relationship

THE GUTIERREZ FAUNA

Mode of preservation

General Discussion

Age and Relationship

OTHER DEVONIAN FAUNAS FROM COLOMBIA

RELATIONSHIP BETWEEN THE COLOMBIAN AND NORTH AMERICAN DEVONIAN

DESCRIPTIONS OF SPECIES NEW TO THE COLOMBIAN DEVONIAN

REFERENCES

ACKNOWLEDGMENTS

In the preparation of this work I have received help from many sources. I am deeply indebted to my Professor Dr. J. W. Wells who not only gave me the idea for the work, but who has been patient and exceedingly generous in his cooperation during the study, and during the correction of the manuscript.

It is a pleasure to express my thanks to Mrs. K. V. W. Palmer who permitted me to examine the collections at Paleontological Research Institution in Ithaca.

My cordial thanks go also to my Professors, Colleagues and Friends in the United States and Colombia: To Dr. H. Bürgl and L. Zanela for their advice during the field work; and to K. R. Reed, D. C. Brew and W. T. Kirshgasser for their generous help.

INTRODUCTION

During part of the summer of 1963, the writer has the opportunity of visiting the four best known Devonian outcrops in Colombia: Floresta, Manaure, Gutierrez and Santa Isabel areas.

Since the Colombian Devonian faunas are so little known, and most of the work has been done on the Floresta fauna (Caster, McNair, Royo y Gómez, etc.), the writer undertook as his prime task the collection of the greatest number of fossils possible from the different localities, in the available time.

The main purposes of this paper are the classification and description of the new species found in the Colombian Devonian, the correlation of the Devonian beds within Colombia, as well as an analysis of the relationship between the Colombian fauna and other South and North American Devonian faunas.

Twenty species not previously reported in the Floresta Devonian beds, 37 in the Manaure Devonian and 8 in the Gutierrez beds were collected, classified and described. Of these, 30 are new for the Colombian Devonian, 14 are new records for South America and at least 2 are new species. This is exclusive of the bryozoans (studied by McNair in 1943) and ostracods.

Although further work on the Colombian Devonian strata is needed, the writer hopes that the results of this paper constitute a useful contribution to the knowledge of the Colombian Devonian fauna.

HISTORICAL RESUME OF STUDY OF THE COLOMBIAN DEVONIAN

Devonian beds were first discovered in situ in Colombia by Olsson and Dickey in 1935, while engaged in geologic work along the Eastern An-

dean Cordillera. The discovery was made on the road which connects the small towns of Tobasia and Floresta, in the Department of Boyacá.

A preliminary notice of the occurrence and content of the faunule collected by Olsson and Dickey was presented by Olsson and Caster in 1937 before the Paleontological Society.

In 1939 Caster published the first extended study on the fossils collected by Olsson and Dickey. In this paper, «A Devonian Fauna from Colombia», Caster described new genera and a number of new species found in the Devonian of Floresta, and attempted to correlate this faunule with other Devonian faunas in North and South America. In this paper are included stratigraphic notes by Olsson, and for the first time the name «Floresta Series» is introduced for the Devonian sequence between the Girón formation (Jurassic-Triassic) and the older Igneous Metamorphic Complex (1939, pp. 10).

McNair published the first and thus far the only study of the Devonian bryozoa from Colombia in 1940, based on material collected by Olsson and Dickey from the same locality as the material described by Caster. In this paper, McNair, after studying and describing twenty four new species, agreed with Caster (1939, pp. 14) in the belief that the Floresta fauna is probably «boreal» rather than «austral» in origin and relationship.

In 1942 Caster published «The Age and Relations of Colombian Devonian Strata», based on previous work and on new material collected from Floresta, with an extensive description of the biotic affinities of the Floresta fauna, together with a description and correlation of the Floresta series, and a generalized study of the paleogeography of the South American Devonian.

In 1942, Royo y Gómez published «Fósiles Devónicos de Colombia», a study of a second fossil collection made in the Floresta region by Sarmiento and Alvarado.

In 1946, Botero published a fundamental paper on the stratigraphy and general geology of the area immediately southwest of Paz de Río, including probably the most detailed description of the Floresta Devonian. He found the Devonian beds lying between Permo-Carboniferous beds and the so-called Metamorphic Complex and not as Caster (1939, pp. 10) believed. In this paper the term «Floresta Formation» is introduced for the Florestas Devonian sequence.

Schuchert in 1935 reported a collection of fossils made by Scholl and Remington on the Colombian side of the Serranía de Perijá. The fossils were identified by Galloway as Middle Devonian in age but no further information on this locality has been published.

A generalized description of Pre-Cretaceous sediments in Colombia was published by Trumphy in 1943. In this paper, Renz reported two new areas where the Devonian strata are found in situ; (1) Curumaní-Santa Isabel region and (2) East of Manaure, on the Colombian side of the Serranía de Perijá (figure 1). Fossils collected in both places were classified respectively by Emeis (Shell Paleontologist) and Williams (U. S. Geol. Surv.), as Middle Devonian age.

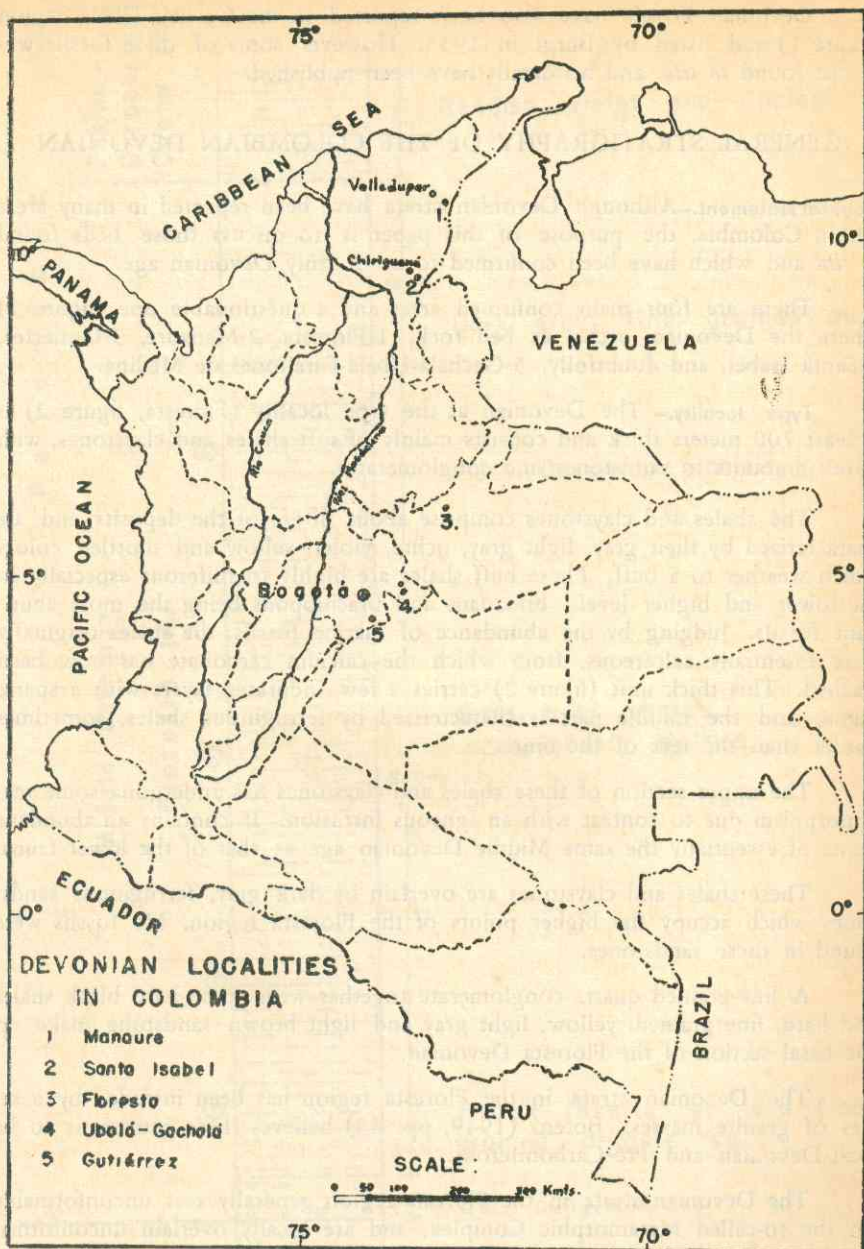


FIGURE 1.—Devonian Localities in Colombia.

Devonian Fossils have also been reported in the Gachalá-Ubalá region (figure 1) and listed by Bürgl in 1953. However some of these fossils were not found *in situ*, and no details have been published.

GENERAL STRATIGRAPHY OF THE COLOMBIAN DEVONIAN

General statement.—Although Devonian strata have been reported in many areas within Colombia, the purpose of this paper is to discuss those beds found *in situ* and which have been confirmed to be of truly Devonian age.

There are four main confirmed areas and a questionable one (figure 1) where the Devonian occurs as bed rock; 1-Floresta, 2-Manaure, 3-Gutiérrez, 4-Santa Isabel, and doubtfully, 5-Gachalá-Ubalá-Farallones de Medina.

Type locality.—The Devonian at the type locality (Floresta, figure 2) is at least 700 meters thick and consists mainly of soft shales and claystones, with minor amounts of sandstones and conglomerates.

The shales and claystones comprise about 80% of the deposits and are characterized by their gray, light gray, ochre, violet, yellow and mottled colors which weather to a buff. These buff shales are highly fossiliferous especially in the lower and higher levels, bryozoans and brachiopods being the most abundant fossils. Judging by the abundance of marine fossils, the shales originally were essentially calcareous, from which the calcium carbonate has now been leached. This thick unit (figure 2) carries a few indurated layers with a sparse fauna, and the middle part is characterized by ferruginous shales, sometimes harder than the rest of the unit.

The upper section of these shales and claystones has undergone some metamorphism due to contact with an igneous intrusion. It contains an abundant fauna of essentially the same Middle Devonian age as that of the lower fauna.

These shales and claystones are overlain by dark gray, ferruginous sandstones which occupy the higher points of the Floresta region. No fossils were found in these sandstones.

A fine-grained quartz conglomerate together with some hard black shales and hard, fine grained, yellow, light gray and light brown sandstone make up the basal section of the Floresta Devonian.

The Devonian strata in the Floresta region has been intruded by a series of granite masses. Botero (1949, pp. 43) believes these intrusions to be Post-Devonian and Pre-Carboniferous.

The Devonian strata in the Floresta region generally rest unconformably on the so-called Metamorphic Complex, and are locally overlain unconformably by rocks which are considered as Permo-Carboniferous in age.

For a complete and detailed description of the Devonian and its relationships with the underlying and overlying beds the reader is referred to «Reconocimiento Geológico del Area Comprendida por los Municipios de Belén, Cerinza, Corrales, Floresta, Nobsa y Santa Rosa de Viterbo, Boy.» by Botero (1949).

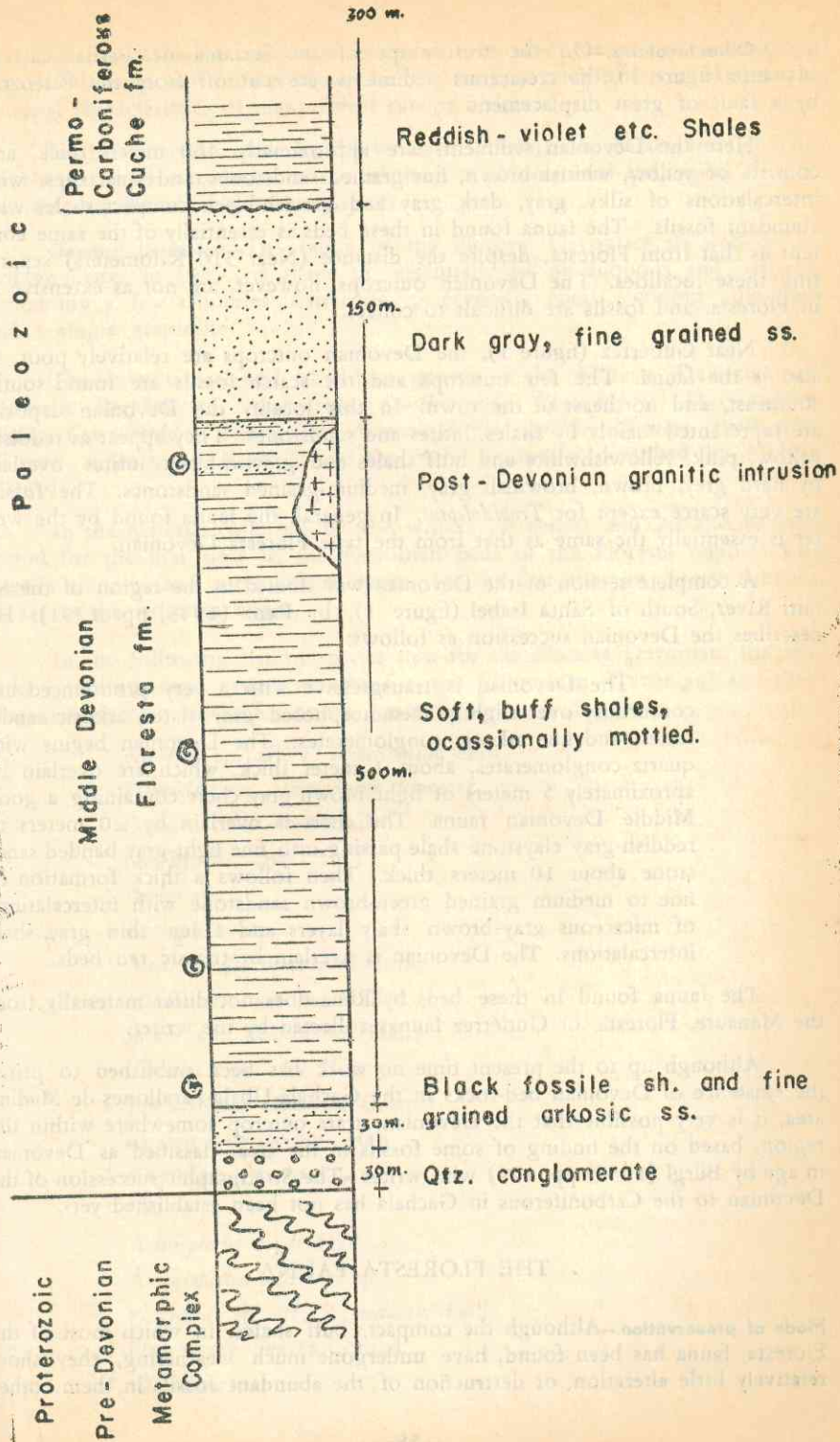


FIGURA 2.—Stratigraphic Column of the Floresta Devonian. Scale 1:50,000 (After Botero, 1946).

Other localities.—On the west slope of the Serranía de Perijá, east of Manaure (figure 1), the cretaceous sediments are cut off from the Paleozoic by a fault of great displacement.

Here the Devonian sediments are approximately 400 meters thick, and consists of yellow, whitish-brown, fine-grained sandstones and quartzites, with intercalations of silky, gray, dark gray and grayish-black compact shales with abundant fossils. The fauna found in these beds is essentially of the same content as that from Floresta, despite the distance (Near 510 Kilometers) separating these localities. The Devonian outcrops, however, are not as extensive as in Floresta, and fossils are difficult to collect.

Near Gutiérrez (figure 1), the Devonian outcrops are relatively poor, as also is the fauna. The few outcrops and the scarce fossils are found south, southeast, and northeast of the town. In this locality the Devonian deposits are represented mainly by shales, lutites and sandstones. They appear as reddish-yellow, pink, yellowishwhite and buff shales and grayish-black lutites overlain by hard grey, brown, brownish gray, medium-grained sandstones. The fossils are very scarce except for *Tropidoleptus*. In general, the fauna found by the writer is essentially the same as that from the type Floresta Devonian.

