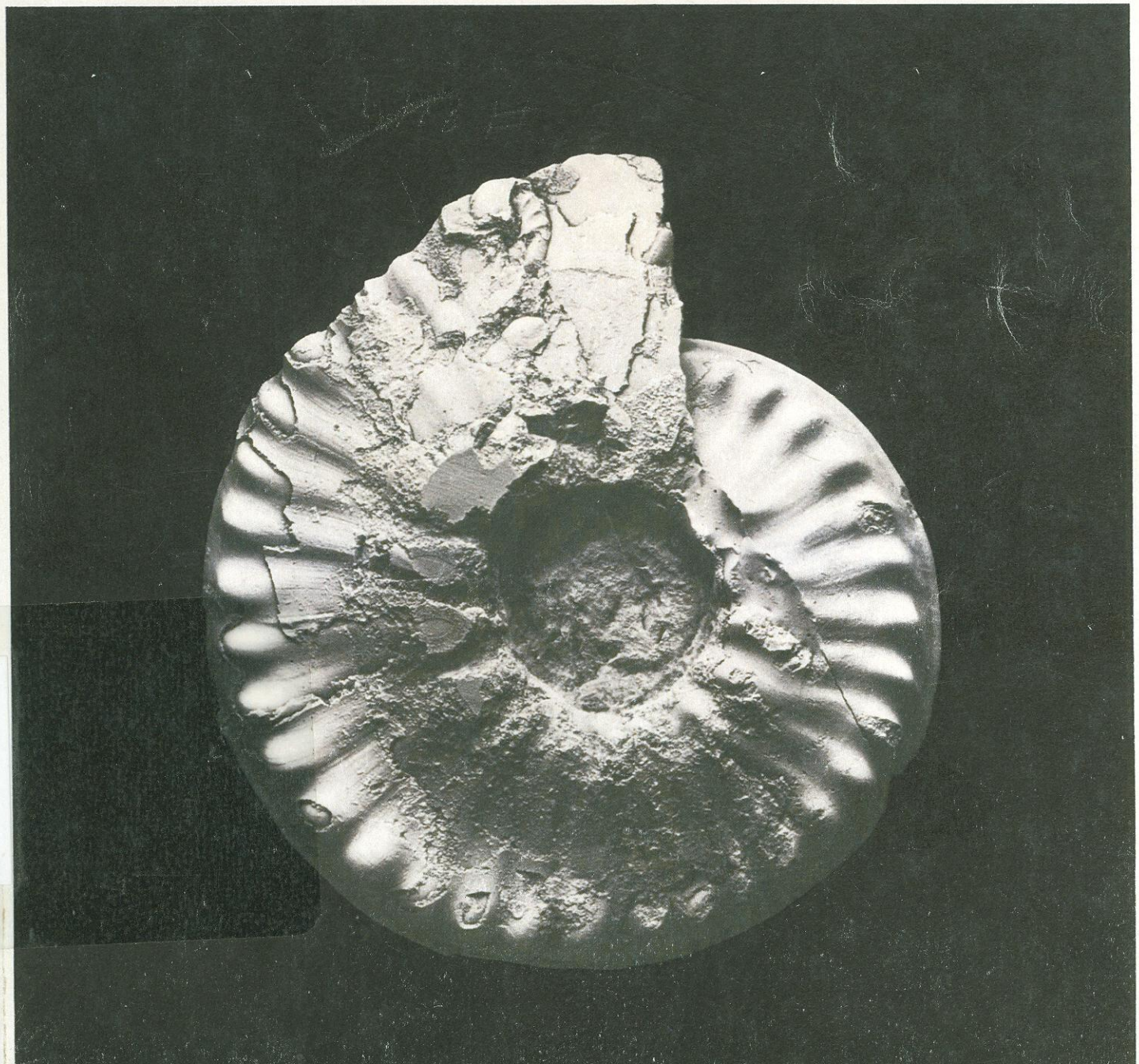
THE CRETACEOUS AMMONITES OF VENEZUELA

OTTO RENZ



The Cretaceous ammonites of Venezuela

Otto Renz, Basel

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About the author:
Dr. Otto Renz was born in Kaufbeuren, Bavaria, and received his university education in Basel, obtaining his doctorate in geology in 1935. The subject of his doctoral thesis was "Stratigraphische und mikropalaeontologische Untersuchung der Scaglia (Obere Kreide - Tertiär) im zentralen Apennin". Following a year as assistant at the University of Basel, Geological Institute he joined the Royal Dutch/Shell Group of Companies and was assigned to Colombia where he worked mainly in the Llanos, the eastern Andes and the Magdalena Valley. Between 1941 and 1945 he was in what is now Indonesia and in 1946 was transferred to Venezuela where he remained until retirement in 1959. During this period he was assigned to special projects in Greece (1954) and Spain (1957). Immediately following retirement Dr. Renz taught final year and post-graduate students at the Central University of Venezuela and in 1960 was retained by Shell to conduct geological research in Puerto Rico and Jamaica. Since January 1962 Dr. Renz has devoted himself to scientific research, mainly in the field of palaeontology, at the Museum of Natural History in Basel.

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Contents

A. Introduction

During the Cretaceous Period a marine basin extended from Trinidad and northern Venezuela across the Cordillera Oriental of Colombia and into the southwestern part of Peru, a distance of some 3500 km. Its northern and northwestern extension into the present-day Caribbean cannot be determined with any precision and must therefore remain open to speculation. The basin limits to the southeast, on the other hand, can be clearly delineated, as it was marked by the edge of the Guayana Shield.

Over much of Venezuela, north of the Guayana Shield, an uninterrupted sequence of sediments accumulated throughout the Cretaceous. Initially vast quantities of terrigenous material, erosion products from the uplifted Guayana Shield, were swept into the basin. The depressions, such as the Uribante and Machiques Troughs, were first filled with conglomerates and later by thick sequences of quartz sands with plant remains which were widespread along the southeastern slope of the basin. These sands are for a great part derived from the Roraima Formation which constitute the pre-Mesozoic cover of the Guayana Shield. The sands are of interest in that they contain intercalations of black shales in which ammonites of Aptian age have been found in the Serranía del Interior situated in the States of Monagas and Sucre. The ammonites are found as limonitized moulds, their overall appearance closely resembling age equivalent assemblages in Europe. In the Andes, lithologically similar non calcareous black shales, probably also of Aptian age, are devoid of ammonites.

Basinwards, the clastic sediments were successively replaced by carbonates predominantly of organogenic origin. Extensive platforms of biostromal limestone were built in a shallow epicontinental sea within the photic zone which apparently were partially subjected to wave action. The associated fauna comprises, in the main, thick-shelled pelecypods, echinoids and locally corals, as in the Serranía del Interior. Foraminifera are restricted to benthic types. Ammonites are rarely present, having been found only in the Andes, within Aptian sediments in the State of Táchira and within the upper Albian sequences in Trujillo and Lara States.

In addition to these shallow water carbonates, lithologically and faunally distinct carbonates were deposited in closed basins which developed at different times in widely separated areas on the platforms. Sedimentation in these restricted basins proceeded in an environment below the wave base and beyond the photic zone, in waters which were poorly oxygenated. The associated bottom fauna in these reducing conditions was, therefore, impoverished and restricted to inoceramids and small bivalves and gastropods. The sediments, on the other hand, locally abound with fossils of pelagic origin, commonly preserved in characteristic ellipsoidal limestone concretions of varying size. In addition to fish and saurian remains, rich assemblages of planktonic foraminifera and of ammonites are found. The euxinic sediments which accumulated in these isolated basins are of great importance in that they constitute a very rich source rock which generated most of the oil found in western Venezuela (Hedberg, 1931).

The comparatively stable conditions which had prevailed throughout most of the Cretaceous Period were interrupted in early Tertiary times. The Caribbean orogeny affected the northern part of the basin causing a strong metamorphism of the sediments and thus destroying their fossil content. Large masses of Cretaceous and older rocks became detached from the rising orogen and were moved southwards, by downslope gliding, into the developing flysch basins of Barquisimeto and Guárico. Within these allochthonous slabs, the original lithologies and fossil assemblages have been preserved. At the same time detached slabs of predominantly Cretaceous sediments slid, under the influence of gravity, down the flexured eastern edge of the basin into the Barquisimeto Trough. These can now be observed between the towns of Carora and El Tocuyo in the State of Lara.

The folding and faulting resulting from the late Tertiary orogenic phase affected the rigid sediments of the Andes in a manner quite distinct from the more plastic, chaotic, originally semifluid masses of glided flysch in the Tertiary basin, deprived locally of its original bedding and burdened by abundant heterogenous rigid rock fragments.

From the foregoing, it can be seen that conditions favourable for the development and preservation of ammonite assemblages persisted from early Aptian to late Coniacian time in Venezuela. The ammonites included in this monograph represent only a small proportion of the total number of species which flourished during that time. This compilation must, therefore, be considered as a first step in the study of Venezuelan ammonites.

In selecting species to be included in this monograph, careful attention has been given to the determination of the precise stratigraphical interval from which they were collected. This not only has an important bearing on the taxonomy but also facilitates comparisons with assemblages from elsewhere in the world. Whenever possible, an attempt has been made to establish the relationship between the Venezuelan assemblages and those described from Europe, North Africa, The Middle East, Madagascar and West Africa, notably Nigeria,

Source of the material

The specimens used in this study and compilation have been brought together from a variety of sources. An important source was the material collected over a number of years by geologists employed by the former Compañía Shell de Venezuela, Ltd. whose documentation in terms of the locality and stratigraphic position of each sample was exemplary.
In 1949 a large collection of specimens from the La Luna Formation of the States of Trujillo and Lara was made by J.D. De Jong. These were provisionally described and identified by Professor M. Breistroffer of Grenoble in the same year.
During the following year, well preserved ammonites were collected from the La Puya Formation. This material, which is lodged in the Basel Museum of Natural History, was studied originally in the years 1968-1972 by O. Renz and more recently revised for the purpose of this monograph.
Materials from the Serranía del Interior in eastern Venezuela comes from two sources. A few specimens from the Valle Grande Formation (Aptian) collected in 1954 by E. Rod and W. Maync were used. Most, however, come from a collection made in 1972 by H.A. Guillaume.
In order to supplement the existing material, selective collecting of ammonites, mainly from Turonian and Coniacian outcrops in the Andes was undertaken in the years 1979 and 1980 by O. Renz assisted by F.A. Galea Alvarez and C. Villalobos.

Abbreviations and depositories of material

The following abbreviations are used to indicate the source of the material:

BM - British Museum (Natural History), London
MBJ - Museum of Natural History, Basel
MPI - Ministerio de Energía y Minas, Caracas
Gu - H.A. Guillaume, Compañía Shell de Venezuela
JG - J.D. de Jong, Compañía Shell de Venezuela
Re - O. Renz, Compañía Shell de Venezuela and Maraven S.A., Caracas
VK - G.H. Voorwijk, Compañía Shell de Venezuela
J - Museum of Natural History, Basel. Casts of specimens deposited with Maraven, Caracas

All specimens collected by geologists from the former Compañía Shell de Venezuela, Ltd. are deposited with Maraven, S.A., Caracas.
Material collected by Prof. Reinhard is deposited in the "Museé d'Histoire Naturelle Geneva".
Material collected by E. Rod is deposited in the Museum of Natural History, Basel.

Measurements are abbreviated as follows:
Dm - diameter; Wh = whorl height; Ww - whorl width; U - umbilicus. All measurements are given in millimeters. Dimensions such as percentage of diameter follow in parentheses.

Preparation and illustration of the ammonites

The time-consuming task of extracting the specimens from the matrix and the detailed preparation was undertaken by the author. In order to highlight the morphological details, particularly of those forms possessing little ornamentation, the specimens were given a light coating of ammonium chloride.
In only a few cases could the ammonites have been illustrated in their living positions as the peristome is seldom preserved. In the interest of consistency and to facilitate comparisons, all specimens have, instead, been illustrated in the accepted conventional position.

Acknowledgments

The initiative to produce a monograph of the Cretaceous ammonites of Venezuela came from the staff of the Exploration Department of Maraven, S.A. in Caracas. The request that I should undertake the task was conveyed to me in June 1978 by Maraven's Exploration Manager, Dr. H. Krause.
The two visits to Venezuela, in 1979 und 1980, gave me the opportunity to study reports and to carry out the necessary additional investigations in the field. Costs incurred during these visits were met by Maraven.
A monograph such as this could not have been produced without the cooperation of others. In the first place I would like to thank Dr. H. Krause, for his hospitality, encouragement and advice during my visits to Venezuela. The field work was done in the company of geologists employed by Maraven, notably Dr. P. Bartok, Dr. A. Mozetic and Dr. V. Pumpin. Their local experience was of benefit and many of their suggestions have been incorporated in this monograph. I am grateful to Mr. C. Villalobos and Miss F.A. Galea Alvarez of Maraven's Paleontological Laboratory for their assistance both in the collecting of additional ammonite specimens and in furnishing me with stratigraphic data.
I acknowledge also the friendly cooperation of Dr. J. Fierro and Dr. F. Rondón, both geologists with the "Ministerio de Energía y Minas". It was they who

introduced me to the modern ideas on the structural geology of Western Venezuela.
I express my gratitude and admiration for the peasants living in the regions investigated, whose kindness and hospitality facilitated my work in the field.
All the laboratory work including specimen preparation and photography was carried out at the Museum of Natural History, Basel. Thanks should be extended to the Museum authorities and in particular to Dr. P. Jung, Director of the Museum's Geological Department whose constructive criticism and advice has been greatly valued.
Special thanks are due to Mr. R. Panchaud, the very experienced curator of the Museum, for his numerous helpful suggestions and practical assistance.
The exceptionally high quality of the photographs included in this monograph demonstrate the ability and skill of Mr. W. Suter of the Museum's photographic laboratory. I am greatly indebted to him for his many hours of patient work.
Much of the burden of tracing literature references and securing copies from many parts of the world has been assumed by Mr. Ch. Scherler, the librarian of the Natural History Museum. I am grateful for his unselfish efforts on my behalf.
I wish to record my thanks to Dr. E. Lanterno of the "Musée d'Histoire Naturelle", Geneva, for lending me the ammonites collected from the Aptian of Eastern Venezuela by Prof. M. Reinhard.
The important responsibility assumed by Dr. P.H. Rowlands of coordinating the various phases involved in the production of this monograph deserves a special mention. He also played a significant role in reviewing and editing the manuscript.
I would lastly like to acknowledge the part played by Dr. P. Soder in editing the text and by Dr. C. Petzall in translating the monograph to produce the Spanish edition.

B. Historical review of ammonite studies in Venezuela

The famous explorer and scientist A. von Humboldt can be credited with being the first to record views on Venezuelan geology. During his journeys through Venezuela, Colombia and Peru in the years 1799 to 1804, von Humboldt observed the rocks which make up the Andes and sought to explain the genesis of that impressive mountain range. He was particularly fascinated by phenomena related to volcanism, though he did not neglect the study of the distribution and succession of sediments and of their fossil content. His observations on the geography and geology of the entire area were elaborated in Paris between 1808 and 1827 and published in 30 volumes under the title: "Voyage aux regions equinoxiales du Nouveau Continent fait en 1799–1804". This was subsequently translated into Spanish by L. Alvarado (1941–1942).

In Venezuela, von Humboldt explored the Andes of Mérida and Trujillo (Pico Niquitáo), the Serranía del Interior of eastern Venezuela (Cueva de los Guácharos) and the Orinoco valley as far south as the Casiquiare region. A collection of fossils assembled by von Humboldt was brought to Europe and investigated by Leopold von Buch (1839). Five ammonite species and some bivalves from Peru and Colombia were described and figured, but none from Venezuela. Half a century elapsed before the first Venezuelan ammonites were collected and described.

In 1849, Herman Karsten studied the geography and geology of parts of Colombia and Venezuela and compiled his observations in a map that was published in 1850. From the Serranía del Interior Karsten (1850, p. 348) mentions fossils from the Cerro de Los Pilones (State of Sucre), namely ammonite fragments, belemnites and inoceramids which he collected in dark shales containing elliptical concretions. These deposits may be considered to be part of what subsequently became known as the Querecual Formation. When crossing the north-eastwards plunging chain of the Andes in the State of Lara, between the town of El Tocuyo and the plain of Carora, Karsten reached the broad synclinal depression of Barbacoas. It was here, in the vicinity of Barbacoas village, that he discovered for the first time complete specimens of Venezuelan ammonites. They were found in a dark blueish limestone which is widely exposed in that depression and which, according to his observations, is similar to the limestones in the Serranía del Interior.

In April 1849, the fossils collected by Karsten were shipped from Puerto Cabello to Berlin, where Leopold von Buch recognized the following species (1850, p. 341):

Ammonites inflatus Sowerby = *Mortoniceras inflatum* (J. Sowerby)

Ammonites varicosus Sowerby = *Hysteroceras varicosum* (J. Sowerby)

Ammonites Hugardianus d'Orbigny = *Neoharpoceras hugardianum* (d'Orbigny)

Ammonites Mayorianus d'Orbigny = *Puzosia mayoriana* (d'Orbigny)

Ammonites Roissyanus d'Orbigny = *Oxytropidoceras (O.) roissyanum* (d'Orbigny)

Ammonites Tucuyensis von Buch = *Anapuzosia tucuyensis* (von Buch)

Ammonites Tucuyensis von Buch actually is the first ammonite to be described from Venezuela (von Buch, 1850, p. 342, figured on plate 10). The holotype here figured (Text fig. 1) is deposited at the Humboldt University in East Berlin. L. von Buch recognized the remarkable similarity between this ammonite assemblage from the Venezuelan Andes and those known at that time from Europe. He wrote:

"Mit nicht wenig Überraschung wird man durch diese Reste von Seethieren ganz wieder nach Europa versetzt, und mehr als es jemals von den Produkten irgend einer andern Gegend von Amerika geschehen ist. Man glaubt eine Sammlung der Versteinerungen aus den hohen Alpen von Savoyen vor sich zu sehen, die Produkte der bekannten Montagne de Fiz oder aus dem Val d'Hilliers in Wallis, oder gar von der Perte du Rhône bei Genf."

When A. Wegener formulated his continental drift hypothesis in 1929 he had no knowledge of these far-sighted supporting remarks.

At present we may assume that most of the ammonites were obtained by Karsten from a limestone layer that forms the top of the late Albian La Puya Formation, which overlies the Albian Peñas Altas Formation.

In 1886, 36 years after his journey, Karsten published his observations from Ecuador, Colombia and Venezuela and figured additional ammonites from his Venezuelan collection. They are:

Ammonites Leonhardianus Karsten (Trujillo), pl. 2, fig. 5 = *Paralenticeras leonhardianum* (Karsten)

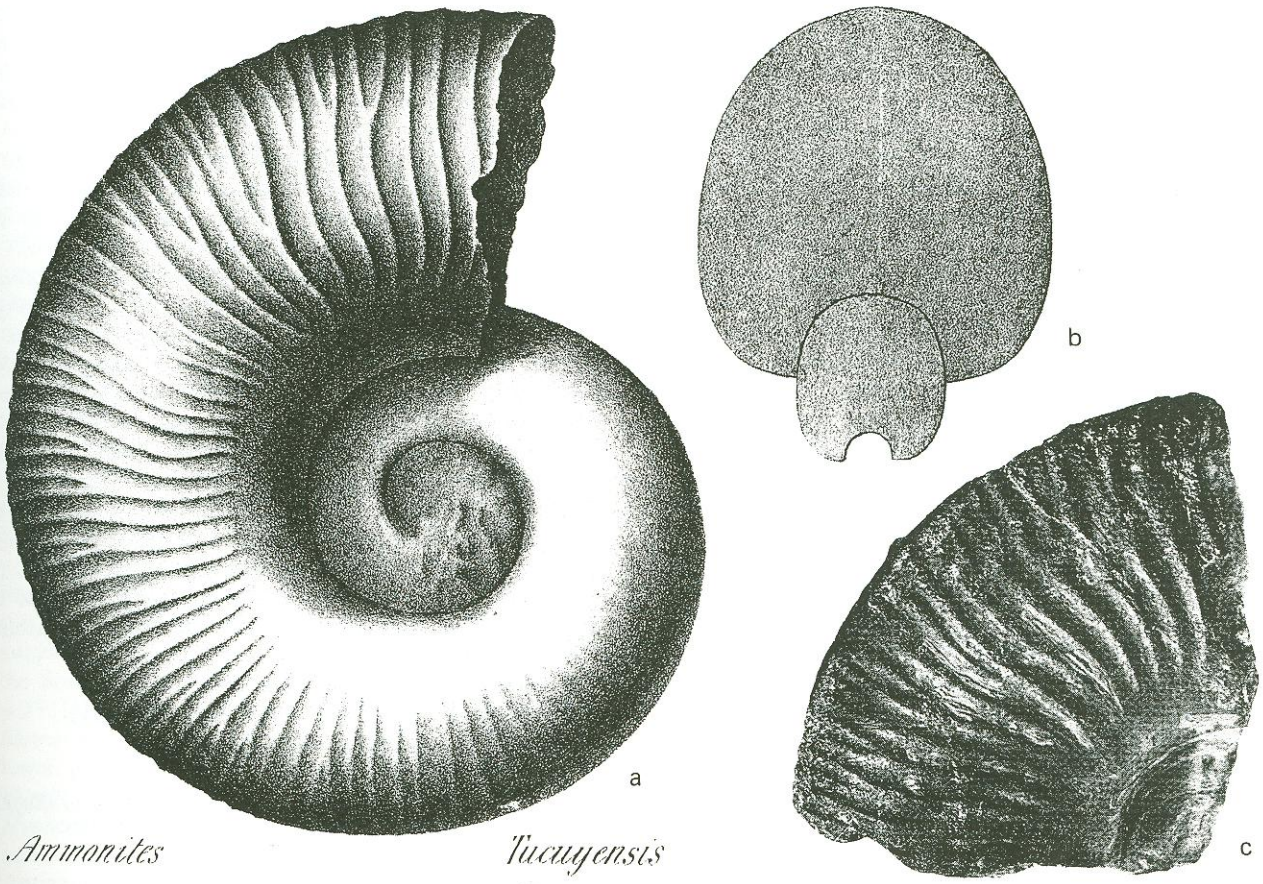
Ammonites Toroanus Karsten (Barbacoas), pl. 4, fig. 2 = *Vascoceras* sp.

Ammonites Ospinae Karsten (Barbacoas), pl. 4, fig. 3 = *Acanthoceras ospinae* Karsten (Bürgl, 1957, p. 137)

Ammonites Mosquerae Karsten (Barbacoas), pl. 4, fig. 4 = *Benueites mosquerae* (Karsten)

Ammonites Barbacoensis Karsten (Barbacoas), pl. 4, fig. 5 = ? *Harleites barbacoensis* (Karsten)

Karsten, in his discussion of the fossil occurrence, comments that "Les sphéroides renferment au centre une coquille". From this it may be deduced that the ammonites originate from the middle and upper part of the La Luna Formation, more specifically from the Chejendé



Text fig. 1
Puzosia (Anapuzosia) tucuyensis (von Buch), 1850
a–b. Reproduction of holotype.
c. Holotype in collection Karsten, Humboldt University, East Berlin.

and Timbetes Members which overlie the Aguada Member in the States of Trujillo and Lara. In these members, fossils are typically found within limestone concretions.