A complete section of the Devonian was studied in the region of the Simití River, South of Santa Isabel (figure 1), by Renz (1943, pp. 1291). He describes the Devonian succession as follows:

The Devonian is transgressive with a very pronounced unconformity over slightly metamorphosed gray slates, arkosic sandstones, and fine arkosic conglomerates. The Devonian begins with quartz conglomerates, about 1 meter thick, which are overlain by approximately 5 meters of light brown-gray chert containing a good Middle Devonian fauna. The chert is overlain by 20 meters of reddish-gray claystone shale passing into fine light-gray banded sandstone about 10 meters thick. Then follows a thick formation of fine to medium grained green-brown sandstone with intercalations of micaceous gray-brown shaly layers and a few thin gray shale intercalations. The Devonian is overlain by triassic red beds.

The fauna found in these beds by Renz does not differ materially from the Manaure, Floresta, or Gutiérrez faunas collected by the writer.

Although up to the present time no work has been published to prove the existence of Devonian bed-rocks in the Gachalá-Ubalá-Farallones de Medina area, it is very possible that the Devonian strata outcrop somewhere within the region, based on the finding of some fossils in the area, classified as Devonian in age by Bürgl (1957, pp. 129) who writes «The Stratigraphic succession of the Devonian to the Carboniferous in Gachalá has not been established yet».

THE FLORESTA FAUNA

Mode of preservation.—Although the compact, buff shales, in which most of the Floresta fauna has been found, have undergone much weathering, they show relatively little alteration or destruction of the abundant fossils in them, other

than solution. Most of the fossils are found in the form of internal and external molds, relatively well preserved, so that the internal morphology as well as the external characteristics of many forms can be observed.

In the collection made by the writer in Floresta, the corals are the most poorly preserved in contrast to the relatively well preserved pelecypod (*Aviculopecten*) and the abundant brachiopods.

General discussion.—The fauna of the Floresta Devonian so well described by Caster in 1939, is made up essentially of brachiopods and bryozoa, containing a few trilobites, ostracods, pelecypods, corals, crinoid columnals and a single graptolite.

The most typical and abundant genera of the Floresta Devonian are: *Leptaena*, *Strophonella*, *Strophodonta*, *Schellwienella*, *Rhytistrophia*, *Dictyostrophia*, *Elytha*, *Cymostrophia*, *Acrospirifer*, *Australospirifer*, *Spirifer*, *Chonetes*, *Productella*, *Phacops*, *Amphigenia*, *Fenestella* and the many bryozoans described by McNair (1940).

In the material collected by the writer, 15 genera and 20 species were found for the first time in the Devonian beds of the Floresta region. Two species are new and some others appear for the first time in South America, so far as the writer is aware.

In the following list of species new for the Floresta Devonian, the asterisks * indicate new generic stocks for the Colombian Devonian, and the - sing new specific stocks for South America.

- * *Favosites* sp. aff. *F. hamiltoniae* Hall
- Pleurodictyum americanum* Roemer
- Camarotoechia dotis* Hall
- * *Leiorhynchus mysia* Hall
- * *Orthis* sp.
- Paraspirifer* sp.
- * *Mediospirifer audaculus* Conrad
- * *Nucleospira concinna* Hall
- Spinulicosta spinulicosta* (Hall)
- Chonetes comstockii* Hartt
- Tropidoleptus carinatus* Conrad
- *Cyrtina hamiltonensis* Hall
- * *Amphigenia* n. sp.?
- * *Grammysia* sp.
- * *Actinopteria boydi* Hall
- *Aviculopecten wellsii* n. sp.
- * *Platyceras* sp. aff. *P. nodosum* Hall
- * *Platyostoma lineata* Conrad
- * «*Orthoceras*» sp.

- * *Odontopleura callicera* (Hall and Clarke)
- * *Cryphaeus* sp.
- * *Proetus* sp.
- * *Acanthograptus* sp.

Judging by the lithology and fauna the Floresta Devonian beds are deposits of a near shore marine environment, similar to the Rhenish in Europe and the Hamilton in the North American Devonian.

Age and relationship.—A study of the new species found in Floresta confirms once more Caster's conclusions concerning the «Boreal» or «American» flavor of the Floresta fauna and its Meso-Devonian age.

In the new material the presence of *Tropidoleptus carinatus*, a species which characterizes the «American» faunal province of the Middle Devonian, is of particular importance. In North America, *T. carinatus* appear in the Hamilton group (Middle Devonian) and recurs in the Chemung (Upper Devonian). The presence of *Nucleospira concinna*, *Mediospirifer audaculus*, *Spinulicosta spinulicosta*, *Cyrtina hamiltoniensis*, *Favosites hamiltoniae*, *Pleurodictyum americanum*, and other typical species of the Hamilton group of New York State, and more particularly of the Centerfield horizon, suggests a Hamiltonian rather than an Onondagan affinity, somewhat younger than at first supposed by Caster, and as concluded by McNair (1940, pp. 118) on the basis of the bryozoan fauna.

The Floresta Devonian fauna is widespread in Colombia and clearly correlates with the faunas of Manaure, Gutiérrez and Santa Isabel.

The tabulation (table I) shows almost identical assemblages of species in the Floresta and Manaure faunas, although these localities are 510 kilometers apart, and there can be no doubt that both deposits represent the same or about the same horizon.

The fossils collected by the writer indicate that the Gutiérrez Devonian fauna is also very closely related to the Floresta fauna (table 1). All of the species found in the Gutiérrez area are present in Floresta, and the same may be said for the fauna of the Santa Isabel Devonian beds.

As Caster (1942, pp. 35) stated, the Floresta Devonian deposit «is a virtual northern outpost in the Southern Hemisphere». From the tabulation of the Floresta fauna (table I) it seems clear that it is made up of a mixture of «American» and «Eurasian» elements, with predominance of the former. Significant is the increase in abundance of «American» and decrease of «Eurasian» elements northward from Floresta to Manaure, confirming Caster's rule: the further south that the exposures of Devonian strata appear, the more abundant that the «Eurasian» faunal elements become.

Within South America, the Floresta Devonian fauna may be correlated with those of the Caño Grande formation of Venezuela, the Sicasica formation of Bolivia and the Ereré Sandstone of Brazil. The Caño Grande is the most closely related to the Floresta Devonian.

The fauna of the Caño Grande formation was described in papers by Weisbord (1929), and Harris and Wells (1943). Based on the faunal lists

found in both papers, and on the faunal assemblage found in Floresta, it is clear that both faunas are very closely related (table 1). The Floresta Devonian and the Venezuelan formation share among others the following genera: *Polypora*, *Fenestella*, *Heliophyllum*, *Acrospirifer*, *Mediospirifer*, «*Spirifer*», *Elytha*, *Atrypa*, *Meristella*, *Pentagonia*, *Strophodonta*, *Strophonella*, *Scbellwienella*, *Dictyotrophia*, *Chonetes*, *Eodevonaria*, *Tropidoleptus*, and *Cypricardinia*.

In addition to this generic relationship, 22 species are present in both faunas and more than 15 others are very closely related, not including the bryozoans which also seem to be similar. This means that about two-thirds of the approximately 60 species known from the Floresta Devonian (bryozoa and ostracods not included) are represented by identical or very closely related species in the Caño Grande formation. Some of the slight specific differences in the faunas may be due to facies changes.

Lithologically the Floresta Devonian strata are not so similar to those of the Caño Grande formation. According to Liddle (1943, pp. 14), the Caño Grande formation consists of gray, micaceous, nodular, limonitic, calcareous, sandy shales containing mud pellets, microscopic particles of lignitic matter, and breaking with a shattery fracture. In the extreme basal portion are some evenly bedded, fine-grained dark gray micaceous, quartzitic sandstones and a few more shaly sandstones.

From the above discussion it seems that the two Devonian deposits, separated by more than 500 kilometers may be coeval. However, the Caño Grande formation is considered by Liddle (1943, pp. 15) to be of Lower and Middle Devonian age (Helderbergian through Oriskanian and Hamiltonian).

The tabulation (table 1) also brings out the relationship between the faunas of Floresta and the Sicasica formation of Bolivia. In this case, the degree of community between the relatively large faunas of Sicasica (51 species) and of the Floresta Devonian (60 species) is very low. In fact, these faunas share only 4 identical species which are typical of and abundant in the Bolivian formation, but sparse in the Floresta beds. They are: *Ambocoelia pseudo-umbonata*, *Chonetes stübeli*, *Phacops salteri* and *Pleurodictyum americanum* (comparable to *P. amazonicum* of the Sicasica).

Here, the main bases for correlation are the species associations and generic similarities rather than specific identity. The assemblage of trilobite genera in Floresta is very similar to that of the Sicasica, but examples are not so abundant and varied in Floresta as they are in the Bolivian formation. The species of «*Spirifer*» found in both faunas are also very closely related. Most of the 20 genera common to the Sicasica formation and the Floresta Devonian are of «American» rather than of «Eurasian» type.

The Floresta fauna can also be correlated to the Ereré fauna of Brazil on the basis as above. The following typical Ereré forms are found in the Floresta Devonian strata: *Camarotoechia dotis*, *Chonetes comstockii* and *Tropidoleptus carinatus*. In addition, both faunas share the presence of Austral forms of «*Spirifer*» which if not identical, are very closely related. On the other hand, the typical and abundant Floresta species *Scbellwienella goldringae* may be compared to *Streptorhynchus agassizi* of Ereré.

According to the tabulation (table I), the faunas of the Floresta Devonian and the Ereré share the following genera: *Camarotoechia*, *Australospirifer*, *Ambocoelia*, *Chonetes*, *Tropidoleptus*, *Orthis*, *Cyrtina*, *Grammysia*, etc. These genera include about 35% of the known species from Floresta.

Generally speaking, the Floresta, Sicasica and Ereré faunas seems to be homotaxial, and as Caster (1949, pp. 52) stated, all differences between the faunas can be perhaps more convincingly explained by ecologic factors than by the more customary interpretation of them as varying phases of the Middle Devonian invasion.

TABLE I
DISTRIBUTION OF THE COLOMBIAN DEVONIAN FAUNA IN
SOUTH AMERICA

	1	2	3	4	5	6	7
<i>Favosites</i> sp. aff. <i>F. hamiltoniae</i> Hall	X						
<i>Heliophyllum</i> sp.	X		X?			0	
<i>Pleurodictyum americanum</i> Roemer	X	X	X		X?	0	
<i>Fenestella venezuelensis</i> Weisbord	X	X	X	X		X	
<i>Camarotoechia sappho</i> Hall		X					
<i>C. dotis</i> Hall	X					X?	X
<i>C. contracta</i> Hall?		X					
<i>Leiorhynchus mysia</i> Hall	X						
<i>Acrospirifer olssoni</i> Caster	X	X		X	0	X	X?
<i>Brachyspirifer palmerae</i> Caster	X	X		X?	0	0	
<i>Mediospirifer audaculus</i> Conrad	X	X?		X?	X	X	
<i>Australospirifer antarticus</i> var. 1 Caster	X	X	X	X	X	X	X
« <i>Spirifer</i> » <i>daleidensis</i> Steininger	X?	X					
« <i>S.</i> » <i>kingi</i> Caster	X	X	X	X	X?	X	X?
<i>Paraspirifer</i> sp.	X	X		X?		X?	
<i>Elytha colombiana</i> Caster	X	X		X		X	
<i>Atrypa barrisi</i> Caster	X	X	X	X		X	
<i>A. spinosa</i> var. <i>nasuta</i> Caster	X	X	X?	X?		0	
<i>A. spinosa</i> Hall		X				0	
<i>Ambocoelia pseudo-umbonata</i> Kozlowski		X?	X		X		
<i>Nucleospira concinna</i> Hall	X	X			X		
<i>Meristella wheeleri</i> Caster	X	X				X	
<i>Pentagonia gemmisulcata</i> Caster	X	X				X	
<i>Megastrophia hopkinsi</i> Caster	X	X					0
<i>Megastrophia pygmaea</i> Caster	X						
<i>Leptaena boyaca</i> Caster	X	X				0	
<i>Cymostrophia schucherti</i> Caster	X	X					

	1	2	3	4	5	6	7
<i>C. waringi</i> Caster	X						
<i>C. dickeyi</i> Caster	X	X					
<i>Strophodonta kozlouskii</i> Caster	X	X	X		X?	X	
<i>S. sp. aff. S. demissa</i> Hall		X					
<i>Strophonella meridionalis</i> Caster	X	X?		X		X	
<i>S. floweri</i> Caster	X						
<i>Schellwienella goldringae</i> Caster	X	X	X		X	X	X
<i>S. goldringae</i> var. <i>juvens</i> Caster	X				X?		X?
<i>Rhytistrophia caribbeana</i> var. <i>colombiana</i> Caster	X	X	X				
<i>Dictyostrophia cooperi</i> Caster	X	X	X			X	
<i>Spinulicosta spinulicosta</i> (Hall)	X					0	
<i>Chonetes billingsi</i> Clarke	X	X					
<i>C. stübeli</i> Ulrich	X	X			X	X	
<i>C. comstockii</i> Hartt	X						X
<i>C. venezuelensis</i> Weisbord	X?	X				X	
<i>Eodevonaria imperialis</i> Caster	X	X	X		0	X	
<i>E. imperialis</i> var. <i>transversa</i> Caster	X	X?				X	
<i>E. imperialis</i> var. <i>parva</i> Caster	X					X	
<i>E. reedi</i> Catter	X	X				X	
<i>Chonostrophia knodi</i> Caster	X						
<i>Rhipidomella liddlei</i> Harris		X	X			X	
<i>R. hybridoides</i> Clarke		X					
<i>Tropidoleptus carinatus</i> Conrad	X	X?	X		X	X	X
<i>Leptocelesia</i> sp.		X					
<i>Orthis</i> sp.	X	X?			0		X?
<i>Cyrtina hamiltoniensis</i> Hall	X	X					
<i>Cyrtina</i> sp.	X	X				0	0
<i>Amphigenia</i> n. sp?	X	X				0	
<i>Cryptonella</i> sp.	X?	X			0		
<i>Meganteris australis</i> Caster	X				X		
<i>Crammysia</i> sp.	X				0		0
<i>Actinopteria boydi</i> Conrad	X	X			0		
<i>Nuculites oblongatus</i> Conrad		X			X		X
<i>Cypricardinia subindenta</i> Weisbord	X	X				X	
<i>Aviculopecten wellsii</i> n. sp.	X					0	
<i>Platyceras</i> sp. aff. <i>P. nodosum</i> Hall	X						
<i>Platyceras</i> sp.	X	X			0	0	
<i>Platyostoma lineata</i> Conrad	X	X	X				0

	1	2	3	4	5	6	7
<i>«Orthoceras»</i> sp.	X		X?		0		
<i>Phacops salteri</i> Kozlowski	X	X	X		X	0	
<i>Odontopleura callicera</i> (Hall and Clarke)	X	X			X		0
<i>Cryphaeus</i> sp.	X				0		0
<i>Proetus</i> sp.	X						
<i>Dalmanites</i> sp.	X				0		0
<i>Acanthograptus</i> sp.	X						

Table 1.—The list of fossils includes all the species (exclusive of most bryozoa and ostracods) found by the writer in the Devonian strata of Floresta, Manaure and Gutiérrez. The tabulation shows the distribution of this fauna in the following localities: 1) Floresta Devonian, Colombia, South America. 2) Manaure Devonian, Colombia, South America. 3) Gutiérrez Devonian, Colombia, South America. 4) Santa Isabel Devonian, Colombia, South America. 5) Sicasica formation, Bolivia, South America. 6) Caño Grande formation, Venezuela, South America. 7) Ereré sandstone, Brasil, South America. The sing X and 0 indicate the presence of an identical or very closely related species respectively, in the locality.

THE MANAURE FAUNA

Mode of preservation.—Generally speaking most of the fossils found in Manaure are in a slightly better state of preservation than those from Floresta, even though they are found also as internal and external molds.

Here again, the original calcareous material has been removed by leaching. However, the preservation is good enough so that the internal morphology, as well as the external characteristics of some of the fossils, may be studied. In most of the brachiopods it is very easy to observe the shape, size, etc. of the muscle scars, the teeth and other internal features as well as the ornamentation of the shell (growth lines, micro-ornamentation, lamellae, etc.) on the external molds.

In the material collected by the writer the pelecypods and the gastropods are poorly preserved in contrast with the relatively well preserved brachiopods and phacopid trilobite molds.

General discussion.—The fauna of the Manaure Devonian is made up primarily of brachiopods and some bryozoans, and very scarce trilobites, pelecypods and gastropods, and one tabulate coral.

As previously stated, the Manaure and the Floresta faunas are identical in specific content. However, in Manaure bryozoans are a minor element, and neither tetracorals or graptolites have been found.

The most typical genera of the Manaure Devonian in order of abundance are: *Chonetes*, *Acrospirifer*, *Australospirifer*, *Shellwienella*, *Eodevonaria*, *Phacops*, *Elytha*, *Platyostoma*, *Fenestella*, *Pentagonia*, *Nucleospira*, *Cyrtina*, *Meristella*, *Nuculites*, etc.

From the collection made by the writer, the following species may be added to Renz's (1943, pp. 1293), list:

- Pleurodictyum americanum* Roemer
- * *Camarotoechia sappho* Hall
 - * *C. contracta* Hall ?
 - Brachyspirifer palmerae* Caster
 - * «*Spirifer*» *daleidensis* Steininger
 - Elytha colombiana* Caster
 - Atrypa harrisi* Caster
 - Atrypa harrisi* var. *nasuta* Caster
 - * *Atrypa spinosa* Hall
 - * *Ambocoelia pseudo-umbonata* Kozłowski
 - * *Nucleospira concinna* Hall
 - Meristella wheeleri* Caster
 - Pentagonia gemmisulcata* Caster
 - Megastrophia hopkinsi* Caster
 - Cymostrophia schucherti* Caster
 - Cymostrophia dickeyi* Caster
 - * *Strophodonta* sp. aff. *demissa* Hall
 - Schellwienella goldringae* Caster.
 - Rhytistrophia caribbeana* var. *colombiana* Caster
 - Dictyostrophia cooperi* Caster
 - Chonetes billingsi* Clarke
 - Chonetes stübeli* Ulrich
 - * *Chonetes venezuelensis* Weisbord
 - Eodevonaria imperialis* Caster
 - Eodevonaria reedi* Caster
 - * *Rhipidomella liddlei* Harris
 - * *Rhipidomella hibridoides* Clarke
 - * *Tropidoleptus carinatus* Conrad
 - * *Cyrtina hamiltoniensis* Hall
 - * *Amphigenia* sp.
 - * *Cryptonella* sp.
 - * *Actinopteria boydi* Conrad
 - * *Nuculitis oblongatus* Conrad
 - Cypricardinia subindentata* Weisbord
 - * *Platyostoma lineata* Conrad
 - Phacops salteri* Kozłowski
 - * *Odontopleura callicera* (Hall and Clarke)

The asterisks indicate those species new for the Colombian Devonian;
- indicates new specific stocks for South America.

Age and Relationship.—There is no question about the Mesodevonian age of the Manaure fauna and its «american» flavor.

As indicated in the foregoing pages, most of the Manaure Devonian species (table I) are identical to those of the Floresta Devonian. This is somewhat unexpected considering the distance (510 kilometers) separating both localities. These two deposits may be easily correlated on their faunal content. Of the 60 species known from Floresta and the 48 in Manaure, 40 species are common to both, without considering the bryozoans, and the ostracods are also very similar if not identical.

According to the author's lists, only 8 species from the Manaure Devonian are not found in Floresta; they are: *Camarotoechia sappho*, *Camarotoechia contracta*, *Atrypa spinosa*, *Leptocoelia* sp., *Strophodonta* sp. aff. *S. demissa*, *Chonetes venezuelensis*, *Rhipidomella liddle*, *Rhipidomella hybridoides* and *Nuculites oblongatus*.

On the other hand, the Floresta Devonian fauna contains 11 genera not found in the Manaure beds. They are: *Favosites*, *Heliophyllum*, *Leiorhynchus*, *Productella*, *Chonostrophia*, *Meganteris*, *Grammysia*, *Aviculopecten*, *Acanthograptus*, *Cryphaeus*, and *Proetus*.

As stated before, the Manaure Devonian seems to represent the same stratigraphic horizon as the Floresta Devonian beds, and according to its faunal content also represents the Lower and Middle Middle Devonian of Colombia, the equivalent of the Eifelian series in Europe and of the U. Ulsterian and L. Erian of North America. (Onondagan through middle Hamilton).

The tabulation (table I) brings out the close relationship between the Manaure and Gutiérrez faunas. The Devonian beds in Manaure contain all of the species found in the Gutiérrez Devonian strata up to the present time, with the exception of *Tropidoleptus carinatus*. However, the Gutiérrez fauna is so little known (16 species), and the localities are so far apart (figure 1), that it is not proper to anticipate any final conclusion until more material from Gutiérrez is collected.

The faunal assemblage of the Santa Isabel Devonian is basically the same as that of Manaure. Here again, all the species listed by Renz (1943, pp. 1291) from Santa Isabel were found by the writer in Manaure. However in this case the localities are relatively close (figure 1), and a very close relationship between both strata may be established based on faunal content as well as lithologic similarity (figure 3).

Elsewhere in South America, the Manaure fauna can also be correlated with Devonian faunas of Venezuela, Bolivia and Brazil.

In Venezuela, the Caño Grande formation (Río Cachimí series) has been correlated with the Manaure Devonian strata. This correlation can be based not only on the faunal but on lithologic similarity. This may be accounted for by the vicinity of the localities. The Río Cachimí Series has been described at about 80 kilometers northeast of Manaure. However, it is curious that the Manaure Devonian fauna seem to be more closely related to the Floresta fauna than to the Río Cachimí fauna, in spite of the Great distance (510 kilometers) between Floresta and Manaure, and the relatively short distance separating Manaure and the Caño Grande formation.

Half of the species found by the writer in the Manaure beds are present in the Venezuelan Devonian fauna. Most of the other half is made up of typical Floresta species not found in the Venezuelan formation (table I). On the other hand, the Caño Grande formation contains 7 species of corals contrasting with the single tabulata coral found in Manaure.

It is clear that these Devonian strata are time equivalents, representing

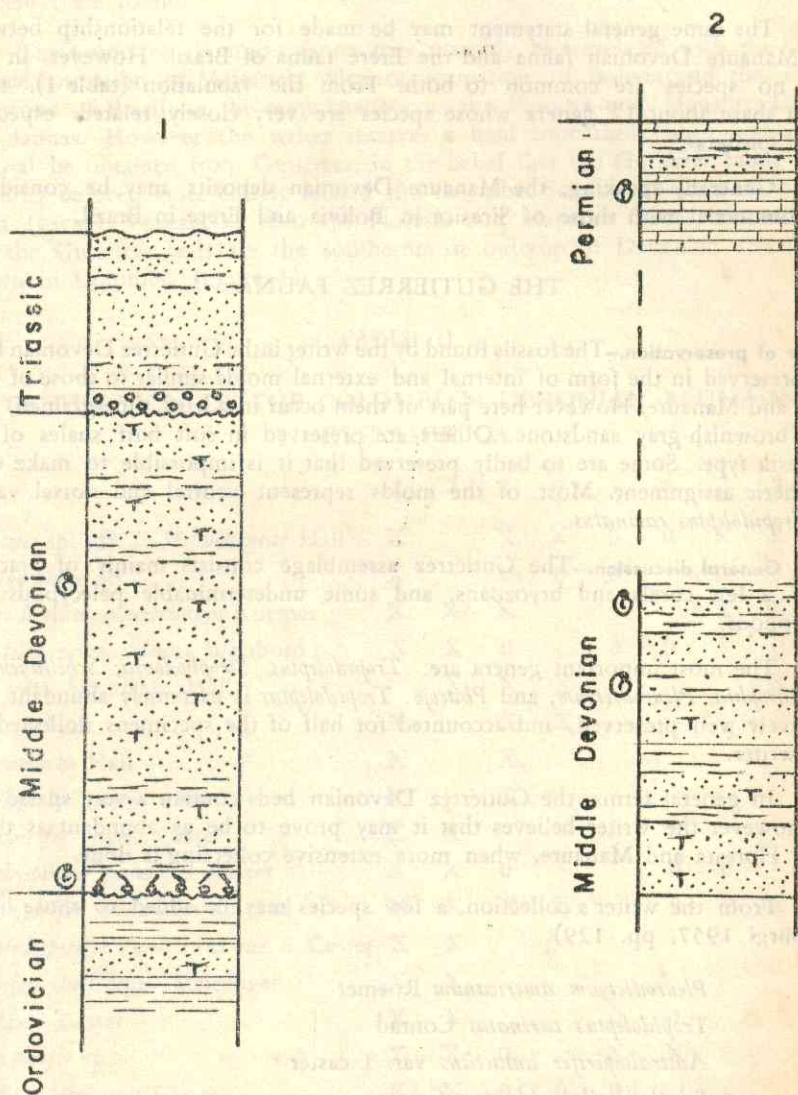


FIGURE 3.—Generalized Stratigraphic Columns of the Devonian. 1) South of Santa Isabel. 2) East of Manaure (After Renz, Scale 1 : 10,000).

a near shore marine environment. The slight differences in faunal content may be due to a facies change.

The tabulation (table I) also brings out the relationship existing between the Colombian Manaure Devonian fauna and the Bolivian Sicasica fauna. Although they only share four species: *Ambocoelia pseudo-umbonata*, *Chonetes stübeli*, *Nuculites oblongatus*, and *Phacops salteri*, they may be correlated on the basis of species affinities and generic similarities, considering the tremendous distance (figure 5) separating the localities.

The same general statement may be made for the relationship between the Manaure Devonian fauna and the Ereré fauna of Brazil. However, in this case no species are common to both. From the tabulation (table I), these strata share about 12 genera whose species are very closely related, especially the «Spirifers».

Generally speaking, the Manaure Devonian deposits may be considered as homotaxial with those of Sicasica in Bolivia and Ereré in Brazil.

THE GUTIERREZ FAUNA

Mode of preservation.—The fossils found by the writer in the Gutiérrez Devonian beds are preserved in the form of internal and external molds similar to those of Floresta and Manaure. However here part of them occur in a hard, fine-grained, gray and brownish-gray sandstone. Others are preserved in soft buff shales of the Floresta type. Some are so badly preserved that it is impossible to make even a generic assignment. Most of the molds represent ventral and dorsal valves of *Tropidoleptus carinatus*.

General discussion.—The Gutiérrez assemblage consists mainly of brachiopods, a few corals and bryozoans, and some undeterminable pelecypods and gastropods.

The most important genera are: *Tropidoleptus*, *Strophodonta*, *Schellwienella*, *Rhytistrophia*, *Pleurodictyum*, and *Phacops*. *Tropidoleptus* is extremely abundant and relatively well preserved, and accounted for half of the specimens collected by the writer.

In general terms, the Gutiérrez Devonian beds contain a very sparse fauna, however the writer believes that it may prove to be as abundant as those from Floresta and Manaure, when more extensive collecting is done.

From the writer's collection, a few species may be added to those listed by Bürgl 1957, pp. 129):

- Pleurodictyum americanum* Roemer
- Tropidoleptus carinatus* Conrad
- Australospirifer antacticus* var. 1 caster
- Schellwienella goldringae* Caster
- Rhytistrophia caribbeana* var. *colombiana* Caster
- Rhipidomella liddlei* Harris

Platyostoma lineata Conrad

Phacops salteri Kozłowski

Age and Relationship.—Judging from the 16 species known at present, a Middle Devonian age may be assigned to the Gutiérrez beds. The faunal assemblage includes almost an equal mixture of «American» and «Austral» elements, all of them represented in both, the Manaure and Floresta strata, and it is reasonable to believe that these deposits are coeval, at least those beds in which the cited faunas are found.

The Gutiérrez Devonian fauna may possibly be correlated with the Caño Grande formation of Venezuela, Sicasisa formation of Bolivia and the Ereré Sandstone of Brasil, in the same manner as the Floresta and Manaure Devonian faunas. However the writer reserves a final conclusion until additional material be obtained from Gutiérrez, in the belief that the Gutiérrez fauna may prove to be even more closely related tho the other South American Devonian strata (except Venezuela) than the Floresta and Manaure faunas, considering that the Gutiérrez beds are the southernmost outcrop of Devonian strata yet known in Colombia (figure 1).

TABLE II

DISTRIBUTION OF THE COLOMBIAN DEVONIAN FAUNA IN
NORTH AMERICA

	1	2	3	4	5	6	7	8
<i>Favosites</i> sp. aff. <i>F. Hamiltoniae</i> Hall	X		X	X	0	0	X	X
<i>Heliophyllum</i> sp.	X		0	0	0		0	0
<i>Pleurodictyum americanum</i> Roemer	X	X?	X				X	X
<i>Fenestella venezuelensis</i> Weisbord	X	X	0		0	0		0
<i>Camarotoechia sappho</i> Hall		X	X	X				X
<i>C. dotis</i> Hall	X		X	X				
<i>C. contracta</i> Hall	X		X					
<i>Leiorhynchus mysia</i> Hall	X		X					
<i>Acrospirifer olsoni</i> Caster	X	X						
<i>Brachyspirifer palmerae</i> Caster	X	X	0			0	0	
<i>Mediospirifer audaculus</i> Conrad	X	X?	X	X		0	0	X
<i>Australospirifer antarcticus</i> var. 1 Caster	X	X						
« <i>Spirifer</i> » <i>daleidensis</i> Steininger	X?	X						
« <i>S</i> » <i>kingi</i> Caster	X	X			0	0		
<i>Paraspirifer</i> sp.	X	X?	0		X?	X?		
<i>Elytha colombiana</i> Caster	X	X	0	0	0		0	
<i>Atrypa harrisi</i> Caster	X	X	0		0	0	0	0
<i>A. harrisi</i> var. <i>nasuta</i> Caster	X	X	0		0	0	0	0

	1	2	3	4	5	6	7	8
<i>A. spinosa</i> Hall		X	X		X		0	X
<i>Ambocoelia pseudo-umbonata</i> Kozlowski	X?	X	X	X	X			X
<i>Nucleospira concinna</i> Hall	X	X	X	X	X			X
<i>Meristella wheeleri</i> Caster	X	X	0	0	0	0	0	
<i>Pentagonia gemmisulcata</i> Caster	X	X	X?	X	0			X
<i>Megastrophia hopkinsi</i> Caster	X	X	0		0		0	0
<i>Megastrophia pygmaea</i> Caster	X							
<i>Leptaena boyaca</i> Caster	X	X	0		0	0	0	0
<i>Cymostrophia schucherti</i> Caster	X	X			0			
<i>C. waringi</i> Caster	X				0			
<i>C. dickeyi</i> Caster	X	X			0			
<i>Strophodonta kozlowskii</i> Caster	X	X	0			0	0	0
<i>S. sp. aff S. demissa</i> Hall.	X	X			X	X	0	0
<i>Strophonella meridionalis</i> Caster	X	X?						
<i>S. floweri</i> Caster	X							
<i>Schellwienella goldringae</i> Caster	X	X						
<i>S. goldringae</i> var. <i>juvens</i> Caster	X							
<i>Rhytistrophia caribbeana</i> var. <i>colombiana</i> Caster	X	X						
<i>Dictyostrophia cooperi</i> Caster	X	X						
<i>Spinulicosta spinulicosta</i> (Hall)	X		X	X			0	X
<i>Chonetes billingsi</i> Clarke	X	X	0	0				0
<i>C. stübeli</i> Ulrich	X	X						
<i>C. comstockii</i> Hartt	X	0	0		0		0	0
<i>C. venezuelensis</i> Weisbord	X?	X						
<i>Eodevonaria imperialis</i> Caster	X	X			X			
<i>E. imperialis</i> var. <i>transversa</i> Caster	X	X?			0			
<i>E. imperialis</i> var. <i>parva</i> Caster	X				0			
<i>E. reedi</i> Caster	X	X						
<i>Chonostrophia knodi</i> Caster	X				0			
<i>Rhipidomella liddlei</i> Harris	X	0					0	0
<i>R. hibridoides</i> Clarke	X							
<i>Tropidoleptus carinatus</i> Conad	X	X?	X	X				X
<i>Leptocoelia</i> sp.		X						
<i>Orthis</i> sp.	X	X?						
<i>Cyrtina hamiltonensis</i> Hall	X	X	X	X			X	X
<i>Cyrtina</i> sp.	X	X	X?	X?			0	0
<i>Amphigenia</i> n. sp. ?	X	X			X?			