The geographer W. Sievers visited the Venezuelan Andes in 1884–85 and compiled his observations in a geological map and in 11 cross-sections published in 1888. His section 11 follows the trail which at that time connected El Tocuyo with the Hacienda Montevideo in the Carora plain. It already reflects some of the main regional tectonic features of the area. In an appendix to Sievers' publication, G. Steinmann (1888, p. 36–38) gave the following determinations from Sievers' collection from the "Schichten von Barbacoas":

Schloenbachia inflata Sowerby = *Mortoniceras inflatum* (J. Sowerby)
Schloenbachia varians Sowerby = *Schloenbachia varians* (J. Sowerby)
Schloenbachia cf. *Belknapi* Marcou = *? Oxytropidoceras (Venezoliceras)* cf. *robustum* Renz

Steinmann (p. 37) assigned a late Albian age to this assemblage and compared the limestone at Barbacoas with lithologically similar, dark, *Exogyra*-bearing limestones which outcrop in Táchira (probably the upper Turonian Guayacán Member which is part of the ill defined "Capacho Formation" of Sievers). Additional material collected by Sievers in the State of Táchira, near the town of Rubio was described by K. Gerhardt (1897a). It includes ammonites indicating a late Coniacian to Santonian age *(Texanites texanus)* which have not been found in other parts of Venezuela. This fauna is composed of:

Mortoniceras texanum Roemer = *Texanites texanus* (Roemer)
Mortoniceras canaense Gerhardt = *Peroniceras canaense* (Gerhardt)
Gauthiericeras Lenti Gerhardt = *Gauthiericeras lenti* (Gerhardt)
Amaltheus Sieversi Gerhardt = *Paralenticeras sieversi* (Gerhardt)
Lenticeras Andii Gabb = *Lenticeras andii* Gabb

Gerhardt (1897b) tried to compare ammonite assemblages from Venezuela with those of Colombia and Peru. In a table (p. 68) the ammonite bearing limestones of Barbacoas are interpreted as "upper Gault" and as time equivalent with the formations containing *Schloenbachia acuto-carinata* Shumard, 1853 = *Oxytropidoceras (Venezoliceras) acutocarinatum* (Shumard) in Colombia and Peru. The interval containing *Lenticeras andii* (Gabb) in Peru was correlated with the respective interval in Venezuela, at present regarded as a limestone corre-

sponding to the lower part of the La Luna Formation (upper Turonian to basal Coniacian), intercalated between the Guayacán Member below and the Táchira chert Member above.

In a revision of the genus *Mortoniceras* of the Gault, C. Stieler (1920, p.392) restudied Karsten's collection from the Barbacoas region. He recognized:

Inflaticeras inflatum Sowerby = *Mortoniceras inflatum* (J. Sowerby)

Inflaticeras Bouchardianum d'Orbigny = *Dipoloceras bouchardianum* (d'Orbigny)

and established the following two new species:

Oxytropidoceras venezolanum Stieler (p.394) and

Oxytropidoceras karsteni Stieler (p.395)

It is almost certain that Karsten obtained all these species from the present La Puya Formation. *Dipoloceras bouchardianum* probably represents one of the broad, strongly tuberculated species of *Oxytropidoceras (Venezoliceras).*

The region of Barbacoas was visited by C. Wiedenmayer in 1937. He correlated the fossiliferous limestones of the present La Puya Formation with the El Cantil Formation (Albian-Cenomanian) of Liddle (1928) which is exposed in the Serranía del Interior and distinguished the following species:

Mortoniceras inflatum (J. Sowerby)

Mojsisovicsia dürfeldi (Stieler)

Venezoliceras venezolanum (Stieler)

Lyelliceras ospinae (Karsten)

The first three species mentioned originate from the La Puya Limestone. *Lyelliceras ospinae* possibly was collected from the Aguada Member of the La Luna Formation (Cenomanian), and, according to Bürgl (1957, p.137, pl.12, fig.5) would be an *Acanthoceras.*

The first ammonites from the Serranía del Interior (State of Monagas) were collected by M. Reinhard in 1922 (p.13) from a conspicuous shale sequence intercalated between the Taguarumo Formation (von der Osten, 1955, p.139) and the El Cantil Formation, which has been referred to as García Formation by H. Guillaume (1972, p.1628). The fossil locality is situated near Pico García (type locality of the García Formation), 6 km north of Aragua de Maturín. L. Collet (1922, p.16) who investigated Reinhard's collection, recognized:

Uhligella Zürcheri Jacob = *Beudanticeras zuercheri* (Jacob)

Saynella bicurvata Michelin = *Aconeceras* sp.

Acanthoplites crassicostatus d'Orbigny = *Colombiceras* sp.

Neocomites (Hoplites) furcatus Sowerby = *Dufrenoyia* sp.

Parahoplites Deshayesi Leymerie = *Burckhardtites* sp.

Parahoplites sp. (four species)

Douvilleiceras Martini d'Orbigny = *Cheloniceras* sp.

Lytoceras aff. *anysoptycum* Uhlig = ?*Tetragonites* sp.

From this assemblage Collet could confirm the presence of Aptian sediments in the Serranía del Interior. He also discussed the similarity of the Alpine-Mediterranean ammonite faunas of Aptian age with that of Venezuela (see also von Buch, 1850).

The ammonites collected by Karsten in the Perijá foothills were again studied by W.O. Diedrich (1924) who for the first time mentioned *Barroisiceras haberfellneri* (Hauer), from the upper part of the La Luna Formation (Coniacian).

In his comprehensive compilation of the geology of Venezuela R.A. Liddle (1928) mentioned some additional ammonite localities from Táchira (p.168) and from the Perijá foothills (Quebrada La Luna, p.174).

In 1937, L. Kehrer collected *Sphenodiscus lenticularis* Hyatt from the Mito Juán Member at the top of the type section of the Colón Formation in the Río Lobaterita (at Peña Negra, about 1 km northwest of the town of Colón; fig.1, 3, p.48), thus confirming the Maastrichtian age of the upper Colón. The determination was made by A. Tobler in Basel. Kehrer extensively studied stratigraphic sections of the Cretaceous in Táchira (fig.1), Mérida (fig.4), Trujillo (fig.5) and Lara (fig.6), however, without finding ammonites and thus failed to obtain a satisfactory basis for correlating his lithological units.

M. Gerth (1941, p.341–352), in his compilation of the geology of South America, restudied Karsten's ammonites and mentioned:

Prionocyclus barbacoensis (Karsten)

Mortoniceras (Pervinquieria) inflatum (Sowerby)

Mortoniceras varians (Sowerby) = ?

Oxytropidoceras cf. *belknapi* (Marcou)

Mojsisoviczia dürfeldi Steinmann = *Mojsisovicsia dürfeldi* Steinmann

Venezoliceras venezolanum (Stieler)

Lyelliceras ospinae Karsten

A few additional ammonites, according to Gerth, would indicate levels older than Albian, namely:

Psilotissotia leonhardiana (Karsten) = *Paralenticeras leonhardianum* (Karsten)

Pseudohaploceras toroanum (Karsten) = *Vascoceras* sp.

Ammonites gen. nov. *mosquerae* Karsten = *Benueites mosquerae* (Karsten)

A pre-Albian age of these species seems unlikely. It is more probable that these species originate from Turonian sediments (upper part of Chejendé Member of the La Luna Formation).

A comprehensive paper by F.H. Sutton (1946) gives the first description of Aptian ammonites of the Apón Formation in the Perijá mountain front. A.A. Olson (unpublished report) determined:

Deshayesites columbianus Riedel (pl.3, fig.1)

Deshayesites cf. *stutzeri* Riedel (pl.3, fig.7)

Parahoplites cf. *inconstans* Riedel (pl.3, fig.4)

From the La Luna Formation, Sutton (p.1650) listed a number of species which, according to him, indicate an early Turonian age *(Eucalycoceras, ?Prionotropis, Hoplitoides, Barroisiceras, Neoptychites),* late Turonian *(Coilopoceras, ?Discohoplites, ?Protacanthoceras),* and Coniacian *(Peroniceras, Barroisiceras).*

The discovery of middle Albian ammonites in the uppermost part of the Chimana Formation by Hedberg and Pyre (1944a, p.9, 1944b) was of regional importance. They were found just below the disconformable contact

with the overlying Querecual Formation (Hedberg, 1937a, b). R.M. Imlay identified *Oxytropidoceras* cf. *carbonarium* (Gabb) = *O. acutocarinatum* (Shumard) indicating a late middle Albian age.

After the Second World War, when oil was discovered in the Cretaceous of the Maracaibo Basin, a more detailed investigation of the Cretaceous exposed along the Perijá foothills and in the Andes became necessary. Accurate information regarding the exact stratigraphic position of ammonite and other fossil occurrences was still lacking at that time. For sound age determinations of lithologic units, ammonites proved to be of decisive importance. Foraminifera are generally poorly preserved and can only be studied in thin sections in the hard, often recrystallized, limestones. Therefore they play a subordinate role in age determination.

A revision of the Cretaceous sections along the Perijá foothills and in the Serranía del Interior of eastern Venezuela, by Rod and Maync (1954), greatly improved the understanding of the stratigraphy and their findings served as a basis for later investigations. From the Serranía del Interior Maync studied foraminifera and ammonites which were collected in great number from the Borracha Formation by Rod (Rod and Maync, 1954, p.232). From there the genera *Cheloniceras* and *Colombiceras* were determined by L.F. Spath (p.265). From the lower part of the Valle Grande Formation (Rod and Maync, 1954, p.239) characteristic species belonging to *Hypacanthoplites, Megalytoceras, Dufrenoyia, Aconoceras, Cheloniceras* and other genera indicate a late Aptian age (*martinioides* Zone). Some Albian genera, such as *Beudanticeras* and *Puzosia,* determined by B.W. Imlay, originate from the Chimana Formation.

Cretaceous rocks of the Venezuelan Andes and the Perijá foothills were further studied by O. Renz, between 1955 and 1958. He discovered a considerable number of new ammonite localities, which provided a sounder basis for the correlation of lithological units (O. Renz, 1956, 1958, 1959a, 1977). He found for the first time Aptian ammonites belonging to the genus *Roloboceras,* in the upper part of the Tibú Member, in the States of Táchira (Seboruco section, Text fig.3, section 16) and Mérida (Egido). In 1968–72 he investigated the late Albian ammonite fauna of the La Puya Formation from Barbacoas in the State of Lara (Renz, 1968, 1970, 1971, 1972).

Here the genera *Mortoniceras, Hysteroceras, Oxytropidoceras (Venezoliceras), Anapuzosia, Desmoceras* and *Parengonoceras* predominate, whereas *Goodhallites* and *Neophlycticeras* are only sporadically observed.

Our knowledge of Venezuelan ammonites was greatly enhanced by H. Guillaume's (1972) investigation of the lower Cretaceous stratigraphy in the Serranía del Interior in 1958–60. The ammonites which he collected were determined by C.W. Wright of the British Museum (London) and the foraminifera (from about 500 samples) by H. Bolli and J.P. Beckmann of the Federal Institute of Technology (Zürich). This resulted in a reliable chronostratigraphic correlation of ammonite and foraminiferal faunas.

The late Aptian *Cheloniceras martinioides* Zone and the overlying *Ch. subnodosocostatum* Zone correspond to the *Bioglobigerinella barri* and *Praeglobotruncana infracretacea* Zones. Within the Albian, the *Douvilleiceras mammillatum* (early Albian) and the *Hoplites dentatus* Zones (middle Albian) can be distinguished. They belong to the *Praeglobotruncana rohri* and *Neobulimina subcretacea* Zones, respectively (Guillaume et al., 1972, p.1640). Part of the ammonites collected by Guillaume are described and figured in this monograph.

A detailed compilation of the geology of Venezuela and its oil-bearing basins was published by González de Juana et al. in 1980. This publication became available when the present study was terminated and could not be considered.

C. Aptian Stage

1. Stratigraphic review

a) Western Venezuela: Perijá Range and Andes
(Text fig. 2–4)

During the Early Cretaceous the *Maracaibo Platform* was a stable featureless peneplain over most of which old metamorphic rocks were exposed. It was bound towards the west and southeast by rapidly subsiding trough regions which were gradually filled by thick, predominantly coarse-grained terrestrial to fluvio-deltaic deposits, referred to as *Río Negro Formation* (Hedberg, 1931). The clastic material was partly derived from the Maracaibo Platform and partly from the Guayana Shield. Locally, supply from the Santander Massif (in Colombia) is also possible. On the Maracaibo Platform, the Río Negro Formation is reduced to a basal conglomerate which is mainly composed of well-rounded quartz pebbles and represents the early transgressive phase of the Cretaceous. Age-indicative fossils are not known so far from the Río Negro Formation.

The subsiding area west of the Maracaibo Platform, in the Perijá Range, is known as the *Machiques Trough* (Sutton, 1946). The infill of this trough is exposed in the Perijá mountain range of Venezuela, in the area between the rivers Santa Rosita to the north and Cusare to the south.

The *Uribante Trough* (Renz, 1956) in the Andes forms the northeastern termination of the Colombian Cretaceous basin in the Cordillera Oriental. The northwestern part of this basin continues into the Perijá Range (Machiques Trough) and the Guajira Peninsula.

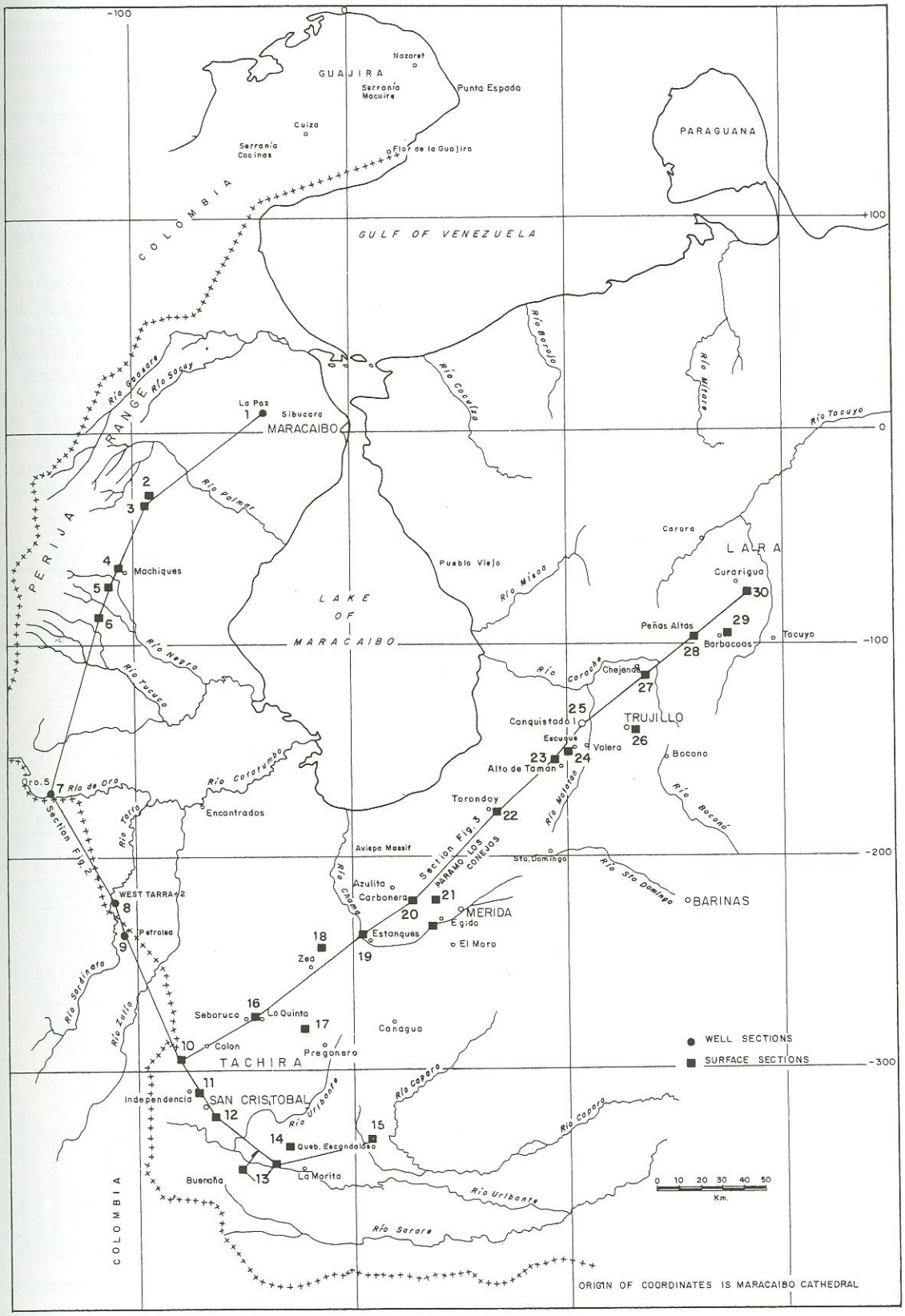
It may be assumed that the trough areas underwent a progressive regional subsidence, beginning during the Late Jurassic to Early Cretaceous in Colombia, and during the Early Cretaceous in the Venezuelan Andes and the Perijá Range. During the Aptian the Maracaibo Platform began also to subside gradually. After the initial transgression by the sea and the deposition of the clastics, a sheet of lithologically and faunistically uniform shallow-water carbonates accumulated in a well-aerated environment, at a level probably just below wave action. These carbonates were originally named the Tibú and were designated as a member of the Uribante Formation by Notestein et al. (1944). Sutton, 1946, p. 1642, incorporated the present Tibú Limestone in his Apón Formation. Renz (1956) suggested that the Tibú should instead be considered as a member of the Apón Formation (Sutton, 1946, p. 1642) and in 1959 he favoured the elevation of the Tibú in the Perijá Range and the Andes to a formation status.

Within the trough areas the *Tibú Formation* reaches thicknesses of several hundred meters. On the Maracaibo Platform as well as on the *Mérida Swell* (a pre-Cretaceous basement uplift coinciding with the highest present-day elevations of the Andes in the State of Mérida) the Tibú is thin, ranging up to 50 m. In the impressive section where the Cretaceous can be seen transgressing over metamorphic basement on the Páramo de los Conejos (4000 m above sea level) north of Mérida, the Tibú, containing *Choffatella,* has a thickness of less than 10 m. It is conformably overlain by the Guáimaros Shale of late Aptian to early Albian age (Renz, 1959a, fig. 6, section 3).

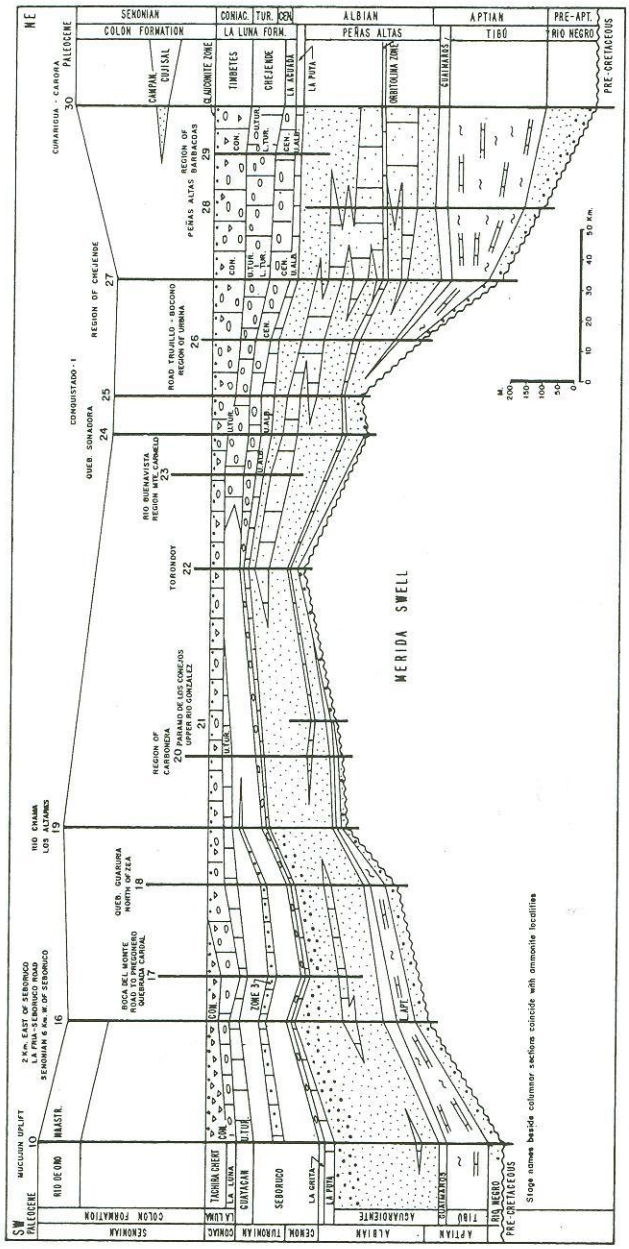
The Tibú in western Venezuela is characterized by light to dark grey, well layered, micritic limestones rich in skeletal particles and interbedded with grey marly limestone and marls. Southeastwards in the direction of the Guayana Shield the character changes in that clastic material constitutes a progressively greater part of the interval. The fauna consists predominantly of benthic organisms typical for a well-aerated shallow marine environment; thick shelled pelecypods and echinids are abundant, whereas corals and photosynthesizing algae are absent. *Choffatella decipiens* Schlumberger (Maync, 1949) is the most common foraminifer. *Orbitolina* has not been observed. A comprehensive search has failed to yield ammonites indicative for the Barremian. The oldest forms are sporadic occurrences of the ammonite genus *Roloboceras* (known throughout the lower Aptian in England) which are restricted to the upper part of the formation in the States of Táchira and Mérida (Renz, 1959a). The exact position of the Barremian-Aptian boundary thus remains undetermined.

The Tibú extends eastwards as far as the Loma León mountain range, situated 10 km southwest of Barquisimeto, which is interpreted by Renz (1960) to be an autochthonous fault-block along the Boconó fault system.

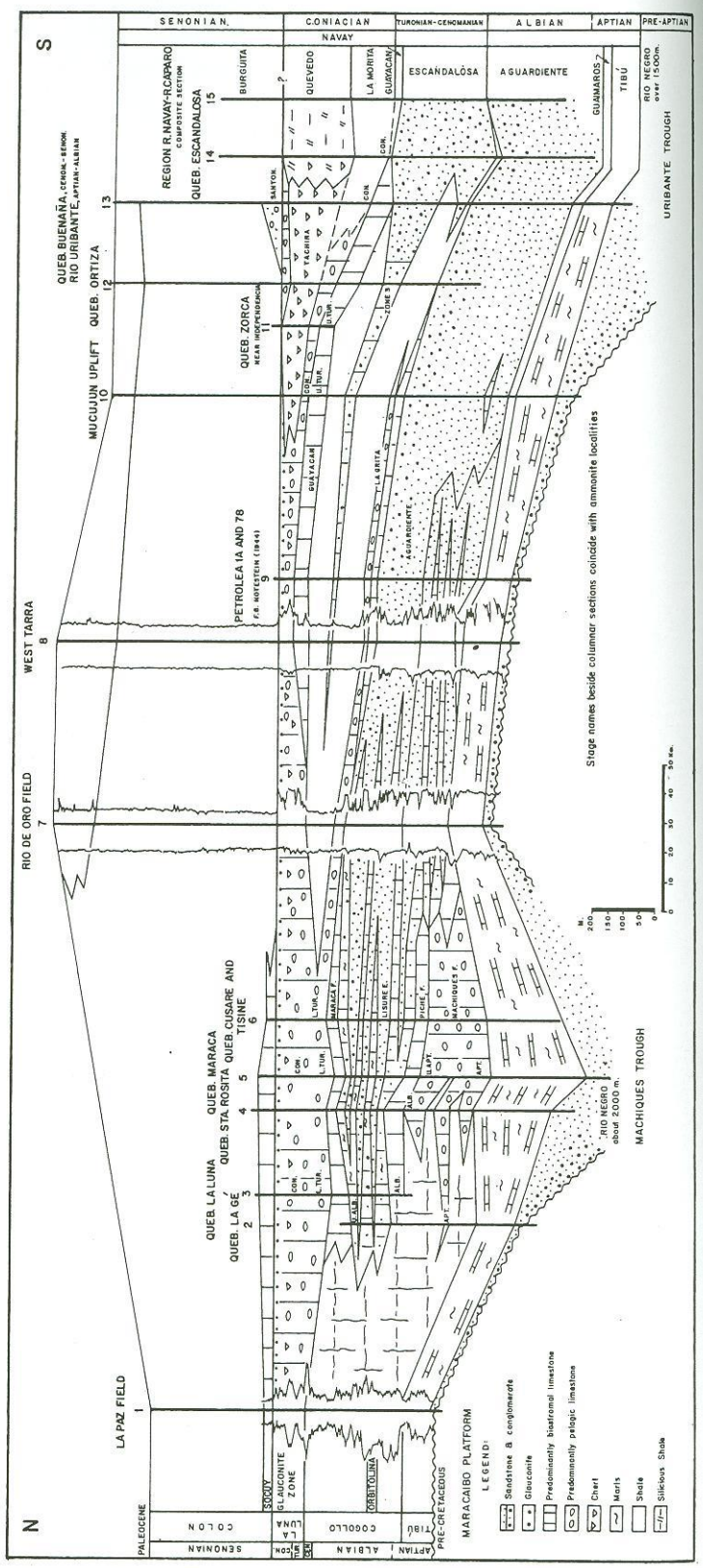
In the Machiques Trough area a closed subsiding anoxious basin developed during the later Aptian, creating favourable conditions for the generation of oil source rocks. Here, bituminous, dark/blue-grey, homogeneous, dense, micritic platy limestones, which contain abundant concretions were deposited. This conspicuous lithological unit has been designated as *Machiques Member* by Renz (1959a). Lithologically, the interval can hardly be distinguished from the La Luna Formation (Turonian–Coniacian), higher in the section. In addition to an abundance of fish remains, the concretions contain a well-preserved assemblage of Aptian ammonites, the majority belonging to the genus *Deshayesites.* The fossils were first figured by Sutton (1946).



Text fig. 2
Location of Cretaceous well and surface sections in western Venezuela mentioned in Text fig. 3 and 4.



Text fig. 3
Correlations of Cretaceous rock units along the Andes from Táchira to Lara, based on Renz, 1981.



Text fig. 4
Correlations of Cretaceous rock units along the Perijá foothills between Táchira and the La Paz oil field, based on Renz, 1981.

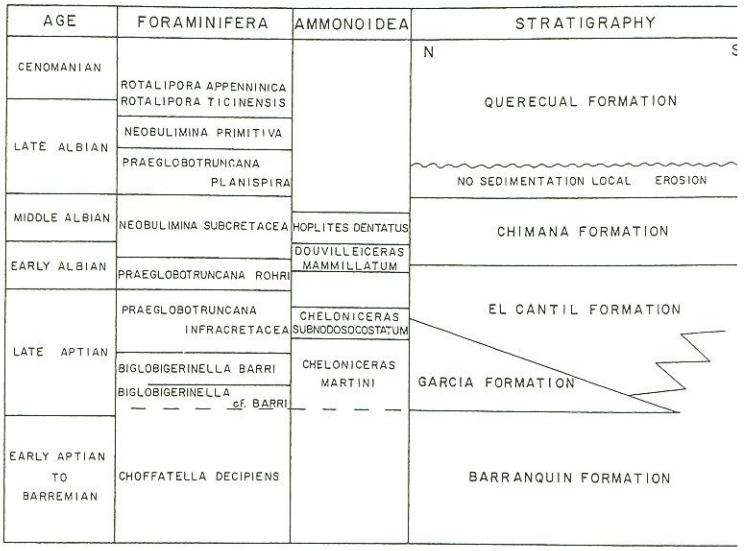
The lateral transition of the Machiques Member into the lower part of the Cogollo Formation is well exposed in Quebrada Santa Rosita (Text fig. 4, section 4). In the southern Perijá Range, south of the Machiques Trough (Colón District), and in the Andes, the carbonate sequence is interrupted by a rather thin interval of fine grained clastic deposits, which separates the Tibú from the overlying Aguardiente Formation. This interval named the *Guáimaros Member* (Renz, 1959a) is composed of dark grey, silty micaceous shale containing occasional plant fragments, notably *Weichselia* (Neumann, 1907, pl. 1, fig. 2). The variable thickness of the

shale interval might be connected with subaquatic erosion and respective accumulation.

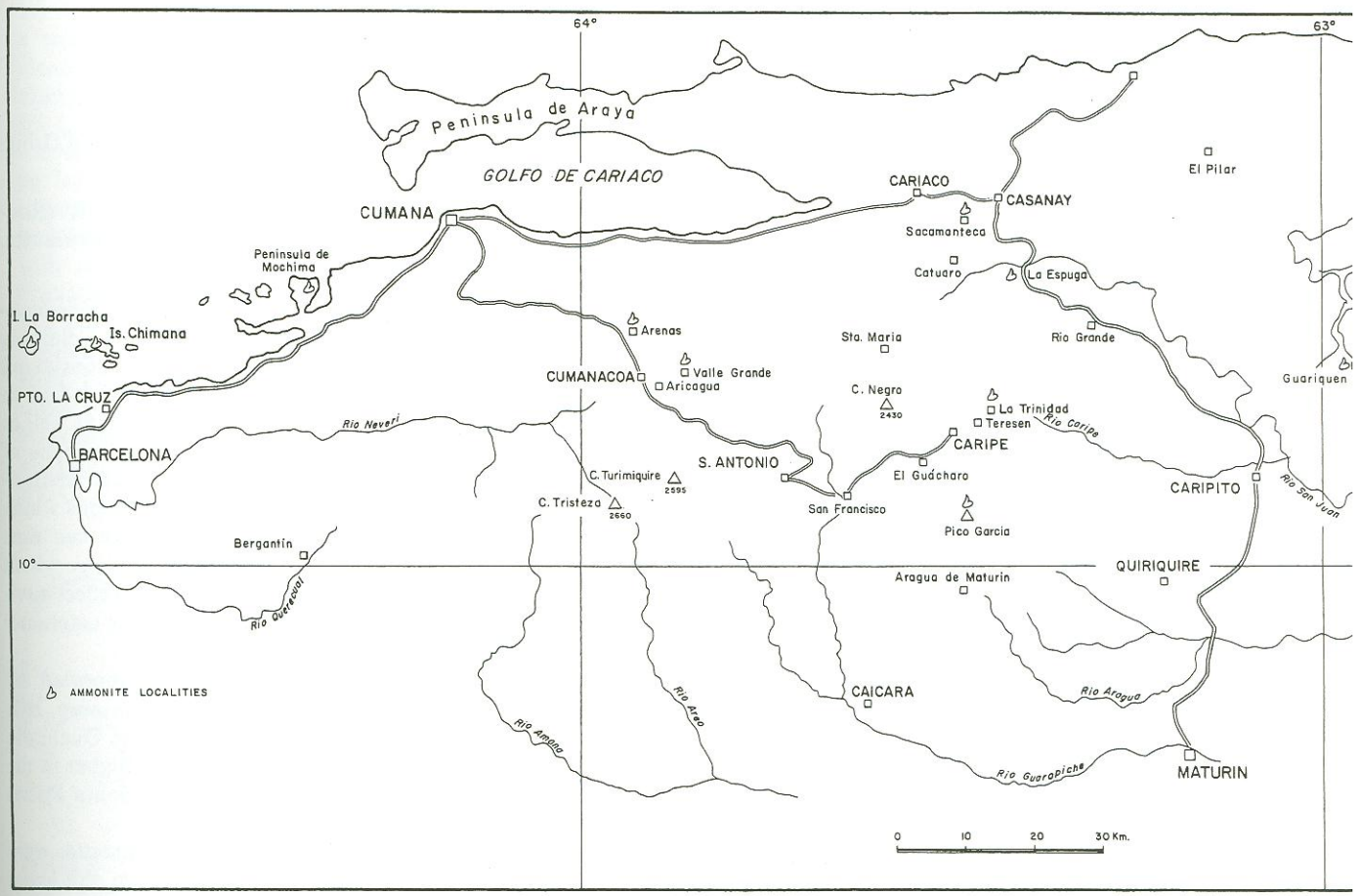
Because of the poorly preserved microfauna and the scarcity of ammonites in the overlying Albian, the limit between Aptian and Albian remains undetermined in the sections along the Perijá as well as in the Andes. According to its stratigraphic position the age of the Guáimaros Shale may be late Aptian to early Albian.

In the Cretaceous section exposed in the Cordillera de la Costa, Aptian ammonites have only been found at Quebrada Onoto, a tributary of the Rió Cura, in the State of Aragua. They belong to the genus *Cheloniceras* and indicate a late Aptian age. They occur in an unmetamorphosed limestone sequence which probably is time-equivalent to the Agua Blanca Formation further west (Renz and Short, 1960, p. 289).

It should be noted that since the Piché, Machiques and Guáimaros were defined as members by Renz in 1959a, the author has reconsidered their stratigraphic status and would now prefer to elevate them to Formations. For this reason they are indicated as Formations in the text figures, and in the text hereafter.



Text fig. 5
Stratigraphic nomenclature of the Cretaceous in the Serranía del Interior, based on H. A. Guillaume, H. M. Bolli and J. P. Beckmann (1972).



Text fig. 6
Location map of Aptian and early Albian ammonite localities in the Serranía del Interior.

b) Eastern Venezuela: Serranía del Interior
(Text fig. 5–6)

In the Serranía del Interior (States of Sucre and Monagas) ammonite-bearing rocks of Aptian age are more favourably developed than in the west of Venezuela.
The oldest Cretaceous sediments belong to what was once referred to as the *Barranquín Formation* (Liddle, 1928), which consists of orthoquartzite interbedded with black-silty shales and thick beds of predominantly biostromal limestones. The age of the succession has been indicated as Barremian to early Aptian (Guillaume, 1972, p. 1624). Towards the north, the upper part of the Barranquín laterally grades into the *Taguarumo Formation* (von der Osten, 1955, p. 139; Guillaume, 1972, p. 1625). The exposed part of this formation reaches a thickness of 250 m according to Guillaume. It consists of thickly bedded rudist-biostromes, calcarenites, oolites and algal limestones. *Choffatella decipiens* is abundant and the presence of *Orbitolina* has been recorded. No determinable ammonites have been found.
The Barranquín to the south, and the Taguarumo Formation developed farther north, are overlain by an ammonite-bearing shale interval referred to as the *García Formation* by Guillaume (1972). The thickness of this shale interval increases northwards to as much as 150 m. Its rich fauna of ammonites, described in this monograph, indicates that it falls within the *Cheloniceras martinioides* Zone of late Aptian age.
The microfauna from the García Formation corresponds to the *Bioglobigerinella barri* and the *Praeglobotruncana infracretacea* Zones according to Bolli and Beckmann (in Guillaume, 1972).
Towards the north, the García Formation laterally grades into the lower part of the Valle Grande Formation (Rod and Maync, 1954) which is characterized by the abundance of glauconite present in shales, quartz sands and carbonates. At the type locality, the Valle Grande overlies the Barranquín Formation and farther north the Taguarumo Formation. Here, the ammonite fauna consists of the genera *Valdedorsella, Beudanticeras, Aconeceras, Diadochoceras, Gargasiceras, Colombiceras, Acanthohoplites, Dufrenoyia* and *Mathoceras.*
The García Formation is followed by the *El Cantil Formation* (Liddle, 1928; Rosales, 1959) which consists of thick bodies of biostromal limestones *(Guácharo Member)* interbedded with shale layers and sandstones which increase in thickness towards the Guayana Shield and from which ammonites are not known. To the north, the El Cantil grades laterally into the *Valle Grande Formation* (Guillaume, 1972, fig. 1). The age of the heterochronous El Cantil Formation ranges from Aptian in the south to early Albian further north.

2. Systematic description of Aptian ammonites

a) Aptian in the Perijá river sections (State of Zulia)
(Text fig. 4)

In the river sections along the Perijá foothills ammonite assemblages of Aptian age were only found in the Machiques Formation which is developed in a La Luna type lithology. They predominantly occur in limestone concretions. These emit a strong oil smell and show positive reactions with chloroform. On breaking the fossils, live oil commonly appears in cavities between calcite crystals. Preservation is good and specimens with tests are generally available. The thick sections of the Tibú Formation (Renz, 1959a and 1977) in the Machiques Trough area, which are believed to be in part of Barremian age, have not yielded any ammonites.

Family Deshayesitidae Stoyanow, 1949

Subfamily Deshayesitinae Casey, 1963

Genus *Deshayesites* Kazansky, 1914

Type species: Ammonites deshayesi Leymerie in d'Orbigny, 1841.

Occurrence: Europe, Caucasus, Georgian SSR (Rouchadzé, 1933), California, Mexico, Colombia, Venezuela, Greenland (Spath, 1946), Queensland.

Casey (1964, p. 289) introduced the genus *Neodeshayesites* for forms described by Riedel (1938) from Colombia (type species: *D. stutzeri,* pl. 7, fig. 5–7). Casey considered those forms 'as a special group, more closely allied to *Dufrenoyia* than to *Deshayesites*'. In Colombia as well as in Venezuela *'Neodeshayesites'* occurs in formations of La Luna lithology, deposited in a very special environment, fundamentally different from environments which prevailed in Europe during Aptian time. We can thus expect that the slight differences in morphology which separate *'Neodeshayesites'* from *Deshayesites* reflect environmental conditions and should not influence taxonomy above species level.
An Aptian age for *Deshayesites* is not supported by additional ammonite genera from the Perijá area. It is only based on the occurrence of *Dufrenoyia* in Quebrada La Gé, within the Cogollo Formation, thus higher in the section than the *Deshayesites* of Quebrada Santa Rosita (Text fig. 4).
In the Serranía del Interior identical *Deshayesites* were collected by Guillaume (1972, p. 1650) from the lower part of the Valle Grande Formation (lower part of the interval corresponding to the *Cheloniceras martinioides* Zone, Guillaume et al., 1972, p. 1648–1650). Wright in

Guillaume (p. 1650) considers those forms as ancestors of *Dufrenoyia* (compare Kemper, 1964). We follow Wright in Guillaume (1972, p. 1650).
Collignon et al. (1979) described similar slightly square-ventered *Deshayesites* from the Aptian in the Santander region in northern Spain.

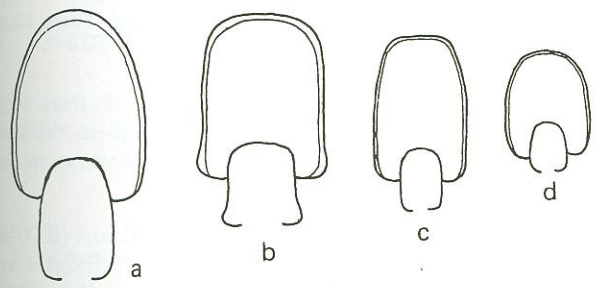
Deshayesites columbianus Riedel
Pl. 1, Fig. 1a–b, 2; Text fig. 7a

1938 *Deshayesites columbianus* Riedel, p. 40, pl. 7, fig. 16–20; pl. 12, fig. 12; pl. 14, fig. 21.
1946 *Deshayesites columbianus* Riedel, Sutton, pl. 3, fig. 1–2.
1957 *Colombiceras karsteni* (Marcou), Bürgl, pl. 9, fig. 1a–c.
1979 *Neodeshayesites columbianus* (Riedel), Etayo-Serna, p. 62, pl. 9, fig. 8; pl. 10, fig. 7.

Lectotype: Deshayesites columbianus Riedel, p. 40, pl. 7, fig. 16, 17, selected by Etayo-Serna, 1979, p. 62.

Location: Perijá foothills, Quebrada Santa Rosita (fig. 2, section 23 in Renz, 1977), early to late Aptian, Machiques Formation.

Description: MBJ28581 internal whorls. Body chamber last half volution. Peristome simple, initiated by a contraction of the whorl followed by a low collar identical with preceding ribs. Whorl section on body chamber oval. On inner volutions venter almost squared (Pl. 1, Fig. 2) thickest below midflank, from there gently converging towards broadly rounded venter (Text fig. 7a). Umbilicus 37% of diameter, feebly expanding towards mouth border. Umbilical wall low, fairly steep; umbilical margin narrowly rounded. Costation begins with about 15 mm diameter (Re2699a, Pl. 1, Fig. 2). Primaries originate low on umbilical wall and cross flank in a prorsiradiate, slightly sigmoidal, curve. Secondaries regularly alternating with primaries, ending near mid-flank. Both cross venter with maximum elevation. Bifurcation or incipient bifurcation occurs occasionally also on body chamber. On last volution 54 ribs occur of which 27 are primaries. Suture line not preserved. Lobe formula: E L U_2 U_3/U_1 I (Schindewolf, 1966, p. 684).



Text fig. 7
Whorl sections of *Deshayesites:*
a. *D. columbianus* Riedel, MBJ28581, Pl. 1, Fig. 1, 1×.
b. *D. ?nodosus* Riedel, Re2699b, Pl. 1, Fig. 3, 1×.
c. *D. rotundus* Riedel, Re2699c, Pl. 1, Fig. 6, 1×.
d. *D. stutzeri* Riedel, Re2699e, Pl. 1, Fig. 5, 1×.

Measurements: Dm 80 mm, Wh 27 (0.35), Ww 20 (0.25), U 30 (0.37)

Specimen Re2699a shows a juvenile stage with late beginning of costation.

Distribution: Colombia, Venezuela.

Remarks: D. columbianus appears to be very similar to, if not identical with *C. karsteni* (Marcou), figured by Karsten (1886, pl. 5, fig. 1a–b), Bürgl (1957, pl. 9, fig. 1a–c) and Etayo-Serna (1979, p. 64, pl. 9, fig. 2; pl. 10, fig. 6).

Deshayesites? nodosus Riedel
Pl. 1, Fig. 3a–b; Text fig. 7b

1938 *Deshayesites nodosus* Riedel, p. 38, pl. 7, fig. 10–11.

Location: Perijá foothills, Quebrada Santa Rosita, Machiques Formation, early to late Aptian.

Description: Re2699b. Last half whorl belongs to body chamber. Peristome just indicated. Whorl section high subrectangular on costal section, intercostally oval. Venter faintly squared. Sides flattened, parallel, widest on strong umbilical tubercles. Umbilical wall low and steep, narrowly rounding into flank at intercostal section. Umbilicus 35% of diameter. Costation slightly inclined forward. Ribs begin near umbilical seam and branch or incipiently branch from umbilical tubercles which are variable in strength, and placed on umbilical margin. Short intermediate ribs, flattening out near mid-flank, are subordinate. All ribs rise slightly on ventrolateral shoulder, then cross straight over venter. External suture typical for genus.

Remarks: The holotype of *Deshayesites nodosus* from Colombia represents a juvenile stage displaying features characteristic for *Dufrenoyia.* The relation of the present specimen with *D. nodosus* Riedel remains doubtful, this also because the stratigraphic position of *D. nodosus* from Colombia in relation to the Venezuelan specimen is not known.

Measurements: Dm 65 mm, Wh 25 (0.37), Ww 19 (0.30), U 23 (0.35).

Distribution: Colombia, Venezuela.

Deshayesites stutzeri Riedel
Pl. 1, Fig. 4a–b, 5a–b; Text fig. 7d

1938 *Deshayesites stutzeri* Riedel, p. 37, pl. 7, fig. 5–9; pl. 12, fig. 14.
1946 *Deshayesites stutzeri* Riedel, Sutton, pl. 3, fig. 7.
1964 *Neodeshayesites stutzeri* (Riedel), Casey, p. 289.

Lectotype: Deshayesites stutzeri Riedel, pl. 7, fig. 5, 6, selected by Casey, 1964, p. 289.

Location: Perijá foothills, Quebrada Santa Rosita, Machiques Formation, early to late Aptian.

Description: Re2699d, adult specimen; Re2699e, juvenile stage without costae on internal whorls. Specific features

differentiating this species from *D. columbianus* are the high whorl section (Text fig. 7d) and the resulting more narrow umbilicus which attains 26% diameter, against 37% in *D. columbianus*. Ribs rise slightly on ventrolateral shoulder, resulting in a slightly squared venter on costal section. Suture imperfectly preserved.

Measurements:	Dm	Wh	Ww	U
Re2669e	35 mm	15 (0.43)	12 (0.34)	9.2 (0.26)
Re2669d	47 mm	20 (0.42)	14 (0.33)	12.5 (0.26)

Distribution: Columbia, Venezuela.

Deshayesites rotundus Riedel
Pl. 1, Fig. 6a–b; Text fig. 7c

1938 *Deshayesites rotundus* Riedel, p. 37, pl. 7, fig. 14–15.

Location: Perijá foothills, Quebrada Santa Rosita, Machiques Formation, early to late Aptian.

Description: Re2699c. Internal mould. Whorl section compressed, highly whorled. Flanks parallel, slightly convex, thickest near mid-flank (Text fig. 7c). Venter subtruncated. Umbilicus with 25% of diameter relatively narrow. Costation fine and densely spaced (29 ribs on half volution). Ribs arise on steep umbilical wall, just above umbilical seam. On umbilical margin ribs elevate into bullate tubercles from which most bifurcate indistinctly, crossing flank in a flexuous curve. Shorter intermediate ribs are intercalated. Faint ribs rise on ventrolateral shoulder, what results in a slight squared venter, not perceptible on holotype from Colombia. All ribs attenuate below mid-flank towards umbilical margin. Suture not visible.

Measurements: Dm 48 mm, Wh 22 (0.46), Ww 13 (0.27), U 12.2 (0.25)

Distribution: Colombia, Venezuela.

Genus *Dufrenoyia* Burckhardt, in Kilian, 1915

Type species: Ammonites furcatus J. de C. Sowerby, 1831.

Occurrence: Europe, Mexico, Texas, Colombia, Venezuela, Japan (Obate et al., 1975), Madagascar (Collignon, 1962).

Dufrenoyia aff. *furcata* (J. de C. Sowerby)
Pl. 1, Fig. 7a–b

1836 *Ammonites furcatus* J. de C. Sowerby, p. 339, pl. 14, fig. 17.
1925 *Dufrenoyia furcata* Sowerby sp., Burckhardt, p. 17, pl. 10, fig. 12–13.
1964 *Dufrenoyia furcata* J. de C. Sowerby, Casey, p. 378, pl. 62, fig. 2–3; pl. 63, fig. 1; pl. 65, fig. 1a–b; Text fig. 134a, 135, 136, cum synon.

Holotype: Hythe Beds, Kent (Fitton, 1847, p. 295). Refigured by Casey, 1964, pl. 62, fig. 2.

Location: Perijá foothills, Quebrada La Gé, from intercalation of dark nodular limestone, 10 cm in thickness and of La Luna facies in the Cogollo Formation, late Aptian.

Description: Re2574. Matrix consists of calcite crystals. Whorl section subtrapezoidal. Sides on costal section bulging below mid-flank, then flattening and converging towards squared venter, bound by narrowly rounded edges. Umbilicus 35% of diameter with low, steep slope, grading into flank. Primary ribs feebly sigmoidal, about radial, broadly rounded and separated by wide interspaces. They begin above umbilical seam. Secondary ribs merge with primaries around mid-flank. Some are free-ending within interspaces. Ribs rise in obtuse tubercles at ventral edges, and then cross straight over venter. Suture destroyed by recrystallisation. For ontogeny of suture line see Michailova, 1957, fig. 2. Lobe formula as on *Deshayesites* (Schindewolf, 1966, p. 688; Wiedmann, 1966, p. 43).

Measurements: Dm 36.5 mm, Wh 13 (0.35), Ww 13 (0.35), U 13 (0.35)

Distribution: England (lower Aptian). According to Casey (1964, p. 380): 'no authentic examples of *D. furcata* have been figured since the time of Sowerby'.

Remarks: The present specimen differs from the holotype by its slightly less sigmoidally curved ribs and by a somewhat denser costation.
The species is absent from the collection of Collet (1922, p. 17); it has been mentioned by Gerth (1935, p. 345) and Liddle (1946, p. 142), but the respective originals are not available.

Dufrenoyia justinae Hill
Pl. 1, Fig. 8a–b

1893 *Acanthoceras Justinae* Hill, p. 38, pl. 7, fig. 1–3.
1925 *Dufrenoyia texana* Burckhardt, p. 20, pl. 9, fig. 2–15.
1938 *Dufrenoyia texana* Burckhardt, Riedel, p. 48, pl. 8, fig. 15–19; pl. 14, fig. 25.
1904 *Hoplites furcatus* Sowerby, Lasswitz, p. 4, text fig. 1.
1939 *Dufrenoyia justinae* (Hill), Scott, p. 1022, pl. 60, fig. 7–8; pl. 62, fig. 9.
1949 *Dufrenoyia justinae* (Hill), Humphrey, p. 122, pl. 6, fig. 1–7; pl. 7, fig. 1–9.
1956 *Dufrenoyia texana* Burckhardt, Bürgl, p. 6, pl. 1–3.
1976 cf. *Dufrenoyia justinae* var. *sanctorum* Bürgl, Cantu Chapa, p. 10, pl. 1, fig. 5.