	1	2	3	4	5	6	7	8
<i>Cryptonella</i> sp.	X?	X	0	0			0	0
<i>Meganteris australis</i> Caster	X							
<i>Grammysia</i> sp.	X		X?	X?			0	X?
<i>Actinopteria boydi</i> Conrad	X	X	X	X			0	X
<i>Nuculites oblongatus</i> Conrad		X	X	X			0	
<i>Cypricardinia subindenta</i> Weisbord	X	X	X	X				X
<i>Aviculopecten wellsi</i> n. sp.	X		0			0	0	0
<i>Platyceras</i> sp. aff. <i>P. nodosum</i> Hall	X				X?			
<i>Platyceras</i> sp.	X	X	X?	X?	X	X		X?
<i>Platystoma lineata</i> Conrad	X	X	X		X			X
« <i>Orthoceras</i> » sp.	X		0	0	0			0
<i>Phacops salteri</i> Kozłowski	X	X	0	0	0		0	0
<i>Odontopleura callicera</i> (Hall and Clarke)	X	X	X		X			
<i>Cryphaeus</i> sp.	X		0	0	0			0
<i>Proetus</i> sp.	X				0		0	
<i>Dalmanites</i> sp. ?	X							
<i>Acanthograptus</i> sp.	X							

Table II.—The list of fossils in table II includes all the species (exclusive of most bryozoa and ostracods) found by the writer in the Devonian beds of Floresta, Manaure and Gutiérrez. The tabulation shows the distribution of the Colombian Devonian fauna in the following localities:

1) Floresta Devonian, Colombia, South America. 2) Manaure Devonian, Colombia, South America. 3) Hamilton group (Middle Devonian), New York State, United States, North America. 4) Centerfield limestone (Hamilton group), New York State, U.S., North America. 5) Onondaga limestone (Lower Middle Devonian), New York State, U.S., North America. 6) Jeffersonville limestone, Indiana, U.S., North America. 7) Traverse group (Middle Devonian), Michigan, U.S., North America. 8) Thedford-Arkona region (Middle Devonian) of South Western Ontario, Canada, North America.

As in table I the signs X and 0 indicate the presence of identical or very closely related species respectively.

RELATIONSHIP BETWEEN THE COLOMBIAN AND NORTH AMERICAN DEVONIAN

In 1939 Caster, after studying the first collection of fossils (except bryozoans) from the Floresta Devonian beds, came to the conclusion that the fauna resembled that of the early Onondagan of the North American Devonian. In 1942, based on additional material, he stated (1942, pp.34) that the fauna is either Onondagan (Ulsterian) or Hamiltonian (Erian). The main reason for Caster's belief

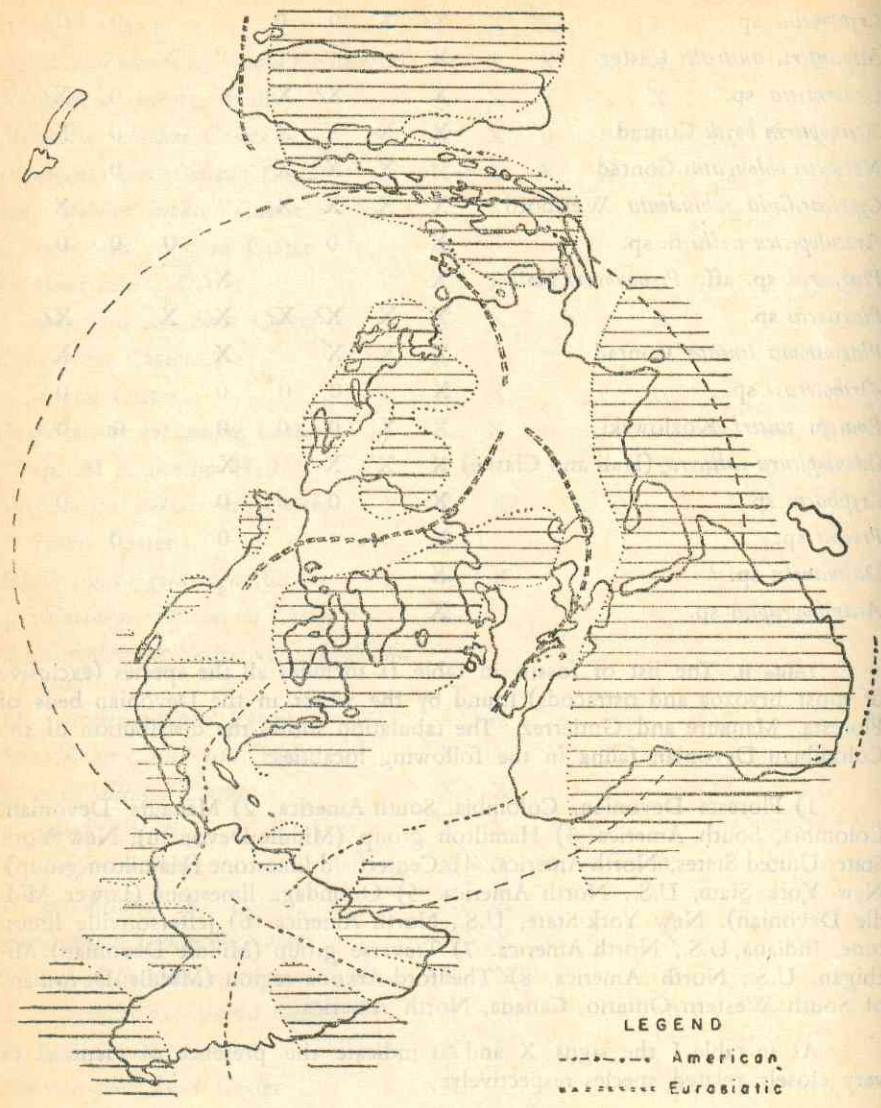


FIGURE 4.—Middle Devonian Faunal Provinces.

in the Onondagan affinity of the Floresta fauna was its close relationship with the Jeffersonville limestone fauna at the Falls of the Ohio (Indiana), considered to be an equivalent of the Onondaga limestone of New York. However Oliver (1960, pp. 174), based on coral studies, suggests that the basal 4 feet of the Jeffersonville limestone at the Falls of the Ohio is correlative with the Pre-Edgecliff *Amphigenia* zone of western New York, and therefore may be of late Early Devonian age.

In 1940 McNair, after study of the unique bryozoan fauna of the Floresta Devonian, believed that this fauna is more closely related to the Hamilton than to the Onondagan, although he stated (1940, pp. 6) that this may be in part accounted for by the fact that Hamilton bryozoans are better known than those from earlier Middle Devonian strata.

The writer agrees with both conclusions. There is no question about the strong similarity existing between the Colombian Devonian faunas of Floresta, and those of northeastern United States, but is difficult to determine their exact equivalence. In some features, for instance the presence of *Mediospirifer audaculus*, *Nucleospira concinna*, *Productella spinulicosta*, *Tropidoleptus carinatus*, and *Pleurodictyum americanum* the fauna is identical with that of the Hamilton (especially the Conterfield member), while in the occurrence of *Amphigenia* sp. and several species of *Eodevonaria* it approaches the early Onondagan.

The tabulation (table II) shows that the Floresta as well as the Manaure faunas contain some of the most typical Hamilton species. The Floresta and the Hamilton Devonian faunas share the following: *Favosites hamiltoniae*, *Heliophyllum* sp., *Leiorhynchus mysia*, *Camarotoechia dotis*, *Mediospirifer audaculus*, *Nucleospira concinna*, *Spinulicosta spinulicosta*, *Tropidoleptus carinatus*, *Cyrtina hamiltoniensis*, *Actinopteria boydi* and *Platystoma lineata*.

In addition to these common species, both faunas contain very closely related species of the following genera: *Megastrophia*, *Dictyostrophia*, *Strophodonta*, *Atrypa*, *Meristella*, *Pentagonia*, *Elytha*, *Ambocoelia*, *Cryptonella*, *Cypricardinia* and *Grammysia*.

These lists include more than 60% of the species classified by the author for Floresta (60 in number, not including bryozoans and ostracods). Thus despite the great distance between Floresta and the type locality of the Hamilton group (New York State), there can be no doubt of the close relationship between the Devonian faunas of these localities. The «American» faunal aspect of the Floresta fauna is almost entirely represented in the New York Middle Devonian group and equivalents in North America such as the Traverse group of Michigan.

On the other hand, the Floresta fauna also can be correlated to some extent with the Onondagan of North America. This is primarily based on the presence of the several species of *Eodevonaria*, *Amphigenia*, and *Proetus*, which are not found in the Hamilton group, and are very closely related in both Devonian beds.

In addition these faunas also share some species which, although more typical of the Hamilton group, are also found in the Onondaga, *Nucleospira concinna* and *Platystoma lineata*. Both faunas also share the presence of the follo-

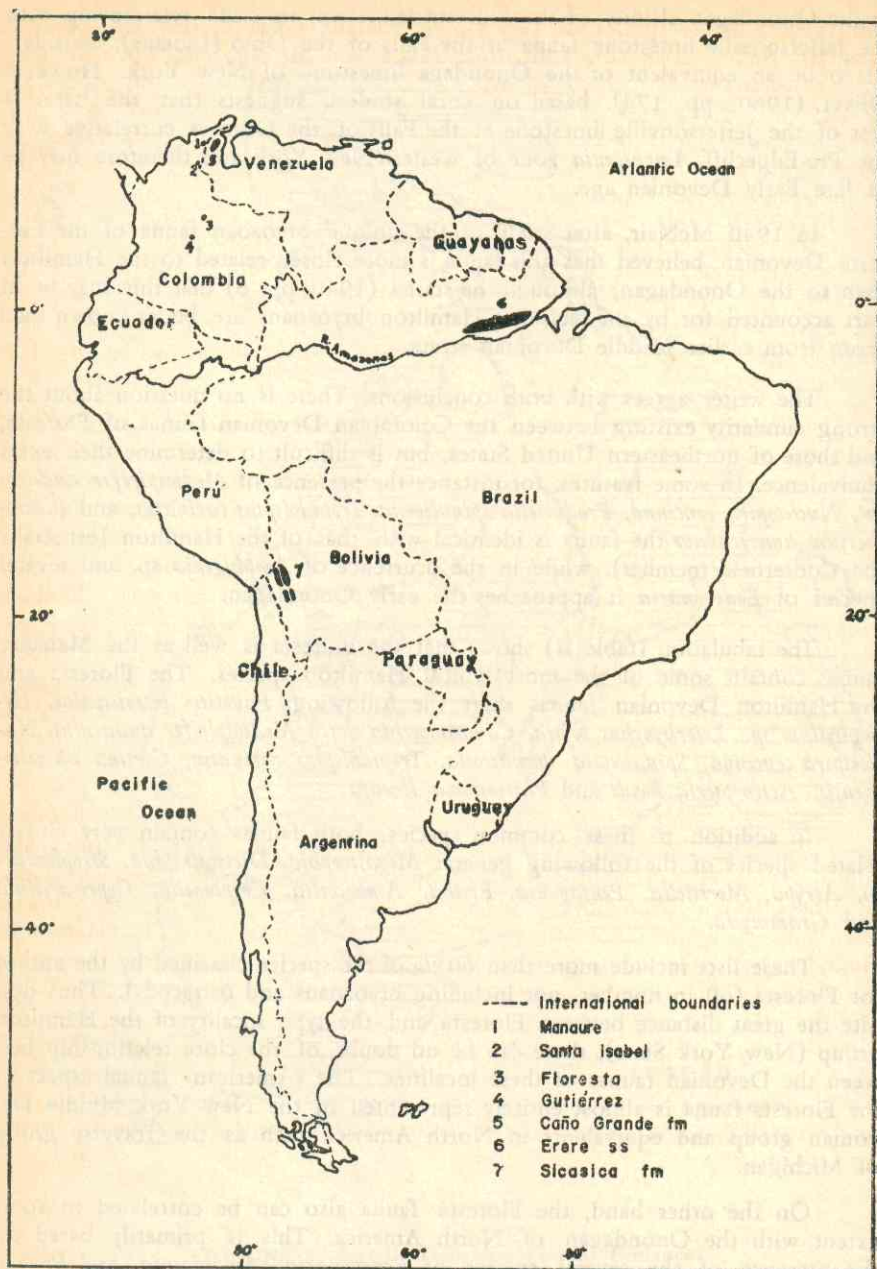


FIGURE 5.—Middle Devonian Outcrops in South America.

wing genera whose species are very closely related: *Favosites*, *Heliophyllum*, *Paraspirifer*, *Atrypa*, *Ambocoelia*, *Meristella*, *Pentagonia*, *Megastrophia*, *Leptaena*, *Chonetes*, *Chonostrophia*, *Platyceras*, *Phacops*, *Cryphaeus* and *Proetus*.

Even though there is a stronger affinity between the Floresta Devonian fauna and that of the Hamilton, it seems that the fauna represents both the Onondagan and the Hamilton faunas of North America.

The tabulation (table II) also brings out the relationship between the Floresta Devonian fauna and that of the Traverse group of Michigan (equivalent to the Hamilton of New York State), as well as the strong similarity between the Colombian and the Middle Devonian fauna of southwestern Ontario, (Theford-Arkona region), Canada, which are also equivalent of the Hamilton group.

An almost identical relationship may be established for the Manaure fauna. In addition to those Devonian species found in both Floresta and Manaure, the presence only in the Manaure assemblage of *Camarotoechia sappho*, *Atrypa spinosa*, *Strophodonta* sp. aff. *S. demissa* and *Nuculites oblongatus*, corroborates a Hamilton affinity. From 48 species known in the Manaure Devonian, about 75% are identical or very closely related to North American Hamiltonian species. The remaining 25% basically are made up of typical Colombian strophomenids and Eurasiatic elements. Here again, the presence of some genera like *Eodevonaria* and *Amphigenia*, in addition to other species very closely related to the Lower Middle Devonian forms of North America, also suggests a close affinity between the Manaure and Onondaga faunas. On the other hand, the presence of a single species of *Leptoecelia* suggests an even earlier Devonian relationship.