Location: Perijá foothills, Quebrada La Gé, from intercalation of dark nodular limestone, 10 cm in thickness and of a La Luna facies in the Cogollo Formation, late Aptian.

Description: Re2416. Differs from *D. dufrenoyi* (d'Orbigny) by the possession of ribs crossing straight over squared venter without bifurcations, especially on body chamber (compare Humphrey, 1949, p. 122–123). Humphrey united *D. texana* with *D. justinae* from the Río Nazas in Mexico. Bürgl (1956, 1957) maintained the species *D. texana* and distinguished the two varieties

sanctorum (large umbilicus and fewer ribs) and *media* (intermediate between *justinae* and *texana*).

Measurements: Dm 42.5 mm, Wh 16 (0.37), Ww 13 (0.31), U 12 (0.28)

Distribution: Mexico, Texas, Colombia, Venezuela.

b) Aptian in the Andes (States of Táchira and Mérida)
(Text fig. 3)

In the Venezuelan Andes cephalopods of Aptian age are very rare and, are apparently restricted to the upper part of the Tibú Formation. Ammonites and some nautili (*Heminautilus etheringtoni* Durham, det. W.S. Adkins; compare Etayo-Serna, 1979, pl. 4, fig. 8; pl. 5, fig. 9) were first observed by Renz in 1949 within the Cretaceous section exposed 2 km east of Seboruco (section 35 on fig. 3, Renz, 1977), situated along the road La Fria-La Quinta (State of Táchira). At that time these ammonites were determined as *Cheloniceras*.
The ammonites lived in a shallow, neritic, well oxygenated environment, just below wave action. They are accompanied by numerous bivalves (mainly *Exogyra*), echinoderms and benthic foraminifera. Corals and algae are absent. The formation consists of hard, micritic, splintery limestones alternating with layers of skeletal limestone of great variety and intercalated with partly nodular marls.
The first collection of fossils was taken to Austin for determination by Dr. Adkins. During a visit to Venezuela in 1979, the author, accompanied by A. Mozetic, obtained additional ammonites which all belong to the genus *Roloboceras* Casey, 1954. In England this genus is restricted to the lower Aptian. In the Seboruco section the age assignment cannot be substantiated by additional ammonites. If an early Aptian age should also prove correct in Venezuela, which is probable, the upper part of the Tibú Formation would be dated as early Aptian. The overlying Guáimaros Shale would thus comprise the late Aptian and probably also part the early Albian. Additional ammonite discoveries might help to clarify the situation.

Family Douvilleiceratidae Parona and Bonarelli, 1897

Subfamily Roloboceratinae Casey, 1961

Genus *Roloboceras* Casey, 1954

Type species: Ammonites Hambrovi Forbes, 1845.

Occurrence: Southern England, France, Spain.

Roloboceras saxbyi Casey
Pl. 3, Fig. 1a-b, 2a-b

1961a *Roloboceras saxbiy* Casey, p. 507, 509.
1961b *Roloboceras saxbyi* Casey, p. 188, pl. 30, fig. 1, 2; text fig. 57c-d.

Holotype: Roloboceras saxbyi Casey, pl. 30, fig. 1a-b; text fig. 57d, suture.

Location: Estado Táchira, Cretaceous Seboruco section between the villages of Seboruco and La Quinta. Tibú Formation, 10 m below limit of Guáimaros shale Formation, late early Aptian.

Description: Re6801 (Pl. 3, Fig. 11). Internal mould. Whorl section at that size semi-circular, depressed. Costation uniform, rather dense for species. Ribs rounded, as wide as interspaces, crossing straight over venter without modifications. Some unite at umbilical border at poorly defined bulges. On a fragment (Re6906, not figured) representing a juvenile stage, distinct umbilical tubercles are developed. Suture not preserved. According to Schindewolf (1966, p. 674, fig. 412) a second umbilical lobe is not present. The primary suture is quadrilobate (Casey, 1961b, p. 188, text fig. 57). Later in ontogeny a small lobe develops on saddle L/U which might be interpreted as U_3.

Measurements: Dm 140 mm, Wh 83 (0.59), Ww 53 (0.37), U 43 (0.30).

Re6905 (Pl. 3, Fig. 2), a septate fragment with distinctly coarser and wider ribs, approaches the holotype.

Distribution: England, Venezuela.

Roloboceras hambrovi (Forbes)
Pl. 2, Fig. 25a-b

1845 *Ammonites Hambrovii* Forbes, p. 354, pl. 13, fig. 4, lectotype.
1921 *Cheloniceras hambrovi* (Forbes), Spath, p. 317, pl. 8, fig. 3.
1961b *Roloboceras hambrovi* (Forbes), Casey, p. 179, pl. 29, fig. 5-6; pl. 30, fig. 7-8; pl. 31, fig. 3; pl. 32, fig. 5, with synonymy.

Lectotype selected by Casey, 1961, p. 179.

Location: Section of Seboruco, Tibú Formation, 10 m below Guáimaros Formation, late early Aptian.

Description: Re6906. Septate fragment with four coarse umbilical bulges preserved. Whorl section depressed, semi-circular with vertical umbilical wall. Strong ribs branch from umbilical bulges, variable in strength. Intermediate ribs do not connect with umbilical bulges and fade out in interspaces. Over venter all ribs preserved are equal in strength.

Distribution: England, Venezuela.

c) Aptian in the Serranía del Interior (States of Sucre and Monagas)

All ammonites available were collected from shales of the García Formation and the basal part of the Valle Grande Formation from widely spread localities, by M. Reinhard (1922), E. Rod and W. Maync (1954), and

H.A. Guillaume (1972). They are mostly small-sized moulds consisting of limonite and occasionally of goethite (FeOOH), Tests are generally not preserved.
Detailed stratigraphic correlations between ammonite localities may not be correct. Most of the fossils were washed out from shale beds, and their original position in the sections had to be reconstructed. Their age is considered to be late Aptian (Gargasien) probably corresponding to the *martinioides* Zone.

Family Ancyloceratidae Meek, 1876

Subfamily Ancyloceratinae Meek, 1876

Genus *Ancyloceras* d'Orbigny, 1842

Type species: Ancyloceras matheronianum d'Orbigny, 1842.

Occurrence: Europe, USA, Japan, Colombia, Venezuela.

Ancyloceras mantelli Casey
Pl. 2, Fig. 24a–b; Text fig. 8a–b

1960 *Ancyloceras mantelli* Casey, p. 21, pl. 1, fig. 3, holotype, pl. 2, fig. 1; pl. 3, fig. 1–2.

Location: Valle Grande Formation type section, 4.5 km east of Cumanacoa, late Aptian. Coll. E. Rod.

Description: MBJ28760. Single, well preserved fragment of inner spiral. Whorl section (Text fig. 8b) as wide as high, suboctogonal in costal section. Widest at smallest dorsal nodes of six-fold-tuberculated ribs which alternate with thinner untuberculated intermediaries. On mould, nodes blunt and rounded, diminishing in size from ventral to dorsal. Over dorsum all ribs subdued in strength. Suture line (Text fig. 8a) complex, with bifid saddles and trifid lateral and dorsal lobes, as typical for the genus.

Family Macroscaphitidae Hyatt, 1900

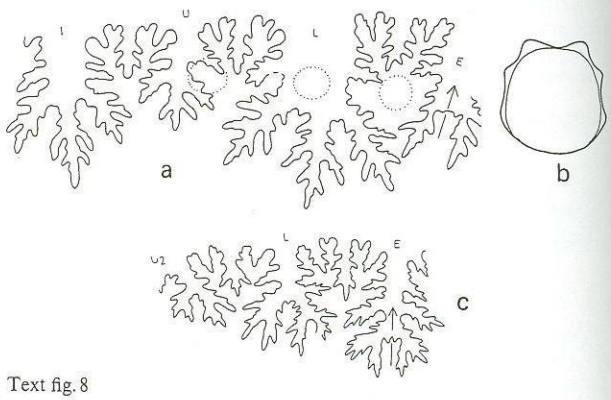
Genus *Macroscaphites* Meek, 1876

Type species: Scaphites yvani Puzos, 1831 (d'Orbigny, 1840, pl. 128, p. 515).

Occurrence: Europe, North Africa, Venezuela.

Macroscaphites cf. *striatisulcatus* d'Orbigny
Pl. 2, Fig. 22a–b

1941 *Macroscaphites striatisulcatus* d'Orbigny, p. 153, pl. 39, fig. 4–7.



Text fig. 8
Ancyloceras mantelli Casey, MBJ28760, Pl. 2, Fig. 24
a. Suture line 5×.
b. Whorl section 2×.
c. ?*Jauberticeras* sp., MBJ28762, Pl. 2, Fig. 23, suture line 5×.

1954 *Macroscaphites striatisulcatus* (d'Orbigny). Rod and Maync, p. 270.

A partly deformed, juvenile, untuberculated specimen (Gu1179) from the García Formation at Pico García may be compared with d'Orbigny's species *Macroscaphites striatisulcatus.*

Family Gaudryceratidae Spath, 1927

Subfamily Gabbioceratinae Breistroffer, 1953

Genus *Jauberticeras* Jacob, 1907

Type species: Ammonites Jaubertianus d'Orbigny, 1950b.

Occurrence: Spain, France, Caucasus, Madagascar, California.

Jauberticeras sp. juv.
Pl. 2, Fig. 23a–b; Text fig. 8c

Location: Valle Grande, type section of Valle Grande Formation, 4.5 km east of Cumanacoa, Aptian. Coll. E. Rod.

Description: MBJ28762. Single, limonitized, juvenile specimen. Whorl section depressed, with bluntly rounded lateral angle on mid-flank. Venter convex rounded. Umbilicus 53% of diameter, wide for genus. Moderately steep slope from lateral angle towards umbilical seam. Ornament consists of dense, prorsiradiate striae-like ribs on test. On last volution four distinct constrictions. Suture (Text fig. 8c) typical for genus. Asymmetric second umbilical lobe widens to a suspensive lobe $U_2 = S$ (compare Wiedmann, 1962b, p. 68, fig. 23b). The specimen appears to be very closely related to *Jauberticeras subbeticum tyrrhenicum* from Sardinia (Wiedmann, 1968; p. 44, pl. 2, fig. 10), but shows a narrower whorl section.

Family Oppeliidae Bonarelli, 1894

Subfamily Aconeceratinae Spath, 1923

The family comprises the genera *Aconeceras* Hyatt, 1903 and *Sanmartinoceras* Bonarelli, 1921. The latter differs from *Aconeceras* by a distinct falcoid costation. In the present collection, from the Serranía del Interior, only *Aconeceras* is represented.

Genus *Aconeceras* Hyatt, 1903

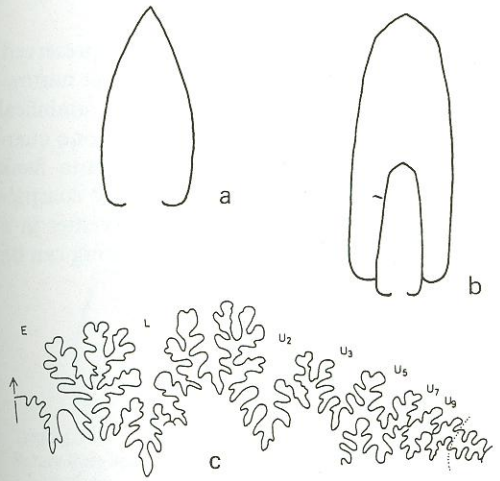
Type species: Ammonites nisus d'Orbigny, 1841, pl. 55, fig. 7–9.

Occurrence: Europe, Madagascar (Breistroffer, 1936a), South Africa (Spath, 1921), Australia (Whitehouse, 1926, 1927).

Aconeceras nisus (d'Orbigny)
Pl. 1, Fig. 15a–b, 19a–b; Text fig. 9a

1841 *Ammonites Nisus* d'Orbigny, p. 184, pl. 55, fig. 7–9
1893 *Oppelia Nisus* d'Orbigny, Sarasin, p. 152, pl. 4–6, fig. 9a–c, Text fig. 1–2.
1910 *Aconeceras nisus* d'Orbigny, Kilian, p. 338 (Lethaea).
1925 *Aconeceras nisus* d'Orbigny, Corroy, p. 271.
1955 *Aconeceras nisum* d'Orbigny, Eristavi, p. 88.
1961b *Aconeceras* cf. *nisus* (d'Orbigny), Casey, p. 128, text fig. 40f.
1962 *Aconeceras nisus* d'Orbigny, Collignon, p. 31, pl. 229, fig. 972.
1966 *Aconeceras nisus* (d'Orbigny), Schindewolf, p. 398.
1979 *Aconeceras nisus* (d'Orbigny), Martinez, p. 346, pl. 1, fig. 6a–c.

Location: Hacienda La Trinidad, 8 km northeast of Caripe.
Basal shale zone of Valle Grande Formation, *martinioides* Zone.



Text fig. 9
Suture line and whorl sections of *Aconeceras:*
a. *A. nisus* (d'Orbigny), Gu1044, Pl. 1, Fig. 15, 6×.
b. *A. haugi* (Sarasin), Gu1568, Pl. 1, Fig. 14, 3×.
c. *A. haugi* (Sarasin), coll. Reinhard, 1922, Pl. 1, Fig. 19, 5×.

Description: Gu1044 (Pl. 1, Fig. 15a–b). Conch oxycone, high-whorled. Sides of whorl feebly convex, converging towards keel without ventrolateral shoulder (Text fig. 9a). Umbilicus 20% of diameter. Low, steep umbilical wall with narrowly rounded edge. No sculpture. Suture not preserved.
A larger, identical specimen (Pl. 1, Fig. 19a–b) from the type locality of the García Shale at Pico García has been collected by M. Reinhard (1922, deposited in the Musée d'Histoire Naturelle, Genève).

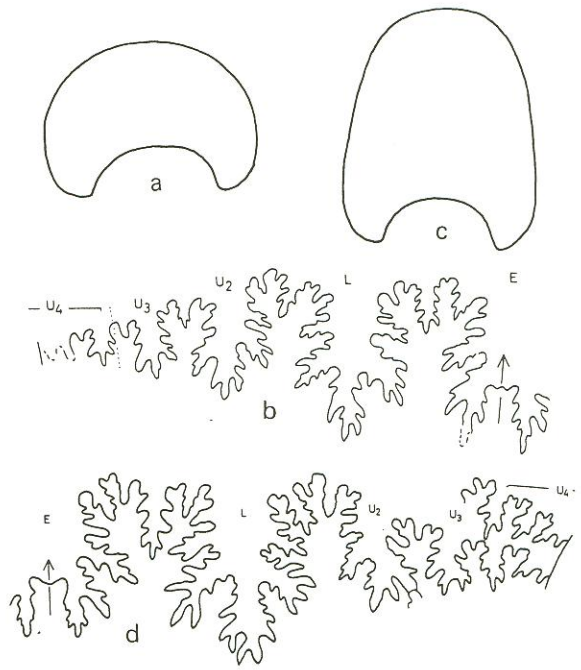
Measurements:	Dm	Wh	Ww	U
Gu1044, Pl. 1, Fig. 15	9.2 mm	5 (0.50)	2.5 (0.26)	2 (0.20)
Museum Geneva, Pl. 11, Fig. 19	15 mm	8 (0.53)	5 (0.33)	2 (0.13)

Distribution: Europe, East Africa, Madagascar, Venezuela.

Aconeceras haugi (Sarasin)
Pl. 1, Fig. 14a–b; Text fig. 9b–c

1893 *Oppelia Haugi* Sarasin, p. 156, pl. 4–6, fig. 11a–c.
1950 *Aconeceras (Sanmartinoceras) haugi* (Sarasin)?, Wright and Wright, p. 123.
1961b *Aconeceras* cf. *haugi* (Sarasin), Casey, p. 128, text fig. 40g–h.
1972 *Aconeceras (Sanmartinoceras) haugi* (Sarasin), Wright in Guillaume et al., p. 1650.

Location: Houses Sacamanteca, along Camino Real Cariaco-Catuaro. Basal shale zone of Valle Grande Formation, *martinioides* Zone.



Text fig. 10
a, b. *Valdedorsella getulina* (Coquand), Gu1602, Pl. 2, Fig. 19,
a. whorl section 3×; b. suture line 6×.
c, d. *Beudanticeras ("Zuercherella") zuercheri* (Jacob), Gu1618, Pl. 1, Fig. 20; c. whorl section 3×; d. suture line 5×.

Description: Gu1568. Involute, high-whorled. Whorl section subfastigate (Text fig. 9b). Ventrolateral shoulder rounded, but distinct. Sides parallel, flattened. Umbilicus 13% of diameter. Umbilical wall steep, pronounced angular edge. Costation feeble; ribs falcoid, broadly flattened, rising slightly near mid-flank. External suture (Text fig. 9c) coincides with drawing by Sarasin (1893, p. 154, fig. 3). According to ontogenetic studies by Schindewolf (1966, p. 398, fig. 242) suture typical for Haploceratidae (Middle Jurassic to Early Cretaceous). Umbilical lobus does not split. The sequence of umbilical lobes on the external line, U_3, U_5, U_7, U_9 (Text fig. 9c) and on the internal line U_4, U_6, U_8 is not observable on the present material (Schindewolf, 1967, p. 399).

Measurements: Dm 22.5 mm, Wh 12 (0.53), Ww 5 (0.22), U3 (0.13)

Distribution: France (lower Aptian), Venezuela.

Remarks: Sanmartinoceras bonarelli in Bonarelli and Nagera (1921, p. 27) from Patagonia as well as *Sanmartinoceras groenlandicum* Rosenkrantz (see Casey, 1961b, p. 131, text fig. 42) are distinguished by more pronounced costae, a high serrated keel, and a spiral depression.

Family Desmoceratidae Zittel, 1895

Subfamily Puzosiinae Spath, 1922

Genus *Valdedorsella* Breistroffer, 1947

Type species: Desmoceras akuschaense Anthula, 1899.

Occurrence: Southern Europe, Caucasus, North Africa, Madagascar, Colombia, Venezuela.

Valdedorsella getulina (Coquand)
Pl. 2, Fig. 19a–c; Text fig. 10a–b

1880 *Ammonites Getulinus* Coquand, p. 18.
1907 *Puzosia Getulina* Coquand, Pervinquière, p. 151, pl. 6, fig. 16.
1912 *Puzosia Getulina* Coquand, Joleaud, p. 120, pl. 1.
1920a *Puzosia Getulina* Coquand, Fallot, p. 45, pl. 2, fig. 7–10.
1962 *Valdedorsella Getulina* Coquand, Collignon, p. 33, pl. 229, fig. 977.
1966 *Valdedorsella getulina* (Coquand), Schindewolf, p. 615 (suture).
1968 *Valdedorsella getulina* (Coquand), Wiedmann and Dieni, p. 108.
1975b *Valdedorsella getulina* (Coquand), Bevia, p. 683, pl. 2, fig. 1–4.

Location: La Espuga along road Carúpano-Caripito, basal shale interval of Valle Grande Formation, late Aptian, *martinioides* Zone.

Description: Gu1602. Whorl section rounded, slightly wider than high, thickest just below mid-flank (Text fig. 10a). Umbilicus narrow, one quarter of diameter. Umbilical wall high, rounding into flank. On outer volution seven straight, deep, slightly prorsiradiate constrictions, curving forward over broad venter. Ribs of low relief between constrictions cross venter. External suture line preserved (Text fig. 10b). Ontogenetic development of suture as for *Beudanticeras* (Schindewolf, 1966, p. 615). Sequence of lobes: E, L, U_2, U_3, U_4 (=S) U_1 I.

Measurements: Dm 17 mm., Wh 7 (0.41), Ww 10 (0.59), U 4.5 (0.26)

Distribution: Upper Aptian in Mediterranean area, Madagascar, Venezuela.

Subfamily Beudanticeratinae Breistroffer, 1953

Genus *Beudanticeras* Hitzel, 1902

Type species: Ammonites beudanti Brongniart, 1822.

Occurrence: World-wide.

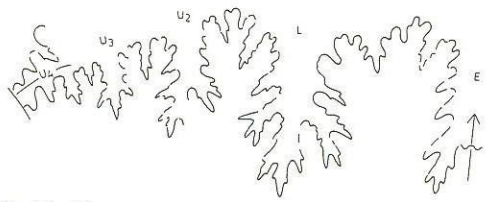
Beudanticeras ("Zuercherella") zuercheri (Jacob)
Pl. 1, Fig. 20a–b; Text fig. 10c–d

1906 *Desmoceras Zürcheri* Jacob, Jacob and Tobler, p. 9, pl. 2, fig. 2a–b.
1920a *Uhligella Zürcheri* Jacob, Fallot, p. 261, pl. 3, fig. 7.
non 1933 *Uhligella Zürcheri* Jacob and Tobler, Rouchadzé, p. 183, pl. 2, fig. 4, 5.
1954a *Zürcherella zürcheri* Jacob, Casey, p. 112.
1958 *Zürcherella zürcheri* Jacob, Luppov and Drushchic, p. 109, pl. 50, fig. 8a–c.
1964 *Zürcherella zürcheri* Jacob, Kemper, p. 39, pl. 4, fig. 1; pl. 15, fig. 1; pl. 17, fig. 1–3.
1966 *Zürcherella zürcheri* (Jacob), Schindewolf, p. 623 (suture).
1968 *Beudanticeras ("Zürcherella") zürcheri* (Jacob), Wiedmann and Dieni, p. 130, pl. 12, fig. 1.
1975b *Zürcherella zürcheri* Jacob, Bevia, p. 686, pl. 4, fig. 3–4.

Lectotype: Desmoceras Zürcheri Jacob, 1906, pl. 2, fig. 1, selected by Casey, 1954a, p. 112.

Location: La Espuga, along the road from Carúpano to Caripito, basal shale of Valle Grande Formation, *martinioides* Zone.

Description: Gu1618. Body chamber not preserved. Conch planulate, involute, high-whorled. Venter narrowly rounded; sides feebly convex, thickest above umbilical margin (Text fig. 10c). Umbilical width about one quarter diameter. Umbilical wall low, rounding into flank without edge. On outer volution eight shallow constrictions fade around mid-flank and then cross venter in a forward directed bow. Faint intermediate ribbing can be



Text fig. 11
Beudanticeras ("Uhligella") cf. *mullerriedi* Humphrey, MBJ28766, Pl. 2, Fig. 21, suture line 5×.

recognized. Suture as on *Valdedorsella getulina* Coquand (Text fig. 10d).

Measurements: Dm 25 mm, Wh 12 (0.48), Ww 8.5 (0.34), U 6 (0.24).

Distribution: Upper Aptian in Europe, Venezuela.

Remarks: This specimen is identical in all aspects with figure 2a–b on plate 2 of Jacob and Tobler (1906) from Chaudron (Basses-Alps), France.

Beudanticeras ("Uhligella") cf. *mullerriedi* (Humphrey)
Pl. 2, Fig. 21a–b; Text fig. 11

1949 *Uhligella mullerriedi* Humphrey, p. 153, pl. 18, fig. 10, 13.

Location: Type section of Valle Grande Formation, 4.5 km east of Cumanacoa, Aptian. Coll. E. Rod.

Description: MBJ28766. Limonitized phragmocone. Conch discoidal. Whorl section subelliptical, thickest above umbilical edge. Sides feebly convex, converging towards narrowly rounded venter. Umbilicus 20% of diameter with low, steeply rounded wall. Ornament restricted to eight collared constrictions projected over venter. The ribs in front of the constrictions are bullae-like swollen, flattening towards mid-flank; the ribs behind the constrictions begin near mid-flank and attain their maximum strength over venter. End of ribs indistinctly connected, knee-like, near mid-flank. Some weak intermediate ribs indistinctly blurred. Suture (Text fig. 11) as on *Beudanticeras*.

Measurements: MBJ28766. Dm 22.5 mm, Wh 10 (0.44), Ww 8.5 (0.38), U 4.5 (0.20).

Remarks: Uhligella riedeli Humphrey (1949, p. 153, pl. 18, fig. 1–2) differs from present species by its strong sigmoidal costae in front of constrictions.

Genus *Melchiorites* Spath, 1923

Type species: Ammonites melchioris Tietze, 1872.

Occurrence: Mediterranean area, Madagascar.

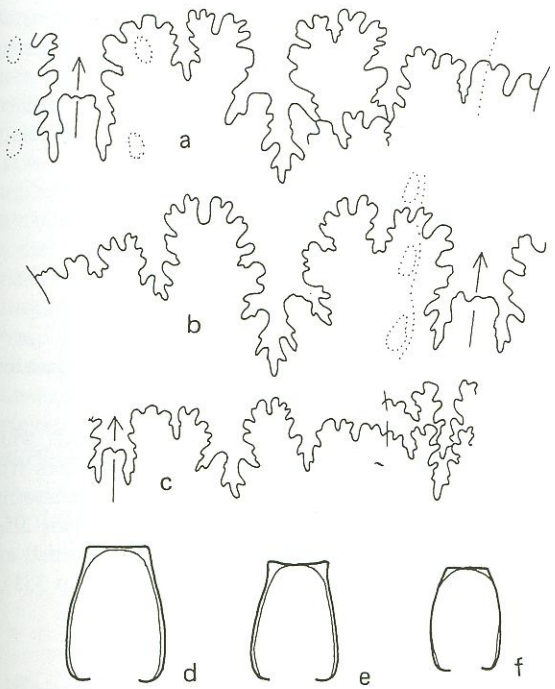
Melchiorites melchioris (Tietze)
Pl. 2, Fig. 20a–b

1872 *Ammonites Melchioris* Tietze, p. 135, pl. 9, fig. 9–10.
1883 *Haploceras Melchioris* Tietze, Uhlig, p. 232, pl. 17, fig. 5, 12.
1898 *Puzosia Melchioris* Tietze, Simionescu, p. 73, pl. 4, fig. 2.
1907 *Puzosia Melchioris* Tietze, Karakasch, p. 75, pl. 7, fig. 4, 8; pl. 8, fig. 6; pl. 24, fig. 23.
1907 *Puzosia (Latidorsella?) Melchioris* Tietze, Pervinquière, p. 147, pl. 6, fig. 15.
1920b *Puzosia Melchioris* (Tietze), Fallot, p. 254, pl. 3, fig. 5.
1962 *Melchiorites Melchioris* Tietze, Collignon, p. 36, pl. 230, fig. 980.
1968 *Melchiorites melchioris* Tietze, Wiedmann and Dieni, p. 109, pl. 10, fig. 4.

Location: Type section Valle Grande Formation, late Aptian. Coll. E. Rod.

Description: MBJ28759. Single, small pyritized specimen. Whorl section compressed, subquadrate, with rounded venter, grading into parallel, flattened sides. Inner whorl without sculpture. Straight, prorsiradiate constrictions, curving forward over venter, beginning at 20 mm diameter. No intermediate ribs. Suture not visible.

Measurements: Dm 23 mm, Wh 9 (0.40), Ww 8 (0.35), U 5.5 (0.24).



Text fig. 12
Suture lines and whorl sections of *Dufrenoyia:*
a, e. *D. dufrenoyi* (d'Orbigny), Gu1585, Pl. 1, Fig. 9, suture 4×, whorl section 1×.
b, f. *D.* aff. *?codazziana* (Karsten), Gu1037, Pl. 1, Fig. 12, suture 4×, whorl section 1×.
c, d. *D. dufrenoyi* (d'Orbigny), Gu1584, Pl. 1, Fig. 10, suture 4×, whorl section 2×.

Family Deshayesitidae Stoyanow, 1949

Subfamily Deshayesitinae Casey, 1964

Genus *Dufrenoyia* Burckhardt, in Kilian and Reboul, 1915
Dufrenoyia dufrenoyi (d'Orbigny)
Pl. 1, Fig. 9a–b, 10a–b, 11a–b, 16; Text fig. 12a, c, d, e

Type species: Ammonites furcatus J. de C. Sowerby.

1841 *Ammonites Dufrenoyi* d'Orbigny, p. 200, pl. 33, fig. 3–6.
1849 *Ammonites Dufrenoyi* d'Orbigny, Quenstedt, p. 158, pl. 5, fig. 10a–b.

1897 *Hoplites Dufrenoyi* d'Orbigny, Sarasin, p. 769, fig. 6 (suture).
1949 *Dufrenoyia dufrenoyi* (d'Orbigny), Humphrey, p. 123, pl. 8, fig. 1–6.
1964 *Dufrenoyia dufrenoyi* (d'Orbigny), Kemper, p. 42.
1966 *Dufrenoyia dufrenoyi* (d'Orbigny), Schindewolf, p. 688 (suture).

Location: Arenas, 5 km north-northeast of Cumanacoa. Basal shale of Valle Grande Formation, late Aptian.

Description: Gu1585, Gu1586, MBJ28764. Conch compressed. Whorl section high-rectangular. Venter flattened, slightly concave between prominent clavi. Sides subparallel, flattened (Text fig. 12d, e). Umbilicus about 28% of diameter. Primary ribs sigmoidally curved, flattening and broadening towards ventrolateral shoulder, and ending into clavi, spirally elongated. Secondary ribs terminate near mid-flank. The internal suture is exposed on a single specimen (Gu1584, Pl. 1, Fig. 10a–b, Text fig. 12c; compare Wiedmann, 1966, p. 46). Lateral lobes are asymmetric on all specimens examined (Text fig. 12a).

Remarks: The range of variations is shown by the figured specimens. Schindewolf (1966, p. 683) studied the ontogenetic development of the suture of the Deshayesitidae. The second umbilical lobus (U_2) does not, as usual, originate between the lateral and umbilical lobe but at a later ontogenic stage, on the crest of the internal saddle. Thus U_2 does not change its original position (Schindewolf, fig. 420, p. 684). Lobe formula: E L U_2 U_3/U_1 I.

Distribution: Europe, Texas, Mexico, Colombia, Nigeria.

Dufrenoyia aff. ?*codazziana* (Karsten)
Pl. 1, Fig. 12a–b; Text fig. 12b, f

1886 *Ammonites codazzianus* Karsten, p. 61, pl. 3, fig. 4a–b, 5a–b.
1972 *Dufrenoyia* cf. *codazziana* (Karsten), Wright in Guillaume et al., p. 1651.
1979 *Dufrenoyia codazziana* (Karsten), Etayo-Serna, p. 58; pl. 1, fig. 7, 8; pl. 3, fig. 4a–b.

Lectotype: Ammonites codazzianus Karsten, 1886, pl. 5, fig. 5, selected by Etayo-Serna, 1979, p. 59.

Location: Hacienda Trinidad, 8 km northeast of Caripe. Basal shale of Valle Grande Formation, late Aptian.

Description: Gu1037. Whorl section compressed, high-rectangular; widest near mid-flank. Sides parallel, feebly convex flattened. Venter squarish, flat; no concavity between low ventrolateral clavi (Text fig. 12f). Umbilical wall gently rounding into flank. Ribs slightly abraded, dense and low. Primary ribs cross flank in prorsiradiate sigmoidal curves. One or two ribs beginning near mid-flank. All ribs end at low, elongate ventrolateral clavi. Suture typical for genus (Text fig. 12b).

Distribution: Colombia, Venezuela.

Remark: The present specimen may represent a new subspecies of *Dufrenoyia codazziana*. Its preservation, however, is not sufficient to figure as a holotype.

Genus *Burckhardtites* Humphrey, 1949

Type species: Neocomites nazasensis Burckhardt

Occurrence: Mexico, Venezuela.

Burckhardtites nazasensis (Burckhardt)
Pl. 1, Fig. 17a–b, 18

1925 *Neocomites nazasensis* Burckhardt, p. 14, pl. 3, fig. 4–7.
1949 *Burckhardtites nazasensis* (Burckhardt), Humphrey, p. 130, pl. 10, fig. 1–5.
1976 *Burckhardtites nazasensis* Burckhardt, Cantu Chapa, p. 10, pl. 1, fig. 1.

Holotype: Neocomites nazasensis Burckhardt, p. 14, pl. 3, fig. 6–7 (see Casey, 1964, p. 289).

Location: Lower part of the type section of the Valle Grande Formation, 4.5 km east of Cumanacoa, late Aptian. Coll. E. Rod.

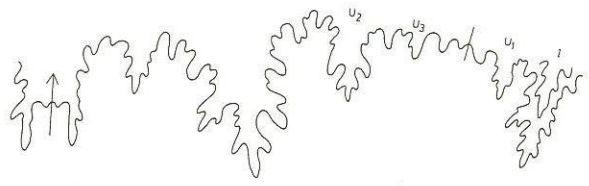
Description: MBJ 28767. Limonitized fragment, closely comparable with holotype. Conch compressed. Sides flattened, converging feebly towards truncated venter. Greatest thickness on umbilical margin. Low umbilical wall declining steeply towards moderately wide umbilicus (on holotype 18% of diameter). Costation close. Fine ribs begin on umbilical seam, elevate bullae-like on umbilical margin and cross flank in a biconcave curve. Intercalated shorter ribs flatten out below mid-flank. All ribs are distinctly elevated on ventrolateral edge and attenuated over venter. Suture not preserved.
The small fragment shown on Pl. 1, Fig. 18 was collected by M. Reinhard from the García Shale at Pico García.

?*Burckhardtites* sp. indet.
Pl. 1, Fig. 13a–b; Text fig. 13

1949 *Burckhardtites* sp., Humphrey, p. 133, pl. 10, fig. 6, 8.

Location: Pico García, type section of García Formation, Aptian. Coll. M. Reinhard, 1922.

Description: One of numerous small fragments which may be compared with *Burckhardtites*. It differs from previously described specimens by exhibiting a stronger and more regular costation. Long and short ribs alternate. The venter is not tabulate but rather rounded and resembles that of *Prodeshayesites* Casey (1964, p. 353), a



Text fig. 13
Burckhardtites sp. (?*Prodeshayesites* sp.), coll. Reinhard, 1922, Pl. 1, Fig. 13, suture line 5×.

genus not accepted by Kemper (1964, p. 41). Suture line (text fig. 13) as on *Dufrenoyia* (compare Wiedmann, 1966, fig. 34, p. 43).

Subfamily Mathoceratinae Casey, 1963

Genus *Mathoceras* Casey, 1963

Type species: Hoplites (Kilianella?) Matho Pervinquière, 1907.

Occurrence: Tunisia.

Mathoceras venezolanum Renz
Pl. 2, Fig. 1a–b, Text fig. 14a

1978 *Mathoceras venezolanum* Renz, p. 681, fig. 3a–b, l, 4a.

Location: Type section of Valle Grande Formation, Serranía del Interior. Late Aptian, *martinioides* Zone.

Description: Gu1237, BM.C68185. About one-fourth of the outer whorl belongs to the body chamber. Whorl smooth on initial stage to about 4.5 mm diameter, whorl section oval. Later turning to subquadrate, thickest on ventrolateral tubercles. Flanks parallel, slightly convex between ribs. Venter subtabulate, broadly concave between opposing external clavi. Umbilicus 30% of diameter. Umbilical wall falls steep on ventrolateral clavi on preceding volution, and rounds gently into flank. Costation distant, about 19 ribs on outer whorl, of which eight, at about equidistant intervals, are stronger primaries provided with prominent ventrolateral tubercles. Towards body chamber primaries are slightly raised into umbilical bullae. Intermediate secondaries, beginning on umbilical margin are weak, variable in strength, and some are faintly elevated on ventrolateral shoulder. All ribs are straight between umbilicus and ventrolateral shoulder, on outer third of flank turning distinctly forward towards the venter, broadening and flattening, and ending in prominent ventral clavi, obliquely projected forward. Few of the secondary ribs are only slightly elevated on venter. Suture (Text fig. 14a) as on *Dufrenoyia* (Schindewolf, 1966, p. 688).

Measurements: Gu1237, BM.C68185 (end phragmocone). Dm 17.5, Ww 7 (0.40), Wh 7.4 (0.42), U 5 (0.30).

Mathoceras sucre Renz
Pl. 2, Fig. 3a–b

1978 *Mathoceras sucre* Renz, p. 682, fig. 3e–f, 4c.

Location: Type section of Valle Grande Formation, Serranía del Interior. Late Aptian, *martinioides* Zone.

Description: Gu1238, BM.C68186. Begin of body chamber uncertain. Juvenile volutions, up to 7 mm diameter, smooth, oval, venter rounded. Later whorl section gradually turning to rectangular, simultaneously with strengthening of ventral clavi. Flanks parallel, slightly convex. Venter flat, tabulate, concave between external clavi. Sipho partly broken out. Umbilicus shallow, about one third of diameter. Umbilical wall low, falling on mid-flank of preceding volution; umbilical margin rounded. Costation weak, variable, beginning at a diameter of about 7 mm. Ribs very low, sigmoidally curved, parting from umbilical margin where faint indications of umbilical bullae are recognizable on body chamber only (better visible on opposite side). Eight roughly equidistant ventrolateral bullae of different strength are developed. From there ribs turn slightly adorally, ending in 20 prominent ventral clavi obliquely turning forward and differing in height according to strength of ribs. Faint looping of ribs between ventrolateral bullae and ventral clavi occurs occasionally.

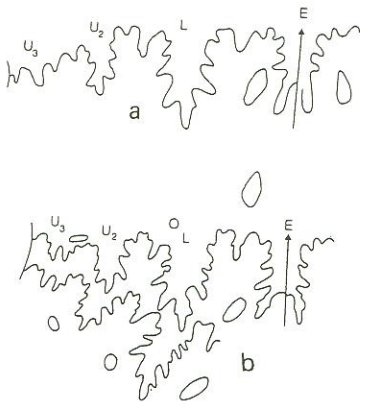
Measurements: Gu1238, BM.C68186: Dm 15.5, Ww 5.4 (0.34), Wh 7 (0.46), U 5 (0.32).

Mathoceras caribense Renz
Pl. 2, Fig. 4a–b; Text fig. 14b

1978 *Mathoceras caribense* Renz, p. 682, fig. 3g–h, m, 4d.

Location: Base of Valle Grande Formation, near houses named Sacamanteca, south-southeast of Cariaco, Serranía del Interior. Late Aptian, *martinioides* Zone.

Description: Gu1570, BM.C68188. Diameter of phragmocone 10 mm. Inner volutions up to about 5 mm diameter, without sculpture, whorl section oval, venter broadly rounded. As growth proceeds whorl section more compressed, turning gradually to subrectangular. Sides feebly convex between ribs, thickest below mid-flank. Venter about tabulate, flatly concave between peripheral clavi. Umbilicus one third of diameter. Umbilical wall rounding into flank and falling on preceding volution slightly above mid-flank. Costation begins at 8 mm



Text fig. 14
Suture lines of *Mathoceras:*
a. *M. venezolanum* Renz, Gu1237, BMC68185, holotype, Pl. 2, Fig. 1, 4×.
b. *M. caribense* Renz, Gu1570, BMC68188, holotype, Pl. 2, Fig. 4, 8×.

diameter. Eight distant, prorsiradiate primary ribs are present which swell on body chamber into low umbilical bullae, and gradually loosing strength toward the outer third of flank. Here they are raised in low, bullae-like tubercles from which they curve forward, ending in prominent ventral clavi. Faint looping of ribs occurs between ventrolateral tubercles and peripheral clavi. Suture (Text fig. 14b) as on *Mathoceras venezolanum.*

Measurements: Gu1570, BM.C68188: Dm 12.3, Ww 4 (0.33), Wh 5 (0.40), U 4 (0.33).

Mathoceras laeve Renz
Pl. 2, Fig. 2a–b

1978 *Mathoceras laeve* Renz, p. 684, fig. 3c–d, 4c.

Location: Base of Valle Grande Formation, near houses referred to as Sacamanteca, SSE of Cariaco, Serranía del Interior, late Aptian, *martinioides* Zone.

Description: Gu1569, BM.C68187. Conch partly covered by thin, iron-stained layer, possibly representing test, diagenetically altered. Beginning of body chamber uncertain (assumed position indicated by line). Whorl section on early stage oval, widest near mid-flank; on outer whorl section rectangular, flat-sided, widest below mid-flank. Venter tabulate; concave between opposing clavi. Umbilicus about 30% of diameter, shallow and low, slightly widening towards end. Umbilical wall steep, grading into rounded margin. Sculpture begins near 8 mm diameter with faint ventral elevations. Costation, smooth, unstable, nearly effaced around mid-flank. Ribs distinctly falcoid, without ventrolateral elevations. Ribs part from low, elongated umbilical bullae at irregular intervals, and change in size. From some umbilical bullae, branching or incipient branching is faintly indicated. Those ribs seem to unite again at rather low, elongated ventral clavi, continuing on venter with pronounced forward obliquity.

Measurement: Gu1569, BM.C68187: Dm 16.1, Ww 5.3 (0.33), Wh 7 (0.43), U 4.9 (0.30).

Remarks: Kvantaliani (1980) assumes *Mathoceras* to be related to the Leymeriellidae Breistroffer (1951). A new subfamily, the Venezuellinae, is introduced. It comprises the genera *Venezuella* Kvantaliani and *Renziella* Kvantaliani. The genus *Venezuella* includes the species *Venezuella venezolana* (Renz), *V. sucre* (Renz) and *V. caribensis* (Renz). The genus *Renziella* has only one species *Renziella laevis* (Renz). In a letter to the author Kvantaliani stated that: "The final decision on this problem will depend, apparently, on the study of the ontogeny of the suture-line of *Mathoceras* Casey, 1964 and on your (Renz) new species." The author supports this sentiment and proposes to carry the study further, when additional material of *Mathoceras* becomes available.

Family Douvilleiceratidae Parona and Bonarelli, 1897

Subfamily Cheloniceratinae Spath, 1923

Genus *Cheloniceras* Hyatt, 1903

Type species: Ammonites cornuelianus d'Orbigny, 1840.

Occurrence: Almost world-wide.

Cheloniceras aff. *debile* Casey
Pl. 2, Fig. 17a–b; Text fig. 15a

1962 *Cheloniceras (Epicheloniceras) debile* Casey, p. 244, pl. 37, fig. 3–7; text fig. 85, holotype.

Location: Type section Valle Grande Formation, 4.5 km east of Cumanacoa, late Aptian. Coll. E. Rod.

Description: MBJ28768. Single limonitized, juvenile specimen reaching 17 mm diameter. Whorl section coronate (Text fig. 15a). Stronger primary ribs provided with faint umbilical bullae, strong ventrolateral bullate tubercles and weak tubercles on broad venter. Primary ribs separated by three to four untuberculated weaker ribs.

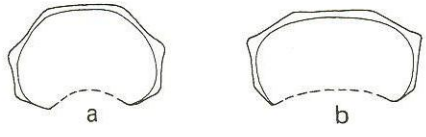
Remarks: According to Kemper (1964, p. 49) *Cheloniceras (Epicheloniceras) debile* Casey coincides with *Cheloniceras tschernyschewi* Sinzow (lectotype: Sinzow, 1906, pl. 3, fig. 2).

Cheloniceras aff. *buxtorfi* Jacob
Pl. 2, Fig. 18a–b; Text fig. 15b

1906 *Douvilleiceras Buxtorfi* Jacob and Tobler, Robler, p. 15, pl. 1, fig. 9–11.
1962 *Cheloniceras (Epicheloniceras) buxtorfi* (Jacob, in Jacob and Tobler), Casey, p. 253, pl. 39, fig. 8a–b, with synonymy.
1964 *Cheloniceras buxtorfi* (Jacob and Tobler), Kemper, p. 53, pl. 11, fig. 1a–b.

Lectotype: 1906 *Douvilleiceras Buxtorfi* Jacob and Tobler, pl. 1, fig. 9a–b, selected by Casey, 1961b, p. 253.

Location: Type section of Valle Grande Formation, 4.5 km east of Cumanacoa, late Aptian. Coll. E. Rod.



Text fig. 15
Whorl sections of *Cheloniceras:*
a. *Ch.* aff. *debile* Casey, MBJ28768, Pl. 2, Fig. 17, 3×.
b. *Ch.* aff. *buxtorfi* Jacob, MBJ28809, Pl. 2, Fig. 18, 2×.

Description: MBJ28809. Single, juvenile specimen. Diameter 21 mm. Whorl section coronate (Text fig. 15b). Costation uniform. 15 ribs on half whorl. Umbilical bullae subdued, ventrolateral bullae pronounced and elevations on broad venter scarcely indicated.

Occurrence: Europe, Transcaspia, Russian Platform (Luppov, 1956), Colombia, Venezuela.

Remark: So far the two mentioned specimens of *Cheloniceras* are the only ones known from the García Formation.

Family Parahoplitidae Spath, 1922

Genus *Diadochoceras* Hyatt, 1900

Type species: Ammonites nodosocostatus d'Orbigny, 1841.

Occurrence: Europe, Caucasus, Japan, Tanzania, Madagascar, Mexico, Venezuela.

Diadochoceras aff. *nodosocostatum* (d'Orbigny)
Pl. 2, fig. 7a–b, 8a–b, 9a–b; Text fig. 16a

1975 *Diadochoceras* aff. *nodosocostatum* (d'Orbigny), Obata, p. 7, pl. 2, fig. 4a–b (from France, Clansayes, Drôme).

Location: Río Morocoto, 6 km west of Guariquén, late Aptian. Lithostratigraphic unit not indicated.

Description: Gu1630 (Pl. 2, Fig. 8, Text fig. 16a); BM.C 68190 = Gu1627 (Pl. 2, Fig. 7); BM.C68191 = Gu1634 (Pl. 2, Fig. 9).
Body chambers not preserved. Coiling moderately evolute. Intercostal section circular (Text fig. 16a). Umbilicus about 40% of diameter. Umbilical wall scarcely differentiated from flank. On outer volution, sixteen low, flat primary ribs occur. They are bullae-like and are elevated above umbilicus. They then weaken near mid-flank before becoming elevated again, into large, blunt, flattened, rounded, ventrolateral nodes which are followed on venter by identical nodes which nearly touch the siphonal line. Secondary ribs, interposed between distant primaries, are feebly indicated over venter and fade out towards mid-flank. Suture not preserved.

Measurements:	Dm	Wh	Ww	U
Gu1630	26 mm	8.2 (0.32)	10.2 (0.40)	10 (0.40)
Gu1627	25 mm	8 (0.32)	9 (0.36)	10 (0.40)

Remarks: Septa replaced by fibrous gypsum, pseudomorphic to aragonite, owing to decomposition of marcasite. Preservation of specimen is inadequate to figure as holotype for a possibly new species.
Michailova (1963, p. 72, fig. 8) shows that the ontogeny of the suture on *Diadochoceras* agrees precisely with that of *Acanthohoplites* and *Hypacanthoplites*. For this reason *Diadochoceras* has been grouped with the Parahoplitidae (Schindewolf, 1966, p. 692).

Genus *Gargasiceras* Casey, 1954

Type species: Ammonites gargasensis d'Orbigny, 1841.

Occurrence: France, Spain (Martinez, 1979), Colombia, Mexico, Venezuela, Madagascar.

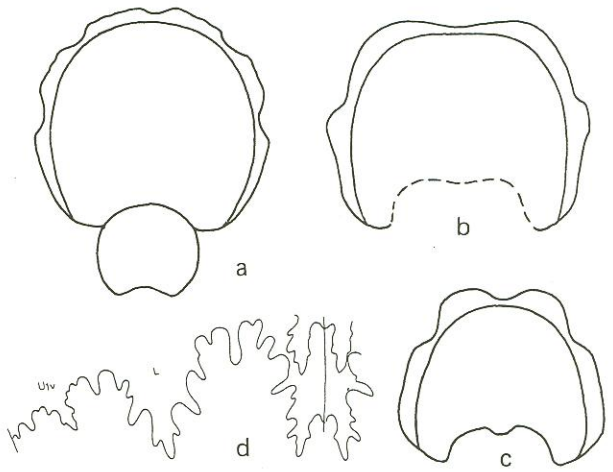
Gargasiceras cf. *recticostatum* (Kilian) Roch
Pl. 2, Fig. 11a–b, 12a–b, 13a–b, Text fig. 16c

1913 *Acanthoplites gargasensis* var. *recticostata* Kilian, p. 346 (Lethaea).
1926 *Acanthoplites gargasensis* var. *recticostata* Kilian, Roch, p. 288, pl. 18, 6a; 7, 7a.
1954a *Gargasiceras recticostatum* (Kilian) Roch, Casey, p. 114.