The Gutiérrez Devonian fauna shows only two species, *Pleurodictyum americanum* and *Tropidoleptus carinatus*, found also in the North American Hamilton group. However, closely related species found in both Devonian beds, and the fact that the Gutiérrez species are found in the Floresta and Manaure beds, suggests a possible relationship between the North American (Hamilton-Onondaga) and the Gutiérrez Devonian faunas. This may be proved when more material from the Gutiérrez Devonian is available.

OTHER DEVONIAN FAUNAS FROM COLOMBIA

The Santa Isabel Devonian fauna, as determined by Emeis (Shell Paleontologist) consists of:

Acrospirifer olssoni Caster

A. sp. (n. sp. ?)

Elythra colombiana Caster

Atrypa harrisi Caster

Strophnella meridionalis Caster

Anaplothea (?) *silvetti* (Ulrich)

Meganteris australis Caster

Spirifer kingi Caster

and 7 different species of *Spirifer*.

As stated on previous pages, these species are found in Floresta and Manaure, and it is clear that this faunal assemblage, when better known, will prove identical or almost identical to those of Floresta and Manaure. The writer had the opportunity of visiting some of the Devonian outcrops south of Santa Isabel, but lack of time prevented the extensive collection of fossils from this locality.

Devonian fossils have been also reported from the Ubalá, Gachalá, Farrallones de Medina area, but no further study on them has been published. The following species, from this region are listed by Bürgl (1957, pp. 129):

Coronura ? sp.

Strophodonta aff. *demissa* Hall

Pentagonia gemmisulcata Caster

Scaphiocoelia boliviensis Whitefield

Spirifer (*Fimbrispirifer*?) *chuquisaca* Ulrich

Brachyspirifer audaculus zulianus Weisbord

Acrospirifer sp.

Elytha aff. *colombiana* Caster

Fenestella venezuelensis Weisbord

Cvathophyllum venezuelense Weisbord

In addition to these faunas, in 1917 Scheibe discovered a loose boulder of fossiliferous graywacke north of Villavicencio, in central Colombia. Schmidt in 1938 described a new crinoid, *Bogotacrinus scheibei*, from this boulder, and considered it to be either Silurian or Lower Devonian.

DESCRIPTIONS OF SPECIES NEW TO THE COLOMBIAN DEVONIAN

Genus *Pleurodictyum* Goldfuss 1829

Pleurodictyum americanum Roemer 1876

Plate I, figures 1-3

Pleurodictyum americanum Roemer 1876, *Lethaea Paleoz.*, pl. 23, figures 2a-b.

Pleurodictyum americanum Ross 1953, *Buffalo Soc. Nat. Sci.*, p. 76, pl. 23, figures 4-9, Vol. 21.

Description.-- Four specimens, all internal molds are present in the collection, and characterized by their elliptical to discoidal outline, consisting of about 24 to 32 hexagonal corallites, those at the periphery inclined toward the base of the colony. Diameter of the colonies: maximum 15 to 34 mm., minimum 15 to 24 mm. In the base of the colony there is a irregularly sinuous serpulid tube located eccentrically between the corallites which are molded a

round it. The diameter of the calices varies from 1 to 5 mm. Mural pores present; striae prominent on corallite walls.

These specimens were at first classified as *Pleurodictyum amazonicum* Kater, but further investigation suggested by Wells, indicated no specific differences with *Pleurodictyum americanum*, after comparison with specimens (No. 39227) at the Cornell Paleontological Laboratory.

Distribution.—Colombia: Floresta, Manaure and Gutiérrez.

Elsewhere: North America and South America (Bolivia).

Range.—Middle Devonian.

Genus *Favosites* Lamarck 1816

Favosites sp. aff. *F. hamiltoniae* Hall 1877

Plate I, figures 4-5

Favosites hamiltoniae Hall 1877, III. *Dev. Foss.*, N. Y. *Geol. Surv.*, pl. XXXIV, figures 1-9.

Description.—This species is represented by two poorly preserved specimens characterized by large massive coralla (20 cm. in diameter). Corallites prismatic, about 3 mm. in diameter. Mural pores not observed, probably because of the state of preservation. Tabulae well developed, generally flat and about 1 mm. apart.

Distribution.—Colombia: Floresta.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *Camarotoechia* Hall and Clarke 1893

Camarotoechia sappho (Hall) 1860

Plate II, figure 1

Rhynchonella sappho Hall 1860, *Thirteenth Report on the State Cabinet*, p. 87.

Camarotoechia sappho Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 311, pl. 118, figures 57-61.

Description.—This species is represented by a single specimen, a mold of the dorsal valve. Trigonal in outline, width about 11 mm., length 10 mm., surface bearing coarse uniplicate costae. Five costae in the sulcus. Larger than *C. dotis* and lacking cardinal process. Dorsal interior with divided hinge plates. The specimen is so badly preserved that further details can not be given. *C. sappho* is generally triangular in shape, with shallow ventral valve and strongly convex dorsal valve, the segment of hinge plate attached to median septum by supporting plates making a short, small cruralium often covered by growth of inner hinge plates.

Distribution.—Colombia: Manaure.

Elsewhere: North America.

Range.—Middle Devonian.

Camartoechia dotis Hall

Plate II, figure 2

Rhynchonella (Stenocisma) dotis Hall 1867, *Paleont. of N. Y.*, Vol. IV, p. 344, pl. 54, figs. 11-20.

Camartoechia dotis Hall 1894, *Paleontont. of N. Y.*, Vol. VIII, part. II, p. 192, pl. 57, figs. 40-41.

Description.-- Smaller than *C. sappho*, represented in the collection by a single specimen, triangular in outline with a shallow sulcus bearing three costae. Twelve subangular costae on the flanks. Width 8 mm., length 10 mm. Ventral valve relatively flat. Dorsal valve not observed.

Distribution.-- Colombia: Floresta.

Elsewhere: North America and South America (Brasil, Venezuela?).

Range.-- Middle Devonian.

Camartoechia contracta (Hall) 1843

Plate II, figure 3

Atrypa contracta Hall 1843, *Report on the Fourth Geol. District, N.Y.*, pl. LXII, figure 3a.

Rhynchonella (Stenocisma) contracta Hall 1867, *Paleont. of N.Y.*, Vol. IV, p. 351, pl. LV, figures 26-39.

Camartoechia contracta Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 311, pl. 118, figs. 54-56.

Description.-- A single specimen in a bad state of preservation represents probably this species. Shell subelliptical in outline attaining a width of 14 mm. and marked by about twenty angular plications. Fold with five costae and sinus with about four. Length of the shell about 11 mm.

Distribution.-- Colombia: Manaure.

Elsewhere: North America.

Range.-- Middle? and Upper Devonian.

Genus *Leiorhynchus* Hall 1860

Leiorhynchus mysia Hall 1867

Plate II, figure 4

Leiorhynchus mysia Hall 1867, *Paleont. of N. Y.*, Vol. IV, p. 357, pl. LVI, figures 1-5.

Description.-- The single specimen found is very small, 3 mm. wide and about 2.5 mm. long, circular in form with 3 strong plications on each side of the sinus, reaching half way from the margin to the beak of the shell. A sin-

gle stronger plication in the sinus. In general, this species is usually less than 9.5 mm. in length, with a width a little greater. Hall reported a individual nearly 6 mm. in length.

Distribution.—Colombia: Floresta.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *Mediospirifer* Bublichenko 1956

Mediospirifer audaculus (Conrad) 1842

Plate II, figure 5

Delthyris audaculus Conrad 1842, *Journ. Acad. Nat. Sci., Phila.*, Vol. 8, p. 262.

Spirifer audaculus Hall 1894, *Paleont. of N. Y.*, Vol. VIII, p. 24, pl. 24, figures 1-13.

Brachyspirifer audaculus Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 323, pl. 123, figures 12-13.

Mediospirifer medialis Bublichenko 1956, *Isuest. Akad. Nauk. Kazakhskoj, Ser. Geol.*, Vyp. 23, p. 93.

Description.—This typical M. Devonian species is characterized by its acute cardinal extremities and long ventral palintrope. The single specimen observed is about 40 mm. wide, with a rather narrow, rounded and moderately high fold. About twenty-two rounded smooth costae on each flank. Dorsal interior with a median septum. Ventral interior not seen.

Distribution.—Colombia: Floresta, Manaure?, and Santa Isabel?

Elsewhere: Widespread; North America, South America (Venezuela and Bolivia), Europe and Asia.

Range.—Middle Devonian.

Genus *Spirifer* Sowerby 1814

«*Spirifer*» *daleidensis* Steininger

Plate II, figures 6-8

«*Spirifer*» *daleidensis* Kayser 1878, *Fauna der ältesten Dev. Abl. Harzes*, p. 174, taf. 35, figure 4.

«*Spirifer*» *daleidensis* Kayser 1889, *Die Fauna des Hauptquartzite und Zorger Schiefer des Unterharzes*, p. 27, taf. I, figures 5-6.

Description.—Two specimens. Shell of medium size, about 25 mm. wide, length 20 m., with rounded lateral margins. Completely costate, and characterized by dichotomous costae occurring not only on the margins but also on the sinus and fold (not observed; only ventral valve seen), marked by small

rod-shaped papillae in a zig-zag pattern. Six subrounded costae in the sinus and about 9 on each side.

Distribution.—Colombia: Manaure.

Elsewhere: Europe (Harz).

Range.—Middle Devonian.

Genus *Atrypa* Dalman 1828

Atrypa spinosa Hall 1843

Plate III, figure 6

Atrypa spinosa Hall 1843, *Report on the Fourth Geol. District of N. Y.*, p. 200, figures 1-2.

Atrypa spinosa Hall 1867, *Paleont. of N. Y.*, Vol. IV, p. 233, pl. LIII A, figures 2-14.

Atrypa spinosa Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 319, pl. 121, figures 4-5.

Description.—This species is represented by the mold of a ventral valve which is nearly flat, subcircular, costate, and concentrically lamellose. Width 24 mm., length 20 mm. Surface marked by spines (not seen in the specimen) at intersection of costae and lamellae. Costae stronger in the middle of the valve, about 20 on the ventral valve. Ventral interior with large flabellate muscle field as in all the species of *Atrypa*.

Distribution.—Colombia: Manaure.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *Ambocoelia* Hall 1860

Ambocoelia pseudo-umbonata Kozłowski 1923

Plate III, figure 1

Ambocoelia umbonata Conrad in Knod 1908, *Dev. Faunen Boliviens*, p. 551.

Ambocoelia pseudo-umbonata Kozłowski 1923, *Annales de Paleont.*, p. 95, pl. IX, figures 1-9.

Description.—Very similar to *A. umbonata* of the North American Devonian. Subpentagonal in outline, ventral valve strongly convex with narrow sulcus. Dorsal valve (not present in the collection) concave and always provided with a shallow sinus (lacking in *A. umbonata*). Beak incurved, hinge line narrow. According to Kozłowski (1923, pp. 95) in *A. umbonata* the two pairs of adductor muscles are nearly equal and very close to one another, but in *A. pseudoumbonata* the posterior impressions are much smaller than the anterior ones; both pairs elongated in the anterior posterior direction.

Distribution.—Colombia: Floresta and Manaure

Elsewhere: South America (Bolivia)

Range.—Middle Devonian

Genus *Strophodonta* Hall 1850

Strophodonta sp. aff. *S. demissa* (Conrad) 1842

Plate III, figure 2

Strophodonta demissa Conrad 1842, *Journ. Acad. Nat. Sci., Phill.*, Vol. VIII, p. 258, pl. 14, figure 14.

Strophodonta demissa Hall 1867, *Paleont. of N. Y.*, Vol. VI, p. 101, pl. IXX, figures 8-12.

Strophodonta demissa Shimer and Shorock 1944, *Index Foss. of N. A.*, p. 339, pl. 131, figures 12-14.

Description.—This concavo-convex brachiopod is represented by a single internal ventral mold. Shell subrectangular in outline. Hinge line straight, 30 mm. wide, and completely denticulated. Ventral muscular area broadly flabellate. Dorsal valve not present.

Distribution.—Colombia: Manaure.

Elsewhere: North America

Range.—Middle Devonian.

Genus *Nucleospira* Hall 1859

Nucleospira concinna Hall 1843

Plate III, figures 4,5,9

Atrypa concinna Hall 1843, *Geol. Report Fourth District N. Y.*, p. 100, figure 3.

Nucleospira concinna Hall 1864, *Paleont. of N. Y.*, Vol. VIII, p. 142, pl. 48, figures 12-34.

Nucleospira concinna Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 331, pl. 127, figures 5-7.

Description.—Represented by 3 specimens characterized by their small size and broadly elliptical outline. Beak small; cardinal area of ventral valve low and obscured by the incurvature of the beak. Hinge line very short, cardinal extremities rounded. Surface covered with short spines. Median septum extending from delthyrial cavity nearly to the anterior. Width 10-11 and 13 mm.; length 11-10 and 12 mm. respectively.

Distribution.—Colombia: Floresta and Manaure.

Elsewhere: North America

Range.—Middle Devonian.

Genus *Spinulicosta* Nalivkin 1937

Spinulicosta spinulicosta (Hall) 1857

Plate III, figures 7-8

Productus spinulicosta spinulicosta Hall 1857, *10th Report on the State Cab.*, p. 173, pl. 23, figures 6-8.

Productella spinulicosta Hall 1867, *Paleont. of N. Y.*, Vol. IV, p. 160, pl. 23, figures 6-8.

Spinulicosta spinulicosta Muir-Wood and Cooper 1960. *Geol. Soc. of Amer., Memoir 81*, p. 153, pl. 32, figures 1-4, pl. 33, figures 1-17.

Description.—Characterized by its semielliptical shape, surface marked by strong concentric lines and several rows of interrupted spine bases and ears strongly wrinkled with four or five spines. Shell concavo-convex, ventral valve strongly convex, resupinate. Dorsal valve (not present in the collection) with erect lobate cardinal process and usually without spines. This species is relatively abundant in the Floresta Devonian beds. Width-8-7 and \pm 13 mm.; length-9-10 and \pm 15 mm. respectively.

Distribution.—Colombia: Floresta.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *Chonetes* Fischer 1837

Chonetes venezuelensis Weisbord 1926

Plate III, figures 10-11

Chonetes venezuelensis Weisbord 1926, *Bull. Amer. Paleont.* Vol. 2, No 46, p. 14, pl. 3, figures 4-7.

Description.—Two specimens representing this species were collected. Their characteristics match Weisbord's description of the type specimens: Shell of medium size, semicircular in outline with straight hinge line slightly shorter than the width of the shell. Ventral valve convex. Dorsal valve nearly flat with a slight central inflation, and barely sulcate. Beak small and appressed. Surface marked by radial riblets separated by interspaces equally as wide, ribs ornamented by small spines which are better developed laterally than centrally. The dimensions in the Colombian specimens are:

Width	Length
17 mm.	14 mm.
12 mm.	9 mm.

No cardinal spines were observed in these specimens.

Distribution.—Colombia: Manaure, Floresta?.

Elsewhere: South America (Venezuela).

Range.—Low and Middle Devonian.

Chonetes comstockii Hartt 1874

Plate IV, figures 1-2

Chonetes comstockii Hartt 1874, *Buffalo Soc. Nat. Sci.*, Vol. 2, p. 250, pl. IX, figures 5, 14, 18, 19 and 31.

Chonetes comstockii Katzer 1903, *Geol. des unteren Amazon.* p. 194, taf. XII, figures 2a-b.

Description.—This concavo-convex brachiopod is represented in the collection by a single specimen, a ventral valve of medium size, width about 14 mm., length 8 mm. Hinge line straight and about of the same length as the greatest wide of the shell. Beak small and depressed. Shell slightly convex, subquadrate in outline, lateral margins rounded, marked by very fine, low, rounded, costellate. Spines not observed.