Lectotype: Acanthoplites gargasensis var. *recticostata* Kilian; selected by Roch, 1926, p. 288, pl. 18, fig. 6, 6a.

Location: Valle Grande Formation, type section, 4.5 km east of Cumanacoa, basal shale body, late Aptian (Gargasien).

Description: Gu1404 (Pl. 2, Fig. 12). Whorl section (Text fig. 16c) subrectangular on costal section, oval on interspaces. Venter sulcate. Umbilicus 27% of diameter; 36% on MBJ28765-2 (Pl. 2, Fig. 11). Umbilical wall steep on ribs and gently rounded on intercostal section. Rectiradiate primary ribs rising above umbilical seam. Dorsal half of ribs beam-like elevated, rising in a distinct tubercle about mid-flank. Here some ribs bifurcate.



Text fig. 16
a. Whorl section of *Diadochoceras* aff. *nodosocostatum* (d'Orbigny), Gu1630, Pl. 2, Fig. 8, 3×.
b. Whorl section of *Gargasiceras acutecostatum* (Riedel), Gu1021, Pl. 2, Fig. 10, 6×.
c. Whorl section of *Gargasiceras* cf. *recticostatum* Roch, Gu1404, Pl. 2, Fig. 12, 6×.
d. Suture of *Gargasiceras aptiense* Roch, MBJ28765-1, Pl. 2, Fig. 6, 5×.

Weaker secondaries without tubercles, intercalated in variable number between primaries. From mid-flank onward all ribs gradually widen and become flat-topped and steep-sided as on *Colombiceras*. All ribs cross straight over venter, where they faintly attenuate on median line.

Measurements:	Dm	Wh	Ww	U
Gu1404	13 mm	6 (0.46)	5 (0.38)	3.5 (0.27)
MBJ28765-2	25 mm	9.5 (0.38)	?8 (0.32)	9 (0.36)
MBJ28763	22 mm	8 (0.36)	8 (0.30)	7 (0.32)

Distribution: France, Venezuela.

Remark: The flat-topped ribs suggest a close connection between the described form and *Colombiceras*, from which it differs only by the concavity of the venter.

Gargasiceras acutecostum (Riedel)
Pl. 2, Fig. 10a–b; Text fig. 16b

1934 *Acanthoplites acutecosta* Riedel, pl. 8, fig. 1–6.
1954 *Gargasiceras acutecostum* (Riedel), Casey, p. 114.

Lectotype: Acanthoplites acutecosta Riedel, 1934, pl. 8, fig. 1–4, here selected.

Location: Type section Valle Grande Formation (about 6 km east of Cumanacoa). Basal shale, late Aptian (Gargasien).

Description: Gu1021. Body chamber mechanically compressed. Whorl section (Text fig. 16b) subrounded, slightly wider than high. Venter flattened, broadly sulcate. Umbilicus 41% of diameter. Umbilical wall rounding into flank. 40 ribs on outer whorl, of which nine are stronger, separated by two to four weaker ribs. Branching or incipient branching occurs near mid-flank from bullae-like elevations. Ribs broadly flatten towards venter (comparable to *Colombiceras*). Suture indistinctly preserved.

Measurement: Dm 15 mm, Wh 5 (0.33), Ww 6 (0.40), U 6.2 (0.41).

Distribution: Colombia, Venezuela.

Gargasiceras aptiense (Roch)
Pl. 2, Fig. 6a–b; Text fig. 16d

1926 *Acanthoplites gargasensis* var. *aptiensis* Roch, p. 292, pl. 18, fig. 5; text fig. 4 (suture).
1954 *Gargasiceras aptiense* Roch, Casey, p. 114.

Location: Valle Grande Formation, 4.5 km east of Cumanacoa, late Aptian. Coll. E. Rod.

Description: MBJ28765-1. Small, rather densely ribbed specimen. Stronger ribs not prominent. Whorl section (Text fig. 16d) subrectangular, slightly wider than high, shoulder rounded. Venter broadly concave on costal section. All ribs flatten over venter, but less distinct than on *Gargasiceras acutecostum*. External suture well preserved (Text fig. 16d). It is of relevance to quote Wiedmann (1966, p. 37, fig. 29) who states that "The umbilical lobe splits into a ventral and a dorsal branch as on *Cheloniceras*".

Measurements: Dm 19 mm, Wh 7 (0.37), Ww 8.5 (0.44), U 7 (0.37).

Genus *Colombiceras* Spath, 1923

Type species: Ammonites crassicostatus d'Orbigny, 1841.

Occurrence: France, England, Sardinia, USSR (Mikhailova, 1958), Madagascar (Collignon, 1962), Mexico, Colombia, Venezuela.
The record of the genus *Colombiceras* is poor in Venezuela. The few fragments available do not permit reliable determinations.

Colombiceras aff. *caucasicum* Luppov
Pl. 2, Fig. 16a–b; Text fig. 17a–b

1949 *Colombiceras caucasicum* Luppov, p. 230, pl. 67, fig. 1.
1958 *Colombiceras caucasicum* Luppov and Drushchic, p. 103, pl. 47, fig. 5a–b.

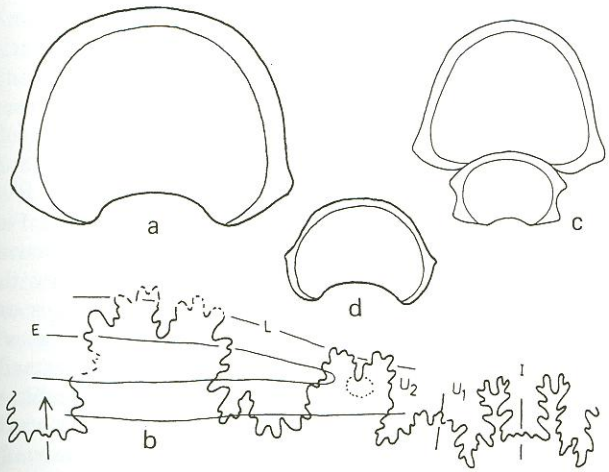
Location: Hacienda La Trinidad, 8 km northeast of Caripe. Basal shale of Valle Grande Formation, late Aptian (Gargasien).

Description: Gu1033. Whorl section depressed, wider than high, broadest at umbilical tubercles (Text fig. 17a). Sides convex, rounding towards umbilicus without forming distinct edge. Costation arises at umbilical seam. Ribs rectiradiate, angulate, wedge-shaped, broadening towards venter, where they become flat-topped with vertical sides. Interspaces about half as wide as ribs, flat at bottom. Bifurcation occurs from conical umbilical tubercles. Suture (Text fig. 17b) is distinguished by shortened, somewhat distorted external and lateral lobes, a feature which results from the vertical rib sides. The ontogenetic development of the suture of *Colombiceras* has been studied by Mikhailova (1960) on well preserved material from the upper Aptian of the south of the USSR. This is referred to in Casey, 1965, p. 419, fig. 153f. The suture line after Mikhailova, 1960, shows a lobe formula E L U_2/U_1 I.

Remarks: The present species differs from *Colombiceras caucasicum tyrrhenicum* Wiedmann (1968, p. 93, pl. 9, fig. 13; text fig. 66), which shows an equally broad whorl section, by a distinctly more dorsal position of the tubercles above the umbilicus.

Colombiceras cf. *caucasicum tyrrhenicum* Wiedmann and Dieni
Pl. 2, Fig. 15a–b; text fig. 17d

1968 *Colombiceras caucasicum tyrrhenicum* Wiedmann and Dieni, p. 93, Pl. 9, fig. 13; text fig. 66.



Text fig. 17
a, b. *Colombiceras* aff. *caucasicum* Luppov, Gu1033, Pl. 2, Fig. 16, a. whorl section 3×, b. suture line 4×.
c. *Colombiceras* sp., MBJ28757, whorl section, Pl. 2, Fig. 14, 3×.
d. *Colombiceras* cf. *caucasicum tyrrhenicum* Wiedmann and Dieni, Gu1391, whorl section, Pl. 2, Fig. 15, 3×.

Location: Valle Grande, 4.5 km east of Cumanacoa. Middle part of Valle Grande Formation. Late Aptian (Gargasien).

Description: Gu1391. This juvenile fragment may indicate the presence in Venezuela of this subspecies described from Sardinia. The features are: Whorl section slightly wider than high (Text fig. 17d). Ribs begin on umbilical seam, broaden continuously towards the widely arched venter and become flat-topped. A conical tubercle is present on the primaries, from which ribs bifurcate just below mid-flank.

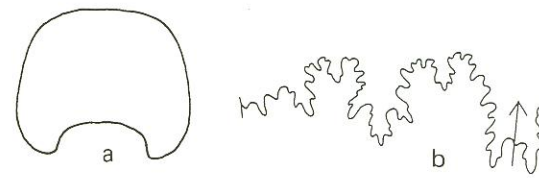
Remarks: The fragment described here differs from *Colombiceras tobleri* (Jacob) 1906 (lectotype, p. 11, pl. 2, fig. 4) by the absence of a conspicuous ventrolateral thickening of ribs. A specimen comparable with *Colombiceras tobleri* has been figured by Riedel (1938, pl. 8, fig. 23, 24) from Colombia.

Distribution: Sardinia, Venezuela.

Colombiceras sp. indet.
Pl. 2, Fig. 14a–b; Text fig. 17c

Location: Valle Grande, 4.5 km east of Cumanacoa. Valle Grande Formation, late Aptian, Coll. E. Rod.

Description: MBJ28757. Outer whorl fragment belongs to body chamber where whorl section (Text fig. 17c) is slightly depressed and widest on high umbilical bullae, from where flanks converge towards rounded venter. Ribs begin on umbilical seam; some increase considerably in breadth and become flat-topped and steep-sided towards venter. Others cross venter with no significant breadth increase. Sharp, high lateral tubercles are developed on phragmocone (inner whorl fragment) above mid-flank, creating a more depressed whorl section. They vanish towards the body chamber. Last tubercle is indicated on first rib of outer volution. Suture not preserved. The specimen is not suitable as a holotype.



Text fig. 18
Acanthohoplites nolani Seunes, Gu1624, Pl. 2, Fig. 5, a. whorl section 3×, b. suture line 4×.

Genus *Acanthohoplites* Sinzow, 1907.

Type species: Hoplites nolani Seunes, 1887.

Occurrence: Widely distributed in western Europe, Caucasus, Algeria, Madagascar (Collignon, 1937, 1962), Venezuela.

Acanthohoplites nolani (Seunes)
Pl. 2, Fig. 5a–b; Text fig. 18a–b

1887 *Hoplites Nolani* Seunes, p. 564, pl. 13, fig. 4.
1905 *Parahoplites Nolani* Seunes, Jacob, p. 408, fig. 3 (suture).
1953 *Acanthoplites nolani* Seunes, Glazunova, p. 32, pl. 4, fig. 1–3.
1955 *Hypacanthoplites nolani* Seunes, Eristavi, p. 104, pl. 4, fig. 8.
1960 *Acanthoplites nolani* Seunes, Kudrjavcev, p. 326, pl. 13, fig. 1–4.
1961a *Nolaniceras nolani* (Seunes), Casey, p. 598.
1968 *Acanthohoplites nolani* (Seunes), Wiedmann and Dieni, p. 88, pl. 9, fig. 10, 17.

Location: Río Morocoto, 6 km west of Guariquén, late Aptian.

Description: Gu1624. Small-sized specimen. At 20 mm diameter whorl section (Text fig. 18a) subquadrate (Ww/Wh = 0.89). Venter feebly flattened, rounding into moderately convex flanks, thickest near mid-flank. Umbilicus 31% of diameter. No umbilical edge. On outer whorl 49 ribs cross straight over flank, bending slightly adorally over venter. Branching of ribs near mid-flank. On inner whorl distinct lateral tubercles recognizable to about 10 mm diameter. Suture partly preserved (Text fig. 18b).

Measurements: Dm 19 mm, Wh 9 (0.47), Ww 8 (0.42), U 6.8 (0.31).

Distribution: Europe, Venezuela.

D. Albian Stage

1. Stratigraphic review

a) Western Venezuela: Perijá Range and Andes
(Text fig. 4)

As mentioned earlier, due to the scarcity of age-indicative fossils, primarily ammonites, no accurate chronostratigraphic limit can be established between the Aptian and the Albian in field sections. The pelagic and benthic foraminifera, which can only be studied in thin-sections, are generally poorly preserved.
On the Maracaibo Platform, as well as along the Perijá foothills north of the Machiques Trough, as far as Toas Island, the Albian is represented by neritic limestones known as the *Cogollo Formation* (Garner, 1921). It is massively bedded, greyish, partly bioclastic (with subordinate oolite) and partly micritic. On the platform, the shallow water environment offered no favourable living conditions for ammonites, and foraminifera are restricted to benthic forms. Southward, towards the Machiques Trough, part of the Cogollo laterally grades into the *Lisure Formation* (Rod and Maync, 1954, p.209). This sequence consists of an alternation of glauconitic quartz sands, sandy glauconitic marls and massively bedded, partly glauconitic limestones.
In Quebrada La Gé a single fragment of an ammonite (Pl.4, Fig.1) belonging to the genus *Mortoniceras,* was found in the upper part of the Lisure Formation (Renz, 1977, section 21). It indicates a late Albian age.
The Lisure Formation is overlain by a massively bedded, light-coloured limestone body containing *Exogyra* biostromes. This interval has been named the *Maraca Formation* by Rod and Maync (1954, p.210). It is conformably followed by the La Luna Formation which contains early Turonian ammonites. Thus, a Cenomanian age may be assumed for the Maraca Formation.
In the Machiques Trough area the Lisure Formation is separated from the underlying Machiques Formation (Aptian) by a massive, light grey limestone body. This contains abundant *Trigonia* sp. and has been distinguished as the *Piché Member* by Renz (1959a). Its age is considered still to be early Albian.
The Lisure Formation can be interpreted as a transitional formation between the Cogollo limestones to the north and the *Aguardiente Formation* (Notestein et al., 1944) to the south, in the State of Táchira. At the type locality, the Fila de Aguardiente, north of Cúcuta (Colombia), the Aguardiente Formation mostly consists of fine to medium grained, partly glauconitic sandstones. The quartz material in the Lisure and Aguardiente Formations is probably derived from the Roraima Formation of the Guayana Shield. Further south, towards the Serranía del Cocuy (5493 m, in Colombia), the formation rapidly increases in thickness. The part exposed in Venezuela can be interpreted as the eastern margin of an extensive deltaic sand body which extends over large parts of the Cordillera Oriental of Colombia.
The glauconitic Aguardiente sands disappear towards the pre-Cretaceous Mérida Swell, being gradually replaced by progressively thickening layers of orthoquartzite without glauconite. These alternate with massively bedded micritic to bioclastic and biostromal limestones. These facies persist as far as the plunge of the Andean chains under the Barquisimeto flysch, which now is considered to be partly allochthonous (Stephan, 1977). The term *Peñas Altas Formation* was introduced by Renz (1959a) for this facies as developed in the States of Trujillo and Lara.
The Peñas Altas Formation is followed by a conspicuous dark, blue grey interval of platform carbonates which contains a rich late Albian ammonite assemblage. The term *La Puya Formation* was originally proposed for this interval by Renz (1959a). The detailed stratigraphy and fauna are discussed under chapter D. 2c.
Allochthonous ammonites of middle Albian age have been observed in the Barquisimeto flysch basin. *Oxytropidoceras (Manuaniceras)* sp. was found in the Parapara region (Renz et al., 1955, p.2066) and in the surroundings of El Tocuyo (found by von der Osten). They derive from a sequence similar in lithology to that of the La Luna.
This indicates that middle Albian sediments of La Luna facies must have existed in the source area of the allochthonous material in the Barquisimeto flysch.
Along the southern foothills of the Cordillera de la Costa no ammonites indicating an Albian age have been found to date.

b) Albian in the Serranía del Interior

During the early and middle Albian favourable conditions for the development of ammonite populations were only present in the Serranía del Interior. The massively bedded limestones of the El Cantil Formation, assumed to be Aptian in age, are overlain by the *Chimana Formation* (Hedberg and Pyre, 1944). The interval, characterized by the abundance of glauconite, consists of dark shales, which are rather irregularly interbedded with massive limestones and glauconitic sands. It reaches a maximal thickness of 800 meters (Guillaume, 1972, p.1631).

Ammonite assemblages associated with rich benthic and planktonic foraminifera occur in shale intercalations. They belong to two ammonite zones, the *Douvilleiceras mammillatum* Zone below and the *Hoplites dentatus* Zone above. The lower part of the Chimana Formation furnished the genera *Phylloceras (Hypophylloceras), Pictetia, Beudanticeras, Douvilleiceras* and *Parengonoceras.* Its foraminiferal fauna corresponds to the *Praeglobotruncana rohri* Zone. In the upper part the genera *Phylloceras, Puzosia, Tetragonites, Beudanticeras, Desmoceras, Mojsisovicsia, Eubrancoceras, Oxytropidoceras, Prolyelliceras, Lyelliceras* and *Tegoceras* were found, together with *Neobulimina subcretacea* (Cushman), of middle Albian age.

The Chimana Formation is unconformably overlain by the *Querecual Formation* (Hedberg, 1937a, b) of which the lower part corresponds to the *Rotalipora ticinensis/appenninica* Zone, but in which no ammonites have as yet been found.

2. Systematic descriptions of Albian ammonites

a) Albian in the Perijá river sections

As previously noted ammonites have only been sporadically found in Albian sediments exposed along the river sections in the Perijá foothills and then only from the Machiques and Lisure Formations. From the uppermost part of the Machiques Formation *Parengonoceras,* the sculpture of which consists of growth lines only, and a *Prolyelliceras* were obtained. In the basal part of the Lisure Formation (lower Albian) *Knemiceras* aff. *flexiloculosum* Basse is the only ammonite found to date.

A single fragment of a *Mortoniceras* from the upper part of the Lisure Formation indicates a late Albian age which implies a Cenomanian age for the overlying Maraca Formation. This specimen is of importance in our stratigraphical considerations and has, therefore, been figured (Pl. 4, Fig. 1).

Family Engonoceratidae Hyatt, 1900

Genus *Parengonoceras* Spath, 1924

Type species: Ammonites ebrayi de Loriol, 1882.

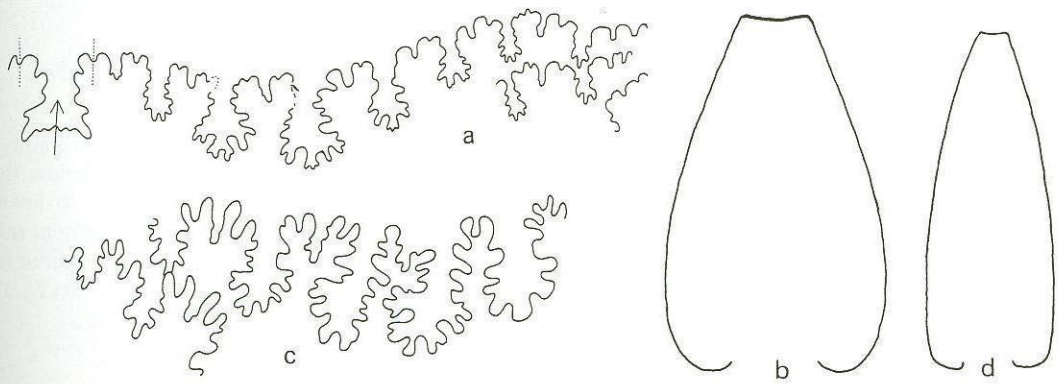
Occurence: Europe, North Africa, Middle East, Venezuela, Colombia, Peru.

Parengonoceras cf. *hachourii* (Dubourdieu)
Pl. 3, Fig. 4; Text fig. 19c–d

1953 *Knemiceras hachourii* Dubourdieu, p. 23, pl. 2, fig. 10–18; pl. 3, fig. 1–5.
1979 *Knemiceras hachouri* Dubourdieu, Masse and Thieuloy, p. 69.

Lectotype here designated: Pl. 2, fig. 10–12.

Description: The fragment (Re2439) from the upper part of the Machiques Formation in the Quebrada Maraca shows falcoid growth striae, but otherwise no sculpture. It can therefore be compared with *K. hachourii* from the lower Albian in the Monts du Mellègue in Algeria. Suture (Text fig. 19c) partly preserved. Strongly frilled saddles, as indicated on worn surfaces of original material from Algeria (Text fig. 8, p. 25), rather suggest an affinity with *Parengonoceras.*



Text fig. 19
Suture lines and whorl sections of *Knemiceras* and *Parengonoceras* of the lower Albian along the Perijá foothills.
a–b. *Knemiceras* aff. *flexiloculosum* Basse, Re2420, Pl. 3, Fig. 3, 1×.
c–d. *Parengonoceras* cf. *hachourii* (Dubourdieu), Re2439, Pl. 3, Fig. 4, suture line 2×, whorl section 1×.

Genus *Knemiceras* Böhm, 1898

Type species: *Ammonites Syriacus* von Buch, 1848.

Knemiceras aff. *flexiloculosum* Basse
Pl. 3, Fig. 3a–b, Text fig. 19a–b

1940 *Knemiceras flexiloculosum* Basse, p. 430, pl. 2, fig. 3a–b.

Location: Perijá foothills, Caño Isure, light grey, dense, micritic limestone layer near the base of the Lisure Formation, early Albian.

Description: Re2420. Specimen originally about 200 mm diameter. Removed body chamber, strongly weathered. Whorl section high-trapezoidal, thickest above umbilicus, from where feebly convex flanks converge towards squared flattened and slightly concave venter which is narrower than on holotype (Text fig. 19b). Sculpture on outer whorl reduced to seven flattened, low, broad folds, strongest below mid-flank. Basse mentions six to seven conical umbilical tubercles on internal whorl which disappear when growth proceeds. Along lateral edges of venter, spirally elongated, rather closely spaced, small clavi are present alternating on both edges. Suture characterized by bifid saddles and frilled lobes as on holotype (Text fig. 19a).

Measurements: Dm 148 mm, Wh 79 (0.53), Ww 44 (0.30), U 14 (0.10)
Holotype: Dm 130 mm, Wh 63 (0.48), Ww 43 (0.33), U 18 (0.14)

Distribution: Syria, Venezuela.

?*Parengonoceras* sp.
Pl. 4, Fig. 2a–b

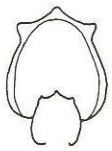
This fragment (Re2522) from the top of the Machiques Formation in Quebrada Macoíta shows no suture. It cannot reliably be attributed either to *Parengonoceras* or to *Knemiceras*. The sculpture is reduced to small tubercles above the umbilical edge. It may represent the tuberculated juvenile stage of *Knemiceras* aff. *flexiloculosum* Basse.

Family Lyelliceratidae Spath, 1921

Genus *Prolyelliceras* Spath, 1920

A single specimen has been obtained from the upper part of the Machiques Formation, indicating that within the Machiques Trough the unit reaches into the lower Albian.

Prolyelliceras flandrini (Dubourdieu)
Pl. 4, Fig. 3a–b, Text fig. 20



Text fig. 20
Whorl section of *Prolyelliceras flandrini* (Dubourdieu), Re2400, Pl. 4, Fig. 3, 1×.

1953 *Lyelliceras flandrini* Dubourdieu, p. 27, pl. 3, fig. 6–22, Holotype pl. 3, fig. 6.

Location: Perijá foothills, Quebrada Santa Rosita, Machiques Formation, early Albian.

Description: Re2400. Internal mould. Moderate in size. Last half of outer volution belongs to body chamber. Whorl section (Text fig. 20) subrectangular, venter fastigate on ribs, rounded on interspaces. Flanks convex, rounding into gently sloped umbilical wall without margin. Umbilicus evolute, 38% of diameter. Costation prominent. Ribs beginning just above umbilical seam, straight to faintly curved over flank, broadening and flattening conspicuously before rising into prominent ventrolateral, spirally elongated clavi. Ribs continuous over venter, not attenuating, elevate into prominent siphonal clavi. Early growth stage, up to about 11 mm diameter without sculpture. Suture well preserved but partly damaged by erosion.

Measurements: Dm 41 mm, Wh 15 (0.36), Ww ?14.5 (0.35), U 15.5 (0.38)

Distribution: Algeria, Venezuela.

Family Brancoceratidae Spath, 1933

Subfamily Mortoniceratinae Spath, 1925

Genus *Mortoniceras* Meek, 1876

Mortoniceras aff. *pricei* Spath, 1922
Pl. 4, Fig. 1a–b

Location: Re2556. Perijá foothills, Quebrada La Gé, near the top of the Lisure Formation, below the transgressive La Sierra Formation (middle to lower upper Eocene). The imperfectly preserved fragment might best be compared with *Mortoniceras pricei* as figured by Spath, 1930 (Ammonoidea of the Gault, p. 394, text fig. 132, from the Perte-du-Rhône near Geneva).

b) Albian in the Serranía del Interior (Text fig. 6)

The fossils here described were collected by H. Guillaume and first determined by C.W. Wright in 1960 (Guillaume, 1972, p. 1647).

All were collected from glauconitic shales and limestones of the middle and upper part of the Chimana Formation, on the islands north of Puerto La Cruz. The majority of the ammonites are limonitized.

Family Phylloceratidae Zittel, 1884

Genus *Phylloceras* Suess, 1865

Subgenus *Hypophylloceras* Salfeld, 1924

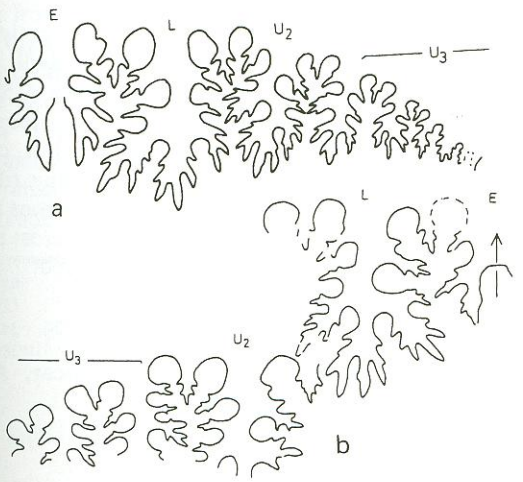
Type species: Phylloceras onoense Stanton, 1895.

Occurrence: World-wide. In Venezuela *Phylloceras* occurs only sporadically. So far this genus has only once been observed in a La Luna type lithology (Pl. 22, Fig. 21) in Venezuela. This is in contrast with the abundance of their occurrence in Europe and South Africa (Kennedy and Klinger, 1977).

Phylloceras (Hypophylloceras) moreti (Mahmoud)
Pl. 4, Fig. 6a–b; Text fig. 21a

1923 *Phylloceras subalpinum* d'Orbigny, Spath, p. 15, pl. 1, fig. 1–2.
1955 *Salfeldiella (Goretophylloceras) Moreti* Mahmoud, p. 81, pl. 5, fig. 2–4.
1963 *Phylloceras (Hypophylloceras) moreti* (Mahmoud), Wiedmann, p. 200, pl. 19, fig. 2, text fig. 46.

Lectotype: Salfeldiella (G.) Moreti Mahmoud, 1956, pl. 5, fig. 3, selected by Wiedmann, 1963, p. 200.



Text fig. 21
Suture lines of *Phylloceras:*
a. *Phylloceras (Hypophylloceras) moreti* Mahmoud, Gu547, Pl. 4, Fig. 6, 4×.
b. *Phylloceras (Hypophylloceras) thetis majoricense* Wiedmann, Gu598, Pl. 4, Fig. 7, 6×.

Location: West side of La Borracha Island, 900 m east of La Cueva inlet, Chimana Formation, middle Albian, *Hoplites dentatus* Zone.

Description: Gu547. Internal mould. Whorl section elliptical, thickest near mid-flank. Sides convex, evenly grading into arched venter and into closed, funnel-like umbilicus. No constrictions. Riblets over venter not exposed. Suture (Text fig. 21a) as shown by Mahmoud (1956) and Wiedmann (1962d, 1963). Saddle E/L diphylloid, L/U_2 triphylloid.

Measurements: DM 30 mm, Wh 17 (0.57), Ww 13 (0.43), Ww/Wh 0.76

Distribution: Egypt (Sinai), Mallorca, Sardinia, England, Venezuela.

Phylloceras (Hypophylloceras) tethys majoricense Wiedmann
Pl. 4, Fig. 7a–b; Text fig. 21b

1963 *Phylloceras (H.) tethys majoricense* Wiedmann, p. 178, pl. 15, fig. 1; pl. 18, fig. 3; text fig. 37 (suture).
1975a *Phylloceras (H.) tethys majoricense* Wiedmann, Bevia, p. 400, fig. 5, 6.

Holotype: Phylloceras (H.) majoricense Wiedmann, 1963, pl. 15, fig. 1, Aptian of Santa Ponsa, Mallorca.

Location: North end of La Borracha Island, top of Chimana Formation. Shale zone above greensand, just below the transgressive Querecual Formation, middle Albian, *dentatus* Zone.

Description: Gu598. Test preserved, partly removed to free suture. Whorl section subtrigonal, widest between umbilicus and mid-flank. Sides feebly convex, converging to a more narrowly arched venter. Umbilicus narrow, funnel-like. No constrictions. Sculpture on test reduced to dense growth lines. Suture (Text fig. 21b) characterized by simple diphylloid saddles. Lateral lobe less asymmetric than on *Phylloceras (Hypophylloceras) moreti.*

Measurements:	Dm	Wh	Ww	U
Holotype	28 mm	17 (0.60)	10 (0.36)	1 (0.04)
Gu598, Pl. 4, Fig. 7	24 mm	13.5 (0.56)	10 (0.42)	2 (0.08)

Distribution: Spain (Barremian–Aptian), Sardinia, Venezuela.

Family Tetragonitidae Hyatt, 1900

Subfamily Tetragonitinae, Hyatt, 1900

Genus *Tetragonites* Kossmat, 1847

Type species: Ammonites timotheanus Pictet, 1848.

Occurrence: World-wide.

Tetragonites rectangularis Wiedmann, 1962
Pl. 4, Fig. 4a–b, 5a–b; Text fig. 22a–c

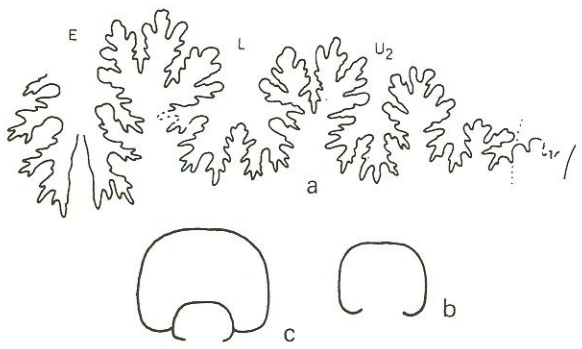
1902 *Lytoceras Timotheanum* Mayor, Anderson, p. 63, pl. 7, fig. 145–48.
1908 *Lytoceras (Tetragonites) Timotheanum* Pictet, Jacob, p. 19, pl. 1, fig. 10, 11.
1940 *Tetragonites* aff. *Timotheanus* Mayor, Fabre, p. 214, pl. 5, fig. 2, 3.
1957 *Tetragonites timotheanus* Mayor, Almela and Revilla, p. 21, pl. 4, fig. 4.
1962a *Tetragonites rectangularis* Wiedmann, p. 178, pl. 14, fig. 3, holotype.
1962b *Tetragonites rectangularis* Wiedmann, p. 78, pl. 6, fig. 1, 2, 7, 8; Text fig. 28.
1963 *Tetragonites rectangularis* Wiedmann, Collignon, p. 21, pl. 249, fig. 1069, 1070.
1968 *Tetragonites rectangularis* Wiedmann, Wiedmann and Dieni, p. 47, pl. 4, fig. 8.
1979 *Tetragonites timotheanus* (Pictet), Scholz, p. 56, pl. 11, fig. 7 (morphotype *rectangularis*).

Location: Mochima Peninsula, Punta La Cruz, northeast of Puerto La Cruz, upper Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu796. Internal mould. Whorl section square, subtrapezoidal (Text fig. 22c). Flanks feebly convex, slightly converging towards flattened, broadly arched venter. Umbilicus deep, 23% of diameter. Umbilical wall vertical, undercut, narrowly merging into flank. Six constrictions strongly projected forward, cross straight over sides, slightly angled on shoulder and adaptically recurving on venter. On specimen Gu548 (Pl. 4, Fig. 4, Text fig. 22b) external suture preserved (Text fig. 22a). Schindewolf (1968, p. 766) discovered presence of a lobe U_3, developed already on primary suture; it is thus six-lobate.

Measurements:	Dm	Wh	Ww	U
Gu796, pl. 4, fig. 5	30 mm	14 (0.46)	18 (0.60)	6.8 (0.23)
Gu548, pl. 4, fig. 4	25 mm	11 (0.44)	14.8 (0.60)	5.5 (0.22)

Distribution: France, Spain (Mallorca), Sardinia, Venezuela, Japan (Matsumoto, 1943).



Text fig. 22
Tetragonites rectangularis Wiedmann:
a. Suture, Gu548, Pl. 4, Fig. 4, 4×.
b. Whorl section, Gu548, Pl. 4, Fig. 4, 1×.
c. Whorl section, Gu796, Pl. 4, Fig. 5, 1×.

Remarks: Tetragonites kitchini Krenkel (1910a, p. 226, pl. 22, fig. 8) from East Africa has a markedly smaller whorl width (about 0.41) and a wider umbilicus (about 0.31).

Family Desmoceratidae Zittel, 1895

Subfamily Puzosiinae Spath, 1922

Genus *Puzosia* Bayle, 1878

Type species: Puzosia planulata Bayle, 1878.

Occurrence: World-wide.

Puzosia quenstedti (Parona and Bonarelli), 1897
Pl. 4, Fig. 8a–b

1847–48 *Ammonites planulatus* J. Sowerby, Quenstedt, p. 221, pl. 17, fig. 13b, d only.
1897 *Desmoceras Quenstedti* Parona and Bonarelli, p. 81, pl. 11, fig. 3.
1908 *Desmoceras (Puzosia) Mayorianum* d'Orbigny, Jacob, pl. 6, fig. 1 only.
1931 *Puzosia quenstedti* (Parona and Bonarelli), Seitz, p. 401, pl. 6, fig. 3–4.
1942b *Puzosia quenstedti angolana* Haas, p. 149, pl. 37, fig. 2–9; pl. 41, fig. 1–6.
1950 *Puzosia Quenstedti* Parona and Bonarelli, Collignon, p. 44, pl. 9, fig. 1.
1968 *Puzosia quenstedti* Parona and Bonarelli, Wiedmann and Dieni, p. 114, pl. 10, fig. 11; pl. 12, fig. 3; Text fig. 72–73.

Holotype: Desmoceras quenstedti Parona and Bonarelli, 1897, refigured Wiedmann and Dieni, 1968, pl. 12, fig. 3.

Location: North end of La Borracha Island, Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu377. Whorl section oval, distinctly higher than wide. Maximal width just below mid-flank. Venter broadly rounded, grading into gently convex flank. Umbilicus 30% of diameter. Umbilical wall steep, edge rounded, indistinct. On outer whorl seven, low, collared constrictions, separated by about sixteen fine ribs over venter, fading out below mid-flank. Constrictions turning slightly forward, towards venter which they cross in a flat adorally directed bow. Suture partly preserved.

Measurements:	Dm	Wh	Ww	U
Gu377, pl. 4, fig. 8	84 mm	33 (0.40)	30 (0.36)	24 (0.30)

Distribution: France, Sardinia, Madagascar, Angola, Venezuela.

Puzosia media Seitz
Pl. 4, Fig. 9a–b, 11a–b

1897 *Desmoceras* cf. *Emerici*, Raspail, Parona and Bonarelli, p. 80, pl. 11, fig. 1.
1910 *Puzosia mayoriana* d'Orbigny, Fallot, p. 27, pl. 1, fig. 4.

1931 *Puzosia quenstedti* var. *media* Seitz, p. 402, pl. 16, fig. 5.
1949 *Puzosia Quenstedti* var. *Breistrofferi,* Collignon, p. 64, pl. 12, fig. 1.
1963 *Puzosia Quenstedti* var. *media* Collignon, p. 61, pl. 263, fig. 1148, 1149.
1968 *Puzosia media* Seitz, Wiedmann and Dieni, p. 115.

Location: North end of La Borracha Island, shale interval at top of Chimana Formation, between greensand and transgressing Querecual Formation, middle Albian (*dentatus* Zone).

Description: Fragment of adult specimen Gu582, Pl. 4, Fig. 11; juvenile specimen Gu585 (Pl. 4, Fig. 9). Whorl section about as wide as high. It differs from *P. quenstedti* by its subcircular whorl section and by slightly deeper and wider constrictions, slightly curved forward over venter.

Measurements: Gu585, Dm 25 mm, Wh 9 (0.36), Ww 10.5 (0.42), U 8 (0.32)

Distribution: France, Austria, Mallorca, Sardinia, Madagascar, Venezuela.

Puzosia lata Seitz
Pl. 4, Fig. 10a–b

1847–48 *Ammonites planulatus* J. Sowerby, Quenstedt, pl. 221, pl. 17, fig. 13a–c only.
1931 *Puzosia lata* Seitz, p. 403, pl. 17, fig. 2.
1963 *Puzosia provincialis* var. *crassa* Collignon, p. 64, pl. 264, fig. 1155.
1968 *Puzosia lata* Seitz, Wiedmann and Dieni, p. 121, pl. 10, fig. 10; pl. 11, fig. 9.

Holotype: Reproduced: Seitz, 1931, pl. 17, fig. 2.

Location: North end of La Borracha Island. Top of Chimana Formation, below transgressing Querecual Formation, middle Albian (*dentatus* Zone).

Description: Gu590. A number of juvenile specimens differ from *P. provincialis* by whorl sections being wider than high, ranging between 0.48 to 0.52. Whorl section subcircular, maximal thickness around mid-flank. Five deep constrictions, bent sigmoidally on outer half of flank, cross venter in a slightly angular sinus. The specimens available to the author may be compared with the transitional form *provincialis-lata* figured by Wiedmann and Dieni (1968, pl. 10, fig. 10a–c, p. 120).

Measurements:	Dm	Wh	Ww	U
Holotype	33.2 mm	0.39	0.43	0.34
Gu590	23 m	9.3 (0.40)	11 (0.48)	6.5 (0.28)

Distribution: France, Sardinia, Madagascar, Venezuela.

Subfamily Beudanticeratinae Breistroffer, 1953

Genus *Beudanticeras* Hitzel, 1902

Type species: Ammonites Beudanti Brongniart, 1822.

Occurrence: Europe, Africa, Queensland, Japan, Texas, Patagonia, Greenland (Spath, 1946).

Beudanticeras ('Uhligella') walleranti (Jacob)
Pl. 4, Fig. 12a–b, 13a–b; Text fig. 23a

1908 *Desmoceras (Uhligella) Walleranti* Jacob, p. 31, pl. 3, fig. 1–4.
1913 *Uhligella walleranti* Jacob, Petrovic, p. 70, fig. 13.
1936 *Beudanticeras (Uhligella) walleranti* Jacob, Breistroffer in Besairie, p. 154, pl. 23, fig. 1.
1947 *Beudanticeras walleranti* (Jacob), Breistroffer, p. 63.
1961b *Beudanticeras walleranti* (Jacob), Casey, p. 161.
1968 *Beudanticeras ('Uhligella') walleranti* (Jacob), Wiedmann and Dieni, p. 129.

Lectotype: Desmoceras (Uhligella) walleranti Jacob, 1908, pl. 3, fig. 1, selected by Wiedmann and Dieni, 1968, p. 129.

Location: Mochima Peninsula, near Punta La Cruz, northeast of Puerto La Cruz, upper Chimana Formation, middle Albian, *dentatus* Zone.

Description: Gu827, Gu838. Whorl section compressed, high-rectangular with parallel flattened sides. Maximal width on lower third of flank. Venter narrowly arched. Umbilicus about 20% of diameter; umbilical wall almost vertical, edge distinctly marked. Ribs on test of low relief and flattened, falciform; on internal mould still less pronounced. Constrictions indistinct. Interpretation of suture (Text fig. 23a) based on Schindewolf (1966, p. 621). U_1 begins to split into a dorsal and a ventral branch on eighth or ninth line, developing faster than later sutural lobes.

Measurements:	Dm	Wh	Ww	U
Gu827, pl. 4, fig. 12	78 mm	39 (0.50)	23 (0.30)	16 (0.20)
Gu838, pl. 4, fig. 13	39 mm	18 (0.46)	12 (0.31)	7 (0.18)

Distribution: Southern Europe, North Africa, Madagascar, Venezuela.

Remark: The species is one of the most common ammonites in the Albian of the Serranía del Interior.

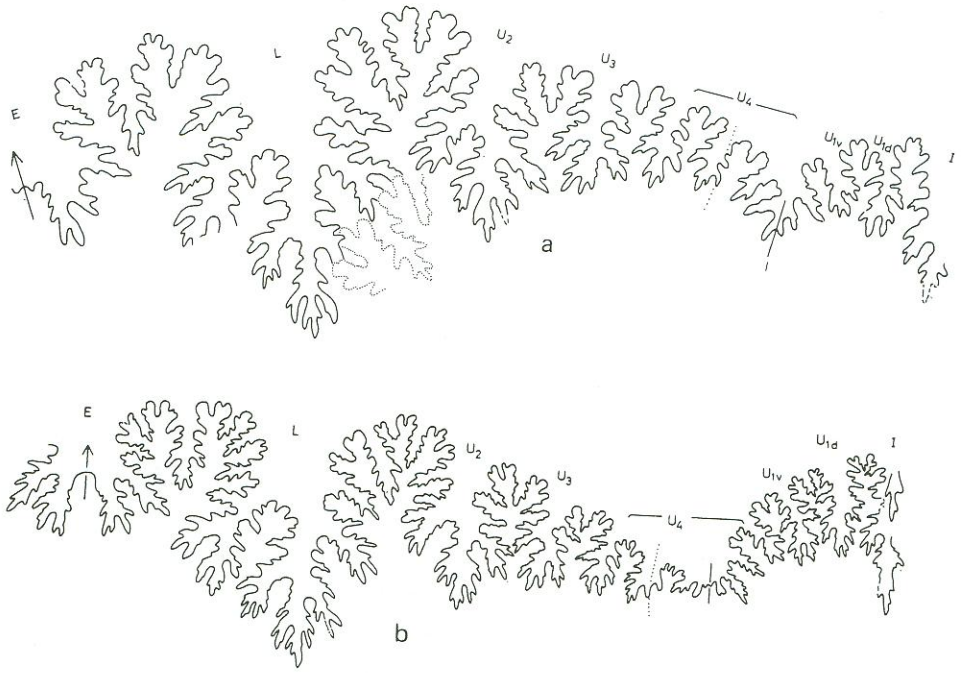
Beudanticeras ('Uhligella') rebouli (Jacob)
Pl. 4, Fig. 14a–b, 15; Text fig. 23b

1908 *Desmoceras (Uhligella) Rebouli* Jacob, p. 32, pl. 4, fig. 1–5.
1910 *Uhligella Rebouli* Jacob, Fallot, p. 21, pl. 2, fig. 1, 2.
1930 *Desmoceras Rebouli* Jacob, Passendorfer, p. 207, pl. 3, fig. 56, 60.
1947 *Uhligella Rebouli* Jacob, Breistroffer, p. 47.
1957 *Uhligella rebouli* Jacob, Almela and Revilla, p. 24, pl. 5, fig. 4.
1968 *Beudanticeras ('Uhligella') rebouli* (Jacob), Wiedmann and Dieni, p. 129, pl. 10, fig. 6.

Lectotype: Desmoceras (Uhligella) Rebouli Jacob, 1908, pl. 4, fig. 2, selected by Wiedmann and Dieni, 1968, p. 129.

Location: Mochima Peninsula, near Punta La Cruz, northeast of Puerto La Cruz. Upper Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu825 (Pl. 4, Fig. 14). Whorl section subrectangular, thickest above umbilical margin. Flanks flat, slightly convex, rounding into wide arched venter. Um-



Text fig. 23
Suture lines of *Beudanticeras:*
a. *Beudanticeras ("Uhligella") walleranti* (Jacob), Gu838, Pl. 4, Fig. 13, 5×.
b. *Beudanticeras ("Uhligella") rebouli* (Jacob), Gu855, Pl. 4, Fig. 15, 2.5×.

bilical wall steep, narrowly rounding into flank. Costation of low relief, as on lectotype. Ribs falciform, slightly strengthening towards ventral third of flank, strongly curved forward over venter, not attenuating towards siphonal line. After reconstruction seven flat, broad constrictions are apparent per whorl. A fragment of a larger specimen (Gu855, Pl. 4, Fig. 15) with less pronounced costation furnished a complete external and internal suture (Text fig. 23b). U_1 is split, as characteristic for Desmoceratidae. Suture identical in all aspects with that of *B. walleranti* (Text fig. 23a).

Distribution: Europe, Venezuela.

Subfamily Desmoceratinae Zittel, 1895

Genus *Desmoceras* Zittel, 1884

Subgenus *Desmoceras* Zittel, 1884

Occurrence: World-wide.

The extreme variability of *Desmoceras latidorsatum* (Michelin) has been recognized since d'Orbigny, 1841; Pictet, 1848; Kossmat, 1897 and Jacob, 1908. The subspecies *complanatum* and *inflatum* can clearly be distinguished in the middle Albian of the Serranía del Interior. In contrast, the numerous specimens of *D. latidorsatum* from the upper Albian, available from the Barbacoas region in the Andes, are remarkably constant in whorl width and height, and may best be placed within *D. latidorsatum latidorsatum* (Renz, 1972, p. 717). It appears that *D. latidorsatum* became stabilized during the late Albian (*Hysteroceras orbignyi* Zone), at least in Venezuela.

Desmoceras (Desmoceras) latidorsatum complanatum Jacob, 1908
Pl. 5, Fig. 1a–b, 2a–b; Text fig. 24a

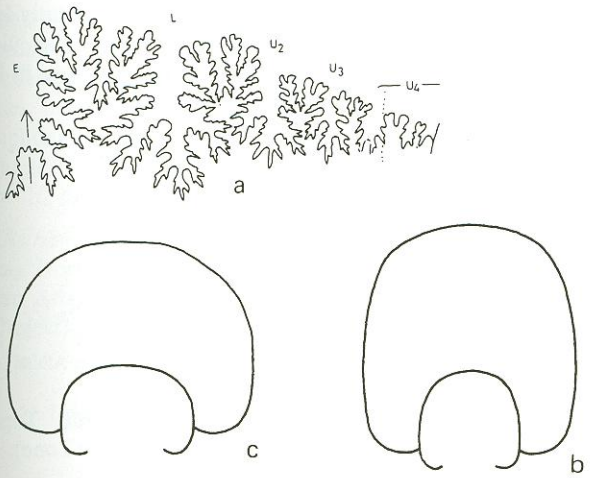
1908 *Desmoceras (Latidorsella) latidorsatum* var. *complanata* Jacob, p. 38, pl. 4, fig. 10a–b; pl. 5, fig. 2a–c.
1963 *Desmoceras latidorsatum* var. *media* Jacob, Collignon, p. 84, pl. 273, fig. 1180.
1968 *Desmoceras (D.) latidorsatum* 'var. *complanata*' Jacob, Wiedmann and Dieni, p. 132, pl. 12, fig. 7a–b.

Lectotype: Here designated: Jacob, 1908, pl. 4, fig. 10a–b.

Location: Gu799. Mochima Peninsula, Punta La Cruz, northeast of Puerto La Cruz. Upper Chimana Formation, middle Albian (*dentatus* Zone). MBJ28808, road Caripe–Casanay near houses named Arenales, middle Albian.

Description: Gu799, MBJ28808. Whorl section broad-oval, distinctly higher than wide, thickest slightly below mid-flank. Umbilicus 17–22% of diameter. Umbilical wall steep, rounding evenly into flank. No constrictions. Suture (Text fig. 24a) typical for genus (compare Schindewolf, 1966, p. 419, fig. 370).