Distribution.—Colombia: Floresta.

Elsewhere: South America (Brasil).

Range.—Devonian.

Genus *Rbipidomella* Oehlert 1890

Rbipidomella hybridoides Clarke 1907

Plate IV, figure 3

Rbipidomella hybridoides Clarke 1907, *N. Y. State Mus. Bull.*, 107, p. 282.

Rbipidomella hybridoides Clarke 1909, *N. Y. State Mus. Mem.* 9, part. II, p. 47, pl. 10, figures 19-28.

Description.—This species is represented by a single external ventral mold characterized by its circular shape and very narrow hinge line. Surface finely costellate. Ventral muscular area small, oval in outline. Width of the shell about 12 mm., length 11 mm. Dorsal valve not present.

Distribution.—Colombia: Manaure

Elsewhere: North America

Range.—Low and Middle Devonian

Rbipidomella liddlei Harris 1943

Plate IV, figure 4

Rbipidomella liddlei Harris 1943, *Bull. of Amer. Paleont.*, Vol. 27, p. 56, pl. 4, figures 1-3a.

Description.—A very badly preserved dorsal interior probably belonging to this species was found in the Manaure Devonian beds. Shell of medium size, nearly circular, width about 24 mm., height 20 mm. Surface of the shell bearing traces of a finely costellate ornamentation. Cardinal area very low. Muscular area nearly circular. The dorsal depression reported by Harris (1943, pp. 56) from the Venezuelan specimens is not clearly seen in the Colombian specimen.

Distribution.—Colombia: Manaüre.

Elsewhere: South America (Venezuela)

Range.—Low and Middle Devonian.

Genus *Tropidoleptus* Hall 1857

Tropidoleptus carinatus (Conrad) 1839

Plate IV, figures 5-11

Plate V, figures 1-4

Strophomena carinata Conrad 1839, *Annual Geol. Report*, p. 64.

Tropidoleptus carinatus Hall 1867, *Paleont. of N. Y.*, Vol. IV, p. 407, pl. 62, figures 2-3.

Tropidoleptus carinatus Hall 1894, *Paleont. of N. Y.*, Vol., VIII, p. 302, pl. 82, figures 26-36.

Tropidoleptus carinatus Hall Shimer and Shrock 1944, *Index Fos. of N. A.*, p. 359, pl. 140, figures 19-20.

Description.—Concavo-convex shell, subquadrate in outline. Hinge line equal to or less than the width of the shell, cardinal extremities rounded. Surface of the shell marked by coarse rounded ribs, costae. Internal layers of the shell perforate. Dorsal valve moderately concave, sometimes flat, and with median septum to which ends of the brachial process are united. There is a median depression or sinus, in some specimens, which becomes conspicuous below the middle of the dorsal valve. Cardinal process strong and wide, almost filling the foramen of the opposite valve. This species is very abundant in the Gutiérrez Devonian beds. A single specimen larger than those from Gutiérrez was found in Floresta.

The dimensions of some of the specimens are:

Width	Length
15 mm.	14 mm.
9.5 mm.	8 mm.
12.5 mm.	11 mm.
11 mm.	9 mm.
± 30 mm.	20 mm. (Floresta)

Distribution.—Colombia: Gutiérrez and Floresta.

Elsewhere: Widespread; North America, South America.

(Bolivia, Venezuela and Brasil), etc.

Range.—Middle and Upper Devonian.

Genus *Leptocoelia* Hall 1859

Leptocoelia sp.

Plate V, figures 5-6

Description.—One specimen, a ventral valve matching the general characteristics of the genus *Leptocoelia* was found, but no specific assignment is possible. Shell small, 9 mm. wide and with a length of 10 mm., coarsely costate with about 14 subrounded ribs, surface marked concentrically by imbricating lines of growth.

Distribution.—Colombia Manaure.

Elsewhere: North America.

Range.—Low and Middle Devonian.

Genus *Cyrtina* Davidson 1858

Cyrtina hamiltoniensis (Hall) 1857

Plate V, figures 7-8

Cyrtina hamiltoniensis Hall 1857, *10th Report on State Cabinet*, p. 166.

Cyrtina hamiltoniensis Hall 1867, *Paleont. of. N. Y.*, Vol. IV, p. 268, pl. 27, figures 23-53.

Cyrtina hamiltoniensis Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 359, pl. 140, figures 37-39.

Description.—Small, triangular-subpyramidal, with wide hinge line, and flat triangular delthyrium covered by a convex pseudodeltidium. Dorsal valve slightly convex with prominent median fold. Ventral valve with a long, deformed interarea whose length is almost equal to length of dorsal valve. Surface of the shell marked with coarse smooth costae. A deep sinus on ventral valve. Ventral interior with spondylium, the median septum appearing as a ridge on the spondylium. This species is relatively abundant in the Manaure Devonian. Not common in Floresta.

Dimensions:

Width	Length	
11 mm.	8 mm.	Dorsal valve
9 mm.	6 mm.	" "
8 mm.	5 mm.	" "
7 mm.	5 mm.	" "
13 mm.	12 mm.	Ventral valve

Distribution.—Colombia: Manaure and Floresta.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *Amphigenia* Hall 1867

Amphigenia n. sp.?

Plate VI, figures 1-5

Description.—The collection contains several specimens of the genus *Am-*

pbigenia which may represent more than one species. These will be studied in detail by Boucot (California Institute of Technology).

The specimens represent internal molds of the ventral valve. Shells are large, smooth, and elongate in outline, ventral interior characterized by a long spondylium supported by a strong median septum. Although the molds are not complete, it seems that the length and the width of the shell is more than 45 mm. in most of the specimens.

Distribution.—Colombia: Floresta and Manaure.

Elsewhere: North America?, South America (Venez. ?).

Range.—Devonian (genus).

Genus *Platyceras* Conrad 1840

Platyceras sp. aff. *P. nodosum* Conrad 1841

Plate VII, figure 4

Platyceras nodosum Conrad 1841, *Annual Report, Paleont. of N. Y.*, p. 56.

Platyceras nodosum Hall 1859, *Paleont. of N. Y.*, Vol. III, p. 473, pl. CXV, figures 1-6.

Platyceras nodosum Hall 1879, *Paleont. of N. Y.*, Vol. V, part II, p. 17, pl. VII, figures 4-5.

Description.—One badly preserved internal mold. Shell obliquely subovate, aperture rounded, surface marked by five nodes which indicate the places of short strong spines. These nodes in the Colombian specimens differ from those of the North American in being fewer, larger and coarser in the single specimen the apex is broken off, so that a single volution is preserved. Height about 24 mm. This specimen may represent a variety of *P. nodosum*, but additional material is needed to determine this.

Distribution.—Colombia: Floresta.

Elsewhere: North America.

Range.—Middle and Upper Devonian.

Sub-Genus *Platystoma* Conrad 1842

Platyceras (Platystoma) lineata Conrad

Plate VI, figure 6

Plate VII, Figures 1-3

Platystoma lineata Conrad 1842, *Jour. Acad. Nat. Sci., Phila.*, p. 276, pl. 17, figure 7.

Platystoma lineata Hall 1878, *Paleont. of N. Y.*, Vol. V, part. II, p. 21, pl. X, figures 1-21.

Description.—This species is abundant in the Devonian beds of Manaure

and Floresta, being represented in the collection by internal as well as external molds. Shell naticiform, whorls in contact at all stages, four to five when complete, most of the specimens showing only three whorls. Surface marked by fine, nearly equidistant, thread like revolving striae, which are crossed by fine concentric striae of about the same intensity, but unequally distant, giving the surface a beautifully cancellated appearance. Apex in most specimens imperfect, outer volution ventricose in some specimens and regularly convex, aperture suborbicular and expanded. Outer lip thin. Umbilicus entirely closed in adults. Most of the specimens in the collection seem to be young individuals. Dimensions:

Maximum diameter	Height
19 mm.	5 + mm.
22 mm.	15 mm.
14 mm.	12 mm.

Distribution.—Colombia: Floresta, Manaure and Gutiérrez.
Elsewhere: North America.

Range.—Low and Middle Devonian.

Genus *Grammysia* de Verneuil 1847

Grammysia sp.

Plate VII, figure 5

Description.—One somewhat crushed internal mold does not permit a specific classification. It shows the general characteristics of the genus *Grammysia*; beaks prominent and very incurved, elongate in outline. The surface of the shell is marked by broad concentric undulations. Height about 75 mm.

Distribution.—Colombia: Floresta.

Elsewhere: Genus widespread; North America, South America (Bolivia, Brasil), Europe, etc.

Range.—Silurian to Mississippian (genus).

Genus *Actinopteria* Hall 1883

Actinopteria boydi (Conrad) 1842

Plate VII, figures 6-7

Avicula boydi Conrad 1842, *Journ. Acad. Nat. Sci. Phill.*, Vol. VIII, p. 237, pl. 12, figure 4.

Actinopteria boydi Hall 1884, *Paleont. of N. Y.*, Vol. V, part I, p. 113, pl. XIX, figures 20-24, 26-30; pl. 86, figures 16-17.

Actinopteria boydi McAlester 1962, *Peabody Mus. Nat. Hist. Bull.* 16, p. 27, pl. III, figures 25-26.

Description.—Three fragmentary specimens of medium size, inequilateral, oblique and moderately inflated. Thin shell. Left valve convex, right valve

nearly flat. Hinge line without teeth. Surface of the shell marked by radiating ribs and transverse growth lines. Posterior ear wing-like, anterior ear very small. Interior features unknown. The best preserved specimen has a height of 15 + mm. and a length of 10 + mm.

Distribution.—Colombia: Floresta and Manaure.

Elsewhere: North America.

Range.—Middle and Upper Devonian.

Genus *Nuculites* Conrad 1841

Nuculites oblongatus Conrad 1841

Plate VII, figure 8

Nuculites oblongata Conrad 1841, *Geol. Surv. N. Y. Ann. Report*, p. 50, figure 8.

Nuculites oblongatus Hall 1885, *Paleont. of N. Y.*, Vol. V, p. 324, pl. XLVII, figures 1-12.

Nuculites oblongatus Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 377, pl. 146, figures 13-14.

Description.—This species is represented by a single internal mold of a left valve. Elongate-ovate, widest at the anterior end, length 12 mm., height 3 mm., marked by a nearly vertical internal partition separating anterior muscle scar from cavity of the shell and extending about two-thirds the distance from the beak to base, represented on the internal filling at and by a deep furrow. Cardinal line slightly oblique. Hinge with numerous transverse teeth. Valves depressed-convex in the lower and posterior portion, more convex on the anterior end and on the umbonal region. Ventral valve not present.

Distribution.—Colombia: Manaure.

Elsewhere: North America, South America (Bolivia).

Range.—Middle and Upper Devonian.

Genus *Aviculopecten* McCoy 1851

Aviculopecten wellsi n. sp.

Plate VIII, figures 1-2

Description.—One specimen, a left valve, was found in the Devonian beds of Floresta. Large, pectiniform, equilateral, not oblique, nearly circular in outline. Height 60 mm., length 65 mm. Margins regularly convex and rapidly curving to the beak. Left valve regularly convex, hinge line straight, length about the same as the length of the shell. Teeth absent. Beak straight, central and rounded. Anterior and posterior ears broad triangular, large, flat and angular at extremities. Anterior ear, although not completely preserved, defined by a narrow, deep sinus in contrast with the very gentle sinus of the posterior ear. Surface of the shell marked by about 36 very strong, rounded, radiating,

continuous plications much wider than the interspaces, strongest in central part of the shell, maximum width 4.5 mm.; ears marked by very fine radii Growth lines irregular. Internal characteristics were not preserved.

This new species differs from *Aviculopecten yeakeli* of the Venezuelan Devonian by its surface ornamentation and hinge line. In the Venezuelan species, the plications are not so strong, the interspaces are wider than in the Colombian species, and the hinge line is shorter.

Aviculopecten wellsii may be comparable with the North American species *Aviculopecten ellipticus* (Upper Devonian, Chemung) illustrated and described by Hall in 1884 (p. 25, pl. VII, figure 31); however Hall's species has much shorter hinge line, which length is a half the length of the shell. In the Colombian species, the hinge line is about equal to the total length of the shell. On the other hand the ears in the Colombian species are larger and ornamented with fine radii which are not present in the Upper Devonian species of North America.

Holotype: Cornell Paleontological Laboratory.

Distribution.—In the upper level of the M. Devonian buff shales of Floresta (Colombia).

Range.—Middle Devonian.

Genus *Odontopleura* Emrich 1839

Odontopleura callicera (Hall and Clarke) 1888

Plate VIII, figures 3-4

Acidaspis callicera Hall and Clarke 1888, *Paleont. N. Y.*, Vol. VII, p. 69, pl. XVIB, figures 1-13.

Odontopleura callicera Shimer and Shrock 1944, *Index Foss. of N. A.*, p. 651, pl. 271, figure 16.

Description.—This small trilobite is represented in the collection by two left free cheeks and an external mold of the glabella.

Glabella 7 mm. wide, semicircular in shape, frontal lobe elongate, two pairs of lateral, small lobes of almost the same length, and separated from the front lobe by elevated furrows. Cheeks (only the left one preserved) presenting essentially the same characteristics than those illustrated and described by Hall (1888, p. 69, pl. XVIB, figures 11-13); broad, slightly concave and sloping abruptly from the elevated eye. Border moderately thickened and produced at the genal angle into a long, slightly incurved spine. Margin ornamented by 11 to 12 short spines. The length of the genal spines 10 to 12 mm. width of cheek about 6 mm. and 3 mm. Eyes small and elevated. Thorax and pygidium not observed.

Distribution.—Colombia: Floresta and Manaure.

Elsewhere: North America.

Range.—Middle Devonian.

Genus *proetus* Steininger 1831

Proetus sp.

Plate VIII, figure 9

Description.—One small pygidium, 12 mm. wide and about 5 mm. high, of a trilobite pertaining to this genus is semicircular in shape, with flat margin, and with about 7 annulations, and a prominent axis.

Distribution.—Colombia: Floresta.

Elsewhere: North America and South America.

Range.—Ordovician-Mississippian (genus).

Genus *Acanthograptus* Spencer 1878

Acanthograptus n. sp. ?

Plate IX, figures 1-2

Description.—One poorly preserved specimen, the first record of graptolites in South American Devonian beds, was identified as *Acanthograptus* sp. by Whittington and Berry.

In complete specimens of *Acanthograptus* the rhabdosome is shrublike (not completely observed in this specimen), consisting of thick serrated branches mainly rising from the base, with little divergence and occasional bifurcation. One side of the branches is furnished with prominent spines which apparently mark thecal apertures.

Distribution.—Colombia: Floresta.

Elsewhere: North America.

Range.—Upper Cambrian to Devonian? (genus).

REFERENCES

- BOTERO, G., 1946.—Reconocimiento Geológico del Area comprendida por los municipios de Belén, Ceniza, Corrales, Floresta Nobsa y Sta. Rosa de Viterbo, Boy., *Serv. Geol. Nat.*, Inf. 534, Bogotá.
- BURGL, H., 1955.—Fósiles Paleozoicos y Cretáceos de Gachalá y Sumapaz, *Serv. Geol. Nat. Inf.* 112 inédito, Bogotá.
- BURGL, H., 1957.—Biostratigrafía de la Sabana de Bogotá y sus alrededores, *Bol. Geol.*, v. 5, n. 2, Bogotá.
- CASTER, K. E., 1939.—A Devonian Fauna from Colombia, *Bull. Amer. Paleont.*, v. 24, n. 83.
- CASTER, R., 1942.—The Age and Relations of Colombian Devonian Strata, *Proce. of the 8th Amer. Sci. Congress, Washington.*
- CLARKE, J. M., 1889.—Molluscos Devonianos do Estado de Pará, *Archiv. do Mus. Nac. do Rio de Janeiro*, v. 10.

- CLARKE, J. M., 1908.—Early Devonian History of N. Y. and Eastern N. A., *N. Y. State Mus., Mem.*, 9, part. I.
- CLARKE, J. M., 1909.—Early Devonian History of N. Y. and Eastern N. A., *N. Y. State Mus., Mem.*, 9, part. II.
- CLARKE, J. M., 1913.—Fosseis Devonianos do Paraná, *Serv. Geol. e Miner. do Brasil*, Mon. 1.
- CHELAND, H. F., 1903.—Fauna of the Hamilton Fm. of the Cayuga Lake Section in Central N. Y.; *U. S. G. S., Bull.* 206.
- CLOUD, P. E., Jr., 1942.—Terebratuloid Brachiopoda of the Silurian and Devonian, *Geol. Soc. of Amer., Spec. Pap.* 38.
- CONRAD, T. A., 1842.—Observations on the Silurian and Devonian systems of the United States with the description of new organic remains, *Acad. Nat. Sci., Phil. Journ.*, v. 8, part. I.
- COOPER, G. A., 1930.—Stratigraphy of the Hamilton Group in N. Y., *Amer. Journ. Sci., Series V*, v. XIX.
- COOPER, G. A., 1934.—Stratigraphy of the Hamilton Group Eastern N. Y., *Amer. Journ. Sci., Series V*, v. XXVII.
- COOPER, G. A., 1942.—Correlations of the Devonian fms. of North America, *Bull. of G. S. A.*, v. 53, Part II.
- COOPER, G. A., and WARTHIN, A. S., 1942.—New Devonian (Hamilton) Correlations *Bull. of G. S. A.*, v. 53, part I.
- DAVIDSON, T., 1880.—British Fossil Brachiopoda, *Mon. Palaeont. Soc.*
- DUMBAR, C. O., 1920.—New species of Devonian fossils from Western Tennessee, *Conn. Acad. Arts and Sci., Trans.*, v. 23.
- FENTON, C. L., 1931.—Studies of evolution in the genus *Spirifer*, *Publ. of the Wagner Free Inst. of Sci.*, v. 2.
- GEORGE, T. N., 1932.—The British Carboniferous Spiriferidae, *Quart Journ. Geol. Soc.* London. v. 88.
- GOLDRING, W., 1923.—Devonian Crinoids of N. Y., *N. Y., State Mus.*, Mem. 16.
- GRABAU, A. W., 1931.—Devonian Brachiopoda of China, *Paleontologica Sinica*, ser. B. v. 3.
- GROSSE, E., 1935.—Huila y Alto Caquetá, *Comp. Est. Geol. en Colombia*, III.
- GREINER, H., 1957.—*Spirifer Disjunctus*, Its evolution and Palaeology in the Katskill Delta, *Peabody Mus. of Nat. Hist., Yale Univ., Bull.* 11.
- HALL, J., 1843.—Report on the 4th. Geol. District; *Geology of N. Y.*, part. IV.
- HALL, J., 1852.—*Paleont. of N. Y.*, v. II.
- HALL, J., 1867.—*Paleont. of N. Y., Brachiopods; N. Y. Geol. Surv.*, v. IV.
- HALL, J., 1877.—III. *Devon. Foss.*, N. Y. Geol. Surv.
- HALL, J., 1884.—*Paleont. of N. Y., Lamellibranchiata Monomyaria*, v. V, part I.
- HALL, J., 1885.—*Paleont. of N. Y., Dev. Trilobites etc.*, v. VII.
- HALL, J., 1888.—*Paleont. of N. Y., Devonian Lamellibranchs, Dimyaria*, v. S. Part II.
- HALL, J., and CLARKE, J. M., 1894.—*Paleont. of N. Y., Brachiopods*, v. 8, part II.
- HARTT, C. F., 1874.—Contributions to the Geology and Physical Geography of the Lower Amazonas, *Buffalo Soc. Nat. Sci.*, v. 2.
- HARTT, C. F., 1878.—(In Rathbun, R.) The Devonian Brachiopods of the Province of Paraná, Brasil, *Boston Soc. Nat. Hist., Proc.*, v. 20.

- HARTT, C. F., and RATHBUN, R., 1875.—Morgan Expedition of 1870-71: On the Devonian Trilobites and Mollus. of Ereré, Province of Pará, Brasil, *Lyceum of Nat. Hist. N. Y.*, v. 11.
- HUBACH, E., 1957.—Contribución a las unidades Estratigráficas de Colombia; *Serv. Geol. Nal.*, Inf. 1212, Bogotá.
- KATZER, F., 1903.—Grundzüge der Geologie des Unteren Amazonasgebietes (des Staates Pará in Brasilien), Leipzig.
- KAYSER, E., 1878.—Fauna der Altesten Devon., *Abl. der Harzes*.
- KAYSER, E., 1889.—Die Fauna des Haupquarzite und Zorger Schiefer des Unterharzes.
- KAYSER, E., 1897.—Beiträge zur Kenntnis einiger Palaeozoischer Faunen Süd-Amerikas, *Zeitschr. d. Deutsch. Geol. Gesell.*, v. 49.
- KAYSER, E., 1900.—Alguns Fosseis Paleozoicos do Estado do Paraná, *Revista do Mus. Paulista*, v. 4.
- KINDLE, E. M., 1899.—The Devonian and Lower Carbonifer Faunas of southern Indiana and Central Kentucky, *Bull. Amer. Pal.*, v. 3, n. 12.
- KINDLE, E. M., 1901.—The Devonian Fossils and Stratigraphy of Indiana, *Ind. Dept. Geol., Nat. Res., Ann. Rep.* 25.
- KINDLE, E. M., 1912.—The Onondaga Fauna of the Alleghe region, *U. S. G. S., Bull.* 508.
- KNOD, R., 1908.—Devonische Faunen Boliviens, Beitr. zur Geol. u. Pal. von Süd-Amerika, pt. 14, *Neues Jahrb. Miner. Geol. Pal.*
- KOZLOWSKI, R., 1923.—Fauna Devonienne de Bolivia, *Ann. de Paleont.*, t. 12.
- LAKE, P., 1904.—The Trilobites of the Bokkeveld beds, *South Africa Mus., Ann.*, v. 4.
- LIDDLE, K. A., 1928.—The Geology of Venezuela and Trinidad, *J. P. McCowan, Ft. Worth, Texas*.
- LIDDLE, K. A., HARRIS, G. D., and WELLS, J. W., 1943.—The Río Cachim section in the Sierra de Perijá, Venezuela, S. A., *Bull. Amer. Paleont.*, v. 27, n. 108.
- MCNAIR, A. H., 1940.—Devonian Bryozoa from Colombia, *Bull. Amer. Paleont.*, v. 25, n. 13.
- MORRIS, J., and SHARPE, D., 1846.—Description of eighth species of Brachiopods Shells from the Falkland Islands, *Geol. soc., London, Proc.*, v. 2.
- MUIR WOOD, H., and COOPER, G. A., 1960.—Morphology, Classification and Life Habits of the Productoidea (Brachiopoda), *Geol. Soc. Amer. Mem.* 81.
- NETTLEROTH, H., 1889.—Kentucky Fossil Shells, *Ky. Geol. Surv., Franfort, Ky.*
- OLIVER, W. A. Jr., 1960.—Coral Faunas in the Onondaga limestone of N. Y., *U. S. G. S. Prof. paper* 400B.
- PERKINS, R. D., 1962.—Petrology of the Jeffersonville ls. (Middle Devon.) of Southern Indiana, *Geol. Soc. Amer., Bull.* 74.
- PHOL, E. R., 1930.—The Middle Devonian Traverse group in Michigan; from the *Prec. of the U. S. Nat. Mus.*, v. 76, Art. 14.
- RATHBUN, R., 1874.—On the Devonian Brachiopoda of Ereré, Province of Paraná, Brasil, *Buff. Soc. Nat. Sci., Bull.*, v. 2.
- RATHBUN, R., 1878.—On the Devonian Brachiopoda of the Province of Paraná, Brasil, *Boston Soc. Nat. Sci., Proc.*, v. 20.
- RAYMOND, P. E., 1940.—The Developmental Changes in some common Devonian Brachiopods, *Amer. Journ. Sci.*, v. 17.

- REED, F. R. C., 1903.—Brachiopoda from the Bokkeveld Beds, *South Africa Mus., Ann.*, v. 4.
- REED, F. R. C., 1906.—Some new Fossils from the Bokkeveld Beds, *South African Mus., Geol. Mag.*, v. 3.
- REED, F. R. C., 1908.—New Fossils from the Bokkeveld Beds, *South African Mus., Ann.*, v. 4.
- REED, F. R. C., 1925.—Revision of the Fauna of the Bokkeveld Beds, *South African Mus., Ann.*, v. 22.
- ROYO y GOMEZ, J., 1942.—Fósiles Devónicos en Floresta (Departamento de Boyacá). *Com. Est. Geol. de Colombia*, t. 5.
- ROSS, M. H., 1953.—The Favositidae of the Hamilton group (M. Devonian of N. Y.), *Buffalo Soc. Nat. Sci.*, v. 21.
- SARMIENTO, R., and ALVARADO, B., 1944.—Yacimientos de Hierro de Paz del Río, *Serv. Geol. Nat.*, Inf. n. 468, Bogotá, Inédito.
- SCHUCHERT, C., 1893.—Synopsis of American fossil Brachiopoda, *U. S. G. S., Bull.* 87.
- SCHUCHERT, C., 1935.—Historical Geology of the Antillean Caribbean region, *John Wiley and Sons*, N. Y.
- SCHUCHERT, C., 1943. Stratigraphy of the Eastern and Central United States.
- SCHUCHERT, C., and COOPER, G. A.—1932.—Brachiopod genera of the suborders Orthoidea and Pentamerioidea, *Peab. Mus. Nat. Hist., Mem.*, v. 4.
- SCHUCHERT, C., and MAYNARD, T. P., 1913.—Systematic Paleontology of the Lower Devonian rocks of Maryland, Brachiopoda, *Md. Geol. Surv.*
- STAINBROOK, M., 1938.—Atrypa and Strophodonta from the Cedar Valley Beds of Iowa, *Journ. Pal.*, v. 12.
- SHIMMER, H. W., and SHROCK, 1944.—Index Fossils of North America.
- STUMM, E. C., 1951.—Check list of Fossils inverteb. described from the M. Devonian, Traverse group of Michigan, *Contributions from the Mus. of Pal. University of Michigan*, v. 9, n. 1.
- STUMM, E. C., 1961—Addenda to the Check list of Foss. Invertebrates described from the Traverse group of Michigan, *Contributions from the Mus. of Paleont., University of Michigan*, v. 17, n. 5.
- STUMM, E. C., and WRIGHT, D., 1958—Check list of Fossils Invertebrate described from the M. Devonian rocks of the Thedford-Arkona region of Southwestern Ontario, *Mus. of Paleont., University of Mich.*, v. 14, n. 7.
- TRUMPY, D., 1943—Pre-Cretaceous of Colombia, *Geol. Soc. Amer., Bull.*, v. 54.
- TWENHOFEL, W. H., 1914.—The Anticosti Island Faunas, *Canada Geol. Surv., Mus. Bull.* 3.
- ULRICH, A., 1892—Palaeozoische Verteinerungen aus Bolivien, *Beitr. zur Geol. u. Pal. von Süd Amerika*, pt. 1.
- WALCOTT, C. D., 1884.—Paleontology of the Eureka Distr., *U. S. G. S., Mon.* 8.
- WARTHIN, A. S., and COOPER, G. A., 1935.—New Formation names in the Michigan Devonian, *Washington Acad. Sci., Journ.*, v. 25.
- WEISBORD, N. E., 1926.—Venezuelan Devonian Fossils, *Bull. Amer. Paleont.*, v. 11, n. 46.

- WELLER, S., 1903.—The Paleozoic Faunas, *Geol. Surv. N. J., Rep. on Pal.*, v. 3.
- WELLS, J. W., 1962.—Stratigraphy 571 Notes.
- WHIDBORNE, G. F., 1896.—Devonian Fauna of S. of Englad, *Palaeontogr. Soc.*, v. 3.
- WILLIAMS, H. S., 1913.—Recurrent Tropicidoleptus zones of the Upper Devonian in N. Y., *U. S. G. S., Prof. Paper 79*.



1



2



3



4



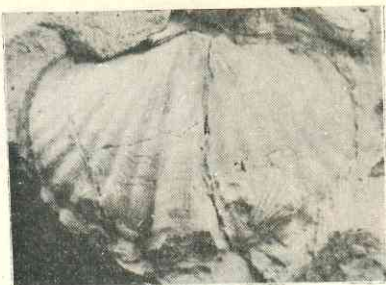
5

PLATE I

1) *Pleurodictyum americanum* Roemer. Top view of a somewhat compressed specimen. Loc: Floresta. x 2.7. 2) *Pleurodictyum americanum* Roemer. Top view of an internal mold showing the serpulid tube. Loc: Gutiérrez. x 4. 3) *Pleurodictyum americanum* Roemer. Top view of internal mold. Loc: Floresta. x 3. 4-5) *Favosites* sp. aff. *F. hamiltoniae* Hall. 4) Top view of part of the coralla. Loc: Floresta. x 3.3. 5) Longitudinal section of same specimen showing the characteristic tabulae. Loc: Floresta. x 3.3.



1



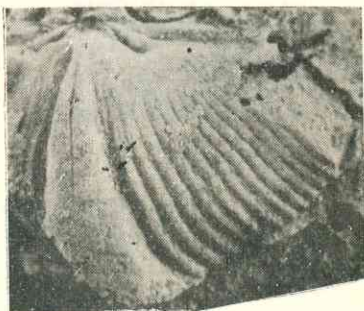
2



3



4



5



6



7



8

PLATE II

1) *Camarotoechia sappho* (Hall). Internal mold of dorsal valve. Loc: Manaure. x 4.5.
 2) *Camarotoechia dotis* Hall. Ventral exterior of *C. dotis* over a well preserved dorsal valve.
 3) *Camarotoechia contracta* (Hall). Dorsal exterior of a crushed specimen. Loc: Floresta. \pm nat. size. 3) *Camarotoechia contracta* (Hall). Dorsal exterior of a crushed specimen. Loc: Manaure. x 2.5. 4) a) *Leiorhynchus mysia* Hall. Ventral exterior of a small individual. Loc: Floresta. x 3. b) *Orthis* sp?. Ventral exterior. Loc: Floresta. x 3. 5) *Mediospirifer audaculus* (Conrand). Dorsal internal mold. Loc: Floresta x 3. 6-8) *Spirifer daleidensis* Steininger. 6) Ventral internal mold. x 1.6. 7) Rubber cast of specimen 6. x 1.6. 8) Ventral exterior of the same specimen showing the zig-zag pattern of the papillae. Loc: Manaure. x 1.6.

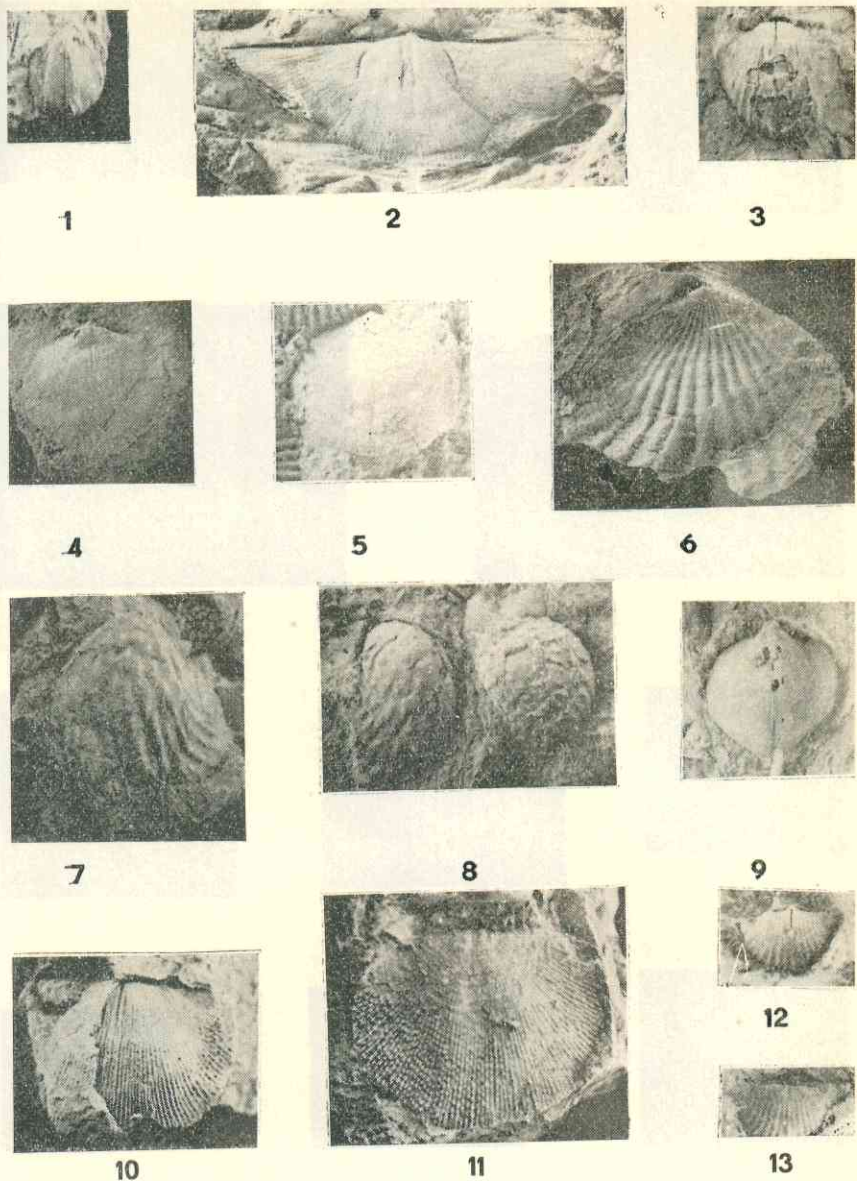


PLATE III

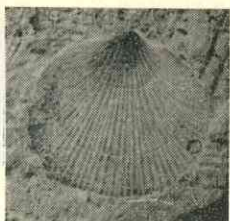
- 1) *Ambocoelia pseudo-umbonate* Kozłowski. Ventral internal mold. Loc: Manaure. x 3. 2) *Strophodonta* sp. aff. *S. demissa* (Conrad). Internal mold of ventral valve. Loc: Manaure. x 2.6. 3) *Chonetes billingsi* Clarke. Ventral internal mold. Loc: Manaure. x 2.5. 4) *Nucleospira concinna* Hall. Internal ventral mold. Loc: Floresta. x 2.5. 5) *Nucleospira concinna* Hall. Internal mold of ventral valve. Loc: Floresta. x 2.5. 6) *Atrypa spinosa* Hall. Ventral external mold. Loc: Manaure. x 1/4. 7-8) *Spinuliscosta spinulicosta* Nalivkin. 7) Ventral exterior. Loc: Floresta. x 2.8. 8) Ventral exterior view of two specimens showing the spine bases. Loc: Floresta. x 2.7. 9) *Nucleospira concinna* Hall. Ventral internal mold. Loc: Manaure. x.25. 10-11) *Chonetes venezuelensis* Weisbord. 10) Ventral view. Loc: Manaure x 3.5. 11) Dorsal view showing the small spines on the ribs. Loc: Manaure. x 3. 12-13) *Chonetes stübeli* Ulrich. Ventral internal molds. Loc: Manaure. x 3.



1



2



3



4



5



6



7



8



9



10



11

PLATE IV

1) *Cbonetes comstockii* Hartt. 1) Ventral view. Loc: Floresta. x 3. 2) Mold of specimen 1. Loc: Floresta. x 3. 3) *Rhipidomella hybridoides* Clarke. External ventral mold. Loc: Manaure. x 3. 4) *Rhipidomella liddle* Harris. Dorsal interior. Loc: Manaure. x 2.5. 5) *Tropidoleptus carinatus* (Conrad). Dorsal external mold. Loc: Floresta. x 2. 6-11) *Tropidoleptus carinatus* (Conrad). 6-7) Ventral exterior views. x 2. 8) Internal ventral mold. x. 2. 9-10) Ventral views. x. 3. 11) External ventral mold. Loc: Gutiérrez. x 2.

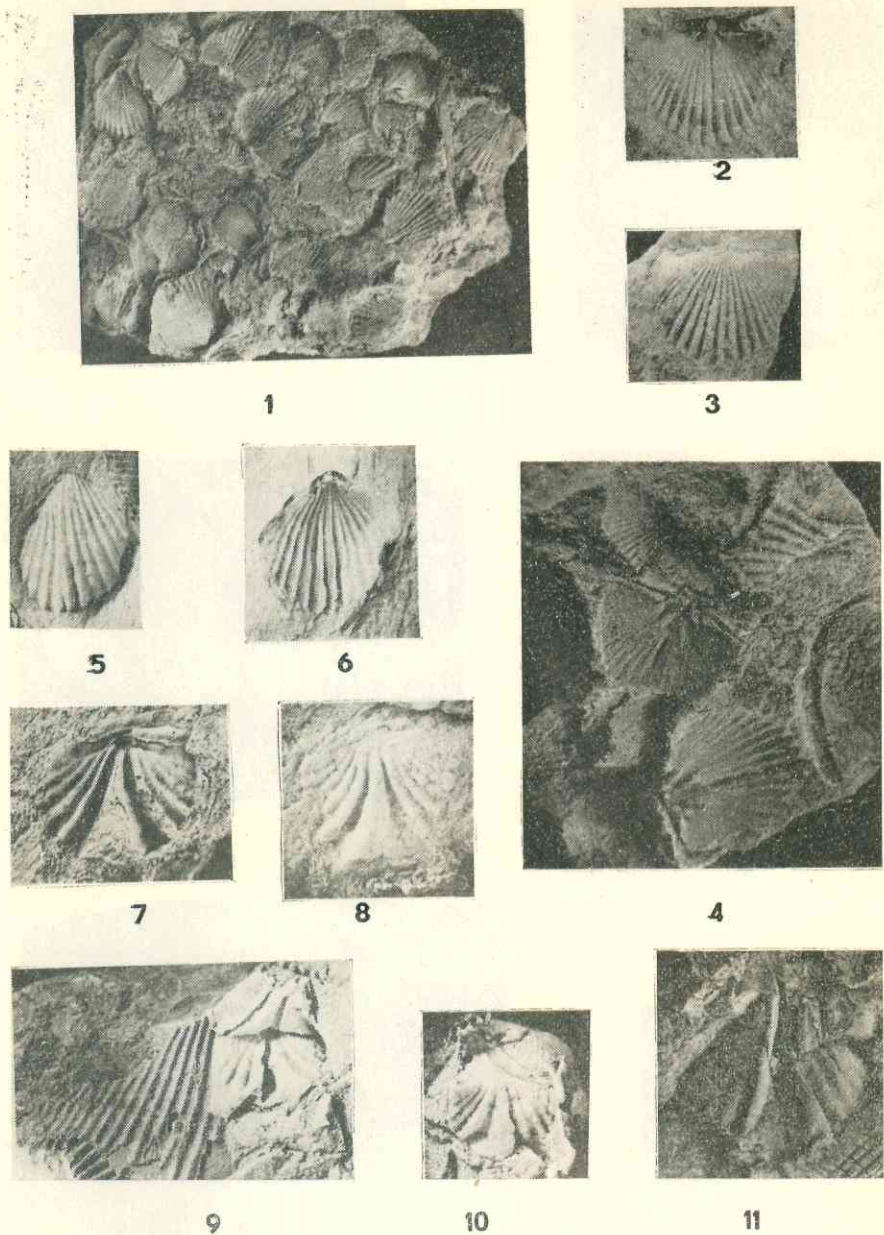
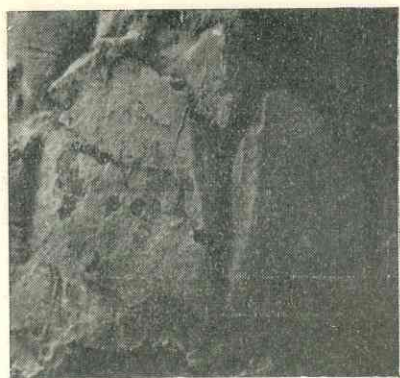


PLATE V

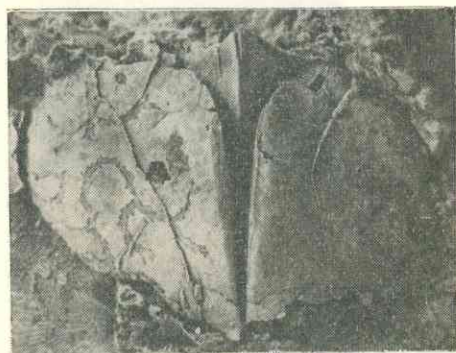
1-4) *Tropidoleptus carinatus* (Conrad). Internal dorsal and ventral molds. 1) and 4) Loc: Gutiérrez. x 2.5. 2) and 3) Loc: Floresta. x 2. 5-6). *Leptocoelia* sp. 5) Ventral view. x 2.8. 6) Mold of specimen 5. Loc: Manaure. x 2.8.) 7-11) *Cyrtina hamiltoniensis* (Hall). Dorsal internal mold. x 3. 8) Dorsal view. x 3. 9a) External mold of dorsal valve and inter-area. x 3. 9b) Incomplete external mold of *Bachyspirifer Palmerae* Caster. x 3. 10) Rubber cast of specimen 9a x 3. 11) Ventral exterior. Loc: Manaure x 3.



1



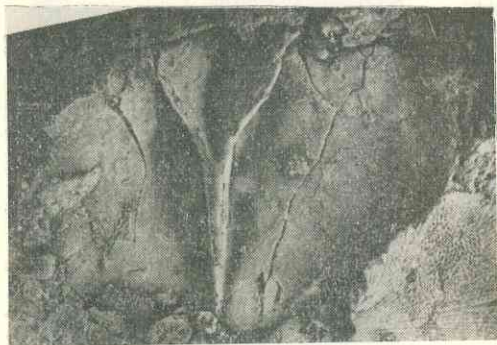
2



3



5



4



6

PLATE VI

1) *Amphigenia* n. sp.? Internal mold of ventral valve. Loc: Floresta. x 1. 2) *Amphigenia* n. sp.? Rubber cast of internal ventral mold. Loc: Floresta. x 1. 3-4) *Amphigenia* n. sp.? Internal ventral mold. x 1.2. 4) Rubber cast of specimen 3. x 1.2. Loc: Floresta. 5) *Amphigenia* n. sp.? Internal ventral mold of a smaller specimen. Loc: Manaure. x 1.5. 6) *Platyostoma lineata* Conrad. Apertural view. Loc: Manaure. x 3.



1



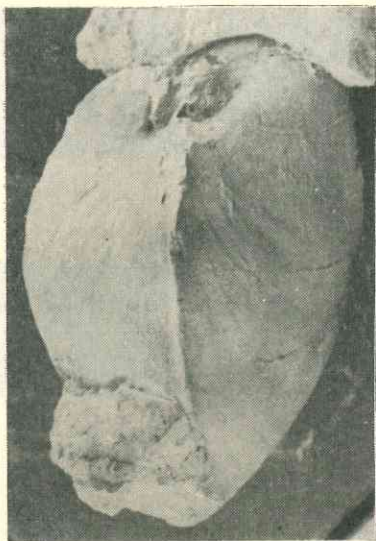
2



3



4



5



6



7



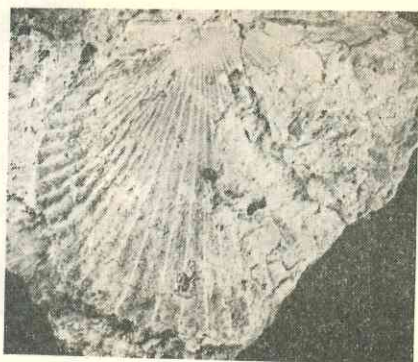
8

PLATE VII

1-2) *Platystoma lineata* Conrad. 1) External mold. Loc: Maure, x 3. 2) Top view of rubber cast of specimen 1. Loc: Manaure, x 3. 3) *Platystoma lineata* Conrad. Top view of internal mold. Loc: Manaure, x 2.8. 4) *Platyceras* sp. aff. *P. nodosum* Conrad. Lateral view of internal mold. Loc: Floresta, x 3. 5) *Grammysia* sp. Anterior view of internal mold. Loc: Floresta, \pm nat. size. 6-7) *Actinopteria boydi* (Conrad). 6) Fragment of a right valve. Loc: Manaure, x 2.5. 7) External mold of left valve. Loc: Floresta, x 2.5. 8) *Nuculites oblongatus* Conrad. Internal mold of left valve. Loc: Manaure, x 2.5.



1



2



3



4



5



7



8



6



9

PLATE VIII

1-2) *Aviculopecten wellsi* n. sp. 1) Exterior view of left valve. \pm nat. size. 2) Mold of the same specimen. \pm nat. size. Holotype: Cornell Paleontological Laboratory. Locality: Floresta. 3-4) *Odontopleura callicera* (Hall and Clarke). 3) Left free cheek. Loc: Floresta. x. 3. 4) Left free cheek of a larger specimen. Loc: Manaure x 3.5. 5) *Phacops salteri* Kozlowski. View of distorted cephalon. Loc: Manaure. x 1.5. 6) *Crypbaeus* sp. Rubber cast of the external mold of part of the cephalon. Loc: Floresta. x 1.5. 7) *Phacops salteri* Kozlowski. Top view of internal mold of thorax and pygidium. Loc: Manaure. x 1.5. 8) *Cypricardinia subindenta* Weisbord. Right exterior. Loc: Manaure. x 2.5. 9) *Proteus* sp. Top view of the small pygidium. Loc: Floresta. x 2.5.



1



3



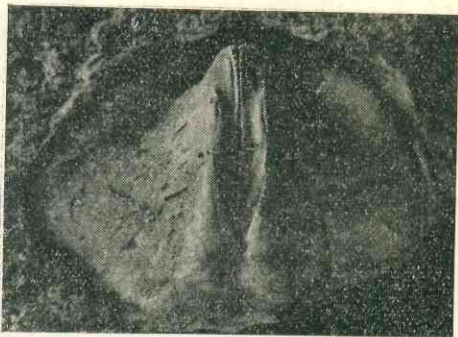
2



4



5



6

PLATE IX

1-2) *Acanthograptus* sp. Two views of the broken specimen showing only part of the Rhabdosome. Loc: Floresta. x 2.6. 3) *Australospirifer antarticus* var. 1 Caster. External ventral mold. Loc: Manaure. 1 x 2.8. 4) *Eodevonaria imperialis* Caster. Internal ventral mold. Loc: Floresta. x 2.5. 5) *Atrypa barrisi* Caster. Internal ventral mold. Loc: Floresta. x 2.5. 6) *Pentagonia gemmisulcata* Caster. Internal dorsal mold. Loc: Manaure x 2.5.