Measurements:	Dm	Wh	Ww	U
MBJ28808, Pl. 5, Fig. 1	30 mm	14.5 (0.48)	14 (0.46)	5 (0.17)
Gu799, Pl. 5, Fig. 2	34 mm	16.5 (0.48)	15 (0.44)	7 (0.20)
Collignon, 1963, fig. 1180	55 mm	26 (0.47)	22 (0.40)	12 (0.22)



Text fig. 24
a. *Desmoceras (D.) latidorsatum complanatum* Jacob, MBJ28808, Pl. 5, Fig. 1, suture line 3×.
b. *Desmoceras (D.) latidorsatum latidorsatum* (Michelin), whorl section, Gu573, Pl. 5, Fig. 5, 2×.
c. *Desmoceras (D.) latidorsatum inflatum* Breistroffer, whorl section, Gu540, Pl. 5, Fig. 8, 2×.

Desmoceras (Desmoceras) latidorsatum latidorsatum (Michelin)
Pl. 5, Fig. 3a–b, 4a–b, 5a–b, 7a–b; Text fig. 24b

1908 *Desmoceras (Latidorsella) latidorsatum* var. *media* Jacob, p. 37, pl. 4, fig. 12.
1963 *Desmoceras latidorsatum* var. *inflata* Jacob, Collignon, p. 84, pl. 273, fig. 1177.
1968 *Desmoceras (D.) latidorsatum* 'var. *media*' Jacob, Wiedmann and Dieni, p. 132, pl. 12, fig. 8.
1972 *Desmoceras latidorsatum* Michelin, Renz, p. 717, pl. 8, fig. 5; pl. 9, fig. 2; pl. 10, fig. 1, 2.

Location: Gu804, Gu573, Gu798, Gu800. North end of La Borracha Island. Shale zone above greensand on top of Chimana Formation, below transgressive Querecual Formation, middle Albian.

Description: Gu804, Gu798, Gu573. Whorl section subcircular (Text fig. 24b). Sides distinctly flattened, weakly convex. Umbilicus 18–24% of diameter. Constrictions distinct over venter, fading out towards umbilicus. Gu800 (Pl. 5, Fig. 7) may represent an intermediate form between the subspecies *latidorsatum* and *inflatum* (see p. 42).

Measurements:	Dm	Wh	Ww	U
Gu798, Pl. 5, Fig. 4	28 mm	12.3 (0.44)	15 (0.53)	6.8 (0.24)
Gu573, Pl. 5, Fig. 5	30 mm	15 (0.50)	16 (0.52)	5.5 (0.18)
Gu800, Pl. 5, Fig. 7	25 mm	12 (0.48)	15 (0.60)	4.8 (0.19)
Gu804, Pl. 5, Fig. 3	29 mm	13.8 (0.47)	14 (0.48)	5 (0.17)

Desmoceras (Desmoceras) latidorsatum inflatum Breistroffer
Pl. 5, Fig. 6a–b, 8a–b, 9a–b; Text fig. 24c

1933 *Latidorsella latidorsata* var. *inflata* Breistroffer, p. 7.
1961 *Desmoceras (Latidorsella) latidorsatum* var. *inflata* Breistroffer, Collignon, p. 59, pl. 24, fig. 1.
1968 *Desmoceras (D.) latidorsatum* var. *'inflata'* Breistroffer, Wiedmann and Dieni, p. 133, pl. 12, fig. 6, 9–13.

Location: Gu572, 540, 607. North end of La Borracha Island. Top of Chimana Formation, middle Albian. Gu800. Mochima Peninsula, Punta La Cruz. Upper Chimana Formation, middle Albian (*dentatus* Zone).

With six specimens available this seems to be one of the most common ammonites of the Albian in the Serranía del Interior.

Description: Gu540, Gu572, Gu607. Whorl section (Text fig. 24c) considerably wider than high, thickest between umbilicus and mid-side, or even just above rounded umbilical margin (specimen Gu607; Pl. 5, Fig. 9). From there, sides curve toward broadly arched venter. Seven to eight constrictions are apparent.

Measurements:	Dm	Wh	Ww	U
Gu572, Pl. 5, Fig. 6	37 mm	15 (0.40)	23 (0.62)	8.5 (0.22)
Gu540, Pl. 5, Fig. 8	38 mm	25 (0.43)	36.5 (0.63)	13 (0.22)
Gu607, Pl. 5, Fig. 9	16.5 mm	6.5 (0.40)	12 (0.72)	3 (0.18)

Remarks: Desmoceras obesum (Reynes) in Spath (1925b, holotype p. 101, pl. 4, fig. 2a–c) differs from the present species, mainly by its still wider whorl section.

The three subspecies of *D. latidorsatum* of the Serranía del Interior are connected by transitional forms.

Family Silesitidae Hyatt, 1900

Genus *Parasilesites* Imlay, 1959

Type species: Parasilesites bullatus Imlay, 1959 (Alaska).

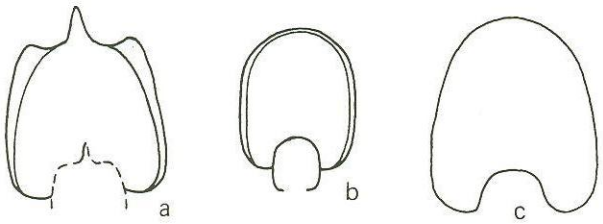
Occurrence: France, Spain, Russia, Algeria, East Africa, Alaska.

Parasilesites kilianiformis (Fallot)
Pl. 5, Fig. 10a–b; Text fig. 25c

1910 *Puzosia Nolani* var. *Kilianiformis* Fallot, p. 26, pl. 1, fig. 5a–b.
1920a *Puzosia Nolani* var. *Kilianiformis* Fallot, p. 46, pl. 3, fig. 3.
1947 *Silesitoides Kilianiformis* (Fallot), Breistroffer, p. 62.
1957 *Silesitoides nolani* var. *kilianiformis* Fallot, Almela and Revilla, p. 28, pl. 7, fig. 3.
1966 *Parasilesites kilianiformis* (Fallot), Schindewolf, p. 625 (suture).
1968 *Parasilesites kilianiformis* (Fallot), Wiedmann and Dieni, p. 124, pl. 10, fig. 7.
1979 *Parasilesites kilianiformis* (Fallot), Renz, p. 364, pl. 2, fig. 1 (Atlantic).

Location: North end of La Borracha Island. Top Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu637. Internal mould. Specimen consists of limonite and goethite. Badly broken, probably by compression during the Andean orogeny and cement-



Text fig. 25
Whorl sections of:
a. *Mojsisovicsia evansi* (Spath), Gu416, Pl. 5, Fig. 17, 1×.
b. *Eubrancoceras aegoceratoides* (Steinmann), Gu109b, Pl. 5, Fig. 11, 2×.
c. *Parasilesites kilianiformis* (Fallot), Gu637, Pl. 5, Fig. 10, 3×.

ed by calcite thereafter. Whorl section compressed, oval (Text fig. 25c). Umbilicus 45% of diameter, umbilical wall low and steep, widely rounding into flank. Four to five broad constrictions occur, intercalated by about twenty weak, densely spaced ribs, commencing around mid-flank, and projecting forward chevron-like over venter. Suture not preserved. According to Schindewolf (1966, p. 439) U_2 splits in two branches as on Desmoceratidae.

Measurements: Dm 30 mm, Wh 10.5 (0.35), Ww 7.5 (0.25), U 13.5 (0.45)

Distribution: Mallorca, Sardinia, Venezuela, Northern Atlantic (Leg 47 B, Site 398 D, Deep Sea Drilling Project).

Family Lyelliceratidae Spath, 1921

Genus *Prolyelliceras* Spath, 1930

Type species: Prolyelliceras peruvianum Spath, 1930

Occurrence: Tunisia, Colombia, Peru, Venezuela, Japan (Obata et al., 1975).

Prolyelliceras peruvianum Spath
Pl. 5, Fig. 12; Text fig. 26e

1881 *Acanthoceras Lyelli* Leymerie, Steinmann, p. 135, pl. 7, fig. 3, 3a.
1906 *Acanthoceras prorsocurvatum* Gerhardt, Douvillé, R., p. 144, pl. 2, fig. 1, 1a.
1930 *Prolyelliceras peruvianum* Spath, p. 65.
1938 *Prolyelliceras ? lobatum* Riedel, p. 57, pl. 9, fig. 9–11.
1955a *Prolyelliceras prorsocurvatum* (Gerhardt), Bürgl, p. 15, pl. 4, fig. 4a–c.
1956 *Prolyelliceras peruvianum* Spath, Benavides-Cáceres, p. 462, pl. 50, fig. 1–4.

Location: North end of La Borracha Island. Top of Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu616. Internal mould. Whorl section broadly oval (Text fig. 26e). Venter flattened, sides convex, gradually declining towards umbilical seam, without forming distinct edge. Ribs single, straight, faintly leaning forward, elevated in ventrolateral clavi on shoulder. Ribs curve slightly forward over venter, ending in low, blunt siphonal clavi. Suture poorly preserved.

Distribution: Colombia, Peru, Venezuela.

Prolyelliceras gevreyi (Jacob)
Pl. 5, Fig. 13a–b

1860 *Ammonites Lyelli* Pictet and Campiche, pl. 24, fig. 7a–b.
1907 *Acanthoceras Gevreyi* Jacob, p. 37.
1947 *Lyelliceras Gevreyi* Jacob, Breistroffer, p. 42 (lower Albian).

Location: North end of La Borracha Island. Top of Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu623. Whorl section compressed, high-rectangular, thickest on dorsal ventrolateral tubercles. Flanks parallel, flat. On siphonal clavi, venter low-fastigate. Ribs roughly radial, faintly sigmoidally curved and flattening over venter. Two rows of ventrolateral clavi and prominent elongated siphonal clavi occur. Umbilicus 35% of diameter; umbilical slope evenly rounding into flank. Suture not preserved.

Measurements: Dm 27 mm, Wh 12 (0.44), Ww 8 (0.30), U 9.5 (0.35)

Distribution: Switzerland, France, Venezuela.

Genus *Lyelliceras* Spath, 1921

Type species: Ammonites Lyelli Leymerie in d'Orbigny, 1841.

Occurrence: World-wide, except Australia.

Lyelliceras lyelli (d'Orbigny)
Pl. 5, Fig. 14a–b

1841 *Ammonites Lyelli* Leymerie, d'Orbigny, p. 255, pl. 74, fig. 4 only.
1860 *Ammonites Lyelli* Leymerie, Pictet and Campiche, p. 196, pl. 24, fig. 1 only.
1878 *Acanthoceras Lyelli* (Leymerie), Bayle, pl. 74, fig. 4–6.
1897 *Acanthoceras Lyelli* (Deshayes in Leymerie), Parona and Bonarelli, p. 96, pl. 13, fig. 7–12.
1930 *Lyelliceras lyelli* d'Orbigny, Spath, p. 61, pl. 9, fig. 7.
1931 *Lyelliceras lyelli* d'Orbigny, Spath, p. 316, pl. 32, fig. 9a–b, 12a–b, 13a–b.
1956 *Lyelliceras lyelli* (Leymerie), d'Orbigny, Benavides-Cáceres, p. 463, pl. 51, fig. 1–3.
1963 *Lyelliceras lyelli* (Leymerie), Collignon, p. 180, pl. 315, fig. 1333.
1966 *Lyelliceras lyelli* (d'Orbigny), Schindewolf, p. 710 (suture).
1971 *Lyelliceras lyelli* (d'Orbigny), Owen, pl. 2, fig. 2a–b.
1979 *Lyelliceras lyelli* (d'Orbigny), Renz, p. 364, pl. 2, fig. 5 (Atlantic).

Lectotype: Ammonites Lyelli Leymerie, d'Orbigny, 1841, pl. 74, fig. 103d in Spath, 1931, p. 319.

Location: La Cueva, west coast of La Borracha Island, upper Chimana Formation, middle Albian (*dentatus* Zone).

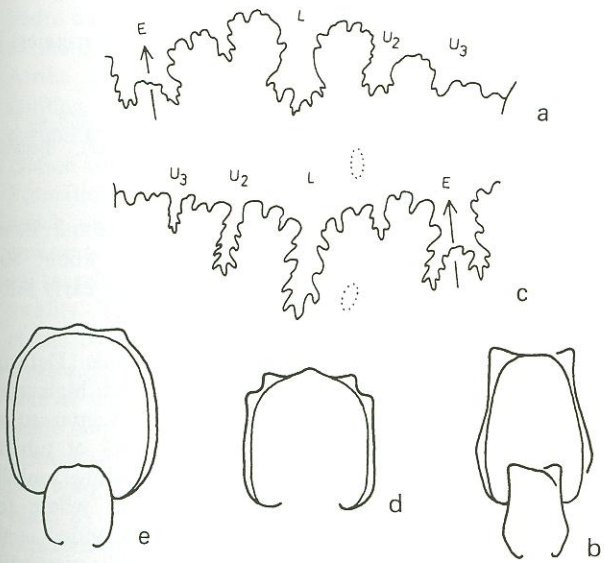
Description: Gu238. Internal mould. Whorl section broad-oval between ribs, polygonal on four rows of tubercles placed on straight, radial ribs. Umbilical tubercles bullate, lateral ones rounded, ventrolateral and siphonal tubercles clavate. Suture not preserved. Arrangement of lobes according to Schindewolf (1966, p. 710, fig. 435: E, L, U_2, U_3, U_5/U_4, U_1, I).

Distribution: Europe, Southern India, Japan, Madagascar, North America, Peru, Colombia, Venezuela, Northern Atlantic (Leg 47 B, Site 398 D, Deep Sea Drilling Project).

Lyelliceras pseudolyelli (Parona and Bonarelli)
Pl. 5, Fig. 15a–b; Text fig. 26c–d

1897 *Acanthoceras pseudo-Lyelli* Parona and Bonarelli, p. 99, pl. 14, fig. 1a–c, 2a–b.
1913 *Acanthoceras Lyelli* Parona and Bonarelli, Sommermeier, p. 407.
1930 *Lyelliceras pseudolyelli* (Parona and Bonarelli), Spath, p. 62.
1931 *Lyelliceras pseudolyelli* (Parona and Bonarelli), Spath, p. 319, pl. 32, fig. 14a–b, 15a–b.
1938 *Lyelliceras pseudolyelli* Parona and Bonarelli, Riedel, p. 54, pl. 9, fig. 5–6; pl. 13, fig. 16.
1956 *Lyelliceras pseudolyelli* Parona and Bonarelli, Benavides-Cáceres, p. 463, pl. 52, fig. 3.
1963 *Lyelliceras pseudo-Lyelli* Parona and Bonarelli, Collignon, p. 179, pl. 315, fig. 1334.
1966 *Lyelliceras pseudolyelli* (Parona and Bonarelli), Schindewolf, p. 711, fig. 436 (suture).

Lectotype: Acanthoceras pseudo-Lyelli Parona and Bonarelli, 1897, selected by Parona and Bonarelli, 1897 from d'Orbigny, 1841, pl. 74, fig. 4.



Text fig. 26
a–b. *Tegoceras gladiator* (Bayle), Gu791, Pl. 5, Fig. 16, suture line 4×; whorl section 2×.
c–d. *Lyelliceras pseudolyelli* (Parona and Bonarelli), Gu423, Pl. 5, Fig. 15, suture line 4×; whorl section 2×.
e. *Prolyelliceras peruvianum* Spath, Gu616, Pl. 5, Fig. 12, whorl section 2×.

Location: Las Playuelas, inlet on eastern side of Chimana Grande Island. Upper Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu423. Deformed specimen. Whorl section rather compressed (Text fig. 26d). Tuberculation less pronounced than on *L. lyelli.* Ribs flattening between lateral tubercles and ventrolateral clavi, then fading out over venter. Median line on venter irregularly crenulated. External suture (Text fig. 26c) as on *L. lyelli.* Ontogenetic development of suture conforms with *L. lyelli* (Schindewolf, 1966, p. 711, fig. 436).

Distribution: France, England, Peru, Colombia, Venezuela.

Genus *Tegoceras* Hyatt, 1900

Type species: Ammonites mosensis d'Orbigny, 1841.

Occurrence: Europe, Pakistan, Venezuela.

Tegoceras gladiator (Bayle)
Pl. 5, fig. 16a–b; Text fig. 26a–b

1878 *Hoplites gladiator* Bayle, pl. 45, fig. 1, 2.
1911 *Rauliniceras gladiator* Bayle, H. Douvillé, p. 299, fig. 13, suture.
1947 *Rauliniceras gladiator* Bayle, Breistroffer, p. 42.
1953 *Rauliniceras gladiator* Bayle, Breistroffer, p. 70, 74.
1957 *Tegoceras gladiator* (Bayle), Casey, p. 32.
1966 *Tegoceras gladiator* (Bayle), Schindewolf, p. 713.
1970 *Tegoceras gladiator* (Bayle), Destombes, p. 2064.

Location: Mochima Peninsula, Punta La Cruz. Upper Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu791. Internal mould. A well preserved fragment of this small-sized ammonite is available. Conch compressed, square shouldered. Whorl section high-rectangular (Text fig. 26b). Flanks parallel, gently declining towards umbilical seam without umbilical edge. Thickest below mid-side on umbilical bullae. Blunt ribs begin just above umbilical seam, rising into radially elongated bullae. They then flatten on outer side of flank, and end in ventrolateral clavi, alternating on both sides of shoulder. Suture pattern observed by the author (Text fig. 26a) coincides with that figured by Casey (1957, fig. 1n, p. 32). Compare also Schindewolf, 1966, p. 713.

Distribution: France, England, Venezuela.

Family Brancoceratidae Spath, 1933

Subfamily Brancoceratinae Spath, 1933

Genus *Eubrancoceras,* Breistroffer, 1952

Type species: Brancoceras aegoceratoides Steinmann, 1881.

Occurrence: England, France, India, Japan, Madagascar, Peru, Colombia, Venezuela.

Eubrancoceras aegoceratoides (Steinmann)
Pl. 5, Fig. 11a–b; Text fig. 25b

1881 *Brancoceras aegoceratoides* Steinmann, p. 133, pl. 7, fig. 2, 2a, 2b.
1912 *Brancoceras varicosum* Sowerby, Schlagintweit, p. 85.
1947 *Brancoceras aegoceratoides* Steinmann, Knechtel et al., p. 103, pl. 21, fig. 4a–c.
1951 *Eubrancoceras aegoceratoides* (Steinmann), Breistroffer, p. 266.
1956 *Brancoceras aegoceratoides* Steinmann, Benavides-Cáceres, p. 461, pl. 49, fig. 2–4.
1963 *Brancoceras aegoceratoides* Steinmann, Collignon, p. 123, pl. 289, fig. 1257–8.
1975 *Eubrancoceras* aff. *aegoceratoides* (Steinmann), Obata et al., pl. 8, fig. 1; pl. 9, fig. 1–7.

Location: La Cieneguita, inlet on south coast of Chimana Grande. Upper part of Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu109b. A rather damaged fragment. Conch small-sized, widely umbilicated. Whorl section (Text fig. 25b) broadly oval, with indistinct ventrolateral shoulder and umbilical edge. Single, round-topped ribs strengthen towards shoulder and then cross straight over venter. Specimen closely resembles the fragment figured by Benavides-Cáceres (1956) from Peru. Ontogeny of suture distinguished by non-splitting of U_1 and by alternating development of single independent umbilical lobes (lobe formula E L U_2 U_3 U_5 U_6/U_4 U_1 I) (Schindewolf, 1966, p. 706).

Measurements: Dm 46 mm, Wh 17.5 (0.38), Ww 15 (0.32), U 9.5 (0.21)

Distribution: Europe, Madagascar, Peru, Colombia, Venezuela, Japan.

Subfamily Mojsisovicsiinae Hyatt, 1903

Genus *Mojsisovicsia* Steinmann, 1881

Type species: Ammonites ventanillensis Gabb, 1869.

Occurrence: Europe, Greenland (Spath, 1946), Pakistan, South Africa (Zululand), Texas, Peru, Colombia, Venezuela.

Mojsisovicsia evansi (Spath)
Pl. 5, Fig. 17a–b; Text fig. 25a

1931 *Dipoloceras evansi* Spath, p. 353, pl. 32, fig. 18a–b, text fig. 115a.
1947 *Dipoloceras (Dipoloceroides) Evansi* Spath, Breistroffer, p. 90.

Location: Las Playuelas, inlet on eastern coast of Chimana Grande Island. Upper Chimana Formation, middle Albian (*dentatus* Zone).

Description: Gu416. Predominantly consisting of limonite and dark, fibrous, red goethite. Body chamber deformed by compaction. Whorl sections (Text fig. 25a) square; intercostal section oval, thickest between mid-flank and umbilicus. Venter flattened, dominated by prominent, sharp keel. Umbilicus 32% of diameter; umbilical wall steep on ribs, rounding into feebly convex flank on interspaces. Ribs single, highly elevated, sharp-crested, asymmetric in section, with steep adoral face and gentle adaptical slope. Towards venter ribs rise into ventrolateral clavi, projected over venter, causing a deep ventral concavity towards keel. In early growth stage, up to about 18 mm diameter, whorls without sculpture. Suture partly preserved. Ontogenetic development identical with *Brancoceras:* E, L, U_2, U_3, U_5/U_4, U_1 I (Schindewolf, 1966, p. 707).

Measurements near end of body chamber:
Dm 65 mm, Wh 24 (0.37), ? Ww 24 (0.37), U 21 (0.32).

Distribution: England, Venezuela.

Remark: Mojsisovicsia ventanillensis (Gabb) described from the middle Albian of Peru (Lissón, 1908, p. 15, pl. 16) appears to be a closely related form.

Family Engonoceratidae Hyatt, 1900

Genus *Parengonoceras* Spath, 1924

Type species: Ammonites ebrayi de Loriol, 1882.

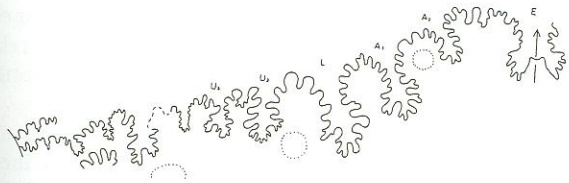
Occurrence: England, France, Spain, Peru, Colombia, Venezuela.

Parengonoceras aff. *pernodosum* (Sommermeier)
Pl. 6, Fig. 1, 2; Text fig. 27

1910 *Placenticeras pernodosum* Sommermeier, p. 331, pl. 7, fig. 1.
1956 *Parengonoceras pernodosum* (Sommermeier), Benavides-Cáceres, p. 444, pl. 44, fig. 3–4; pl. 45, fig. 1–5.

Location: West end of Chimana Grande Island. Base of upper member of Chimana Formation, about 80 m above Borracha-Guácharo limestone, late early Albian (*Douvilleiceras mammillatum* Zone).

Description: Gu29, Gu33. Internal moulds. Deformed quarter whorls. Whorl section compressed, high-rectangular, thickest on umbilical tubercles. Venter square-shouldered, broadly flattened. Four rows of tubercles placed on blunt primary folds, connecting umbilical tubercle with mid-flank tubercles, from where folds branch, rising into inner, ventrolaterally rounded, conical tubercles. From there, folds become slightly rursiradiate, ending in spirally elongated clavi, placed on sharp ventrolateral shoulder. Secondary folds begin on tubercles placed below mid-flank where they branch, ending in ventrolateral clavi, as primaries. Suture somewhat more strongly indented than on *Parengonoceras* from the



Text fig. 27
Suture line of *Parengonoceras* aff. *pernodosum* (Sommermeier), Gu29, Pl. 6, Fig. 1, 1.5×.

upper Albian in the Andes, but otherwise identical (Text fig. 27).

Distribution: Peru, Venezuela.

Remark: The holotype of *Knemiceras tetranodosum* Lissón (1925, p. 25, pl. 2, fig. 3) from Peru, which consists only of a fragment, seems to be very similar, if not identical to the present species.

c) Albian in the Andes (States of Trujillo and Lara)
(Text fig. 33)

The rich assemblage of late Albian ammonites of the La Puya Formation used in the sense prescribed by Renz (1959a), found in the surroundings of the village of Barbacoas in the State of Lara, merits some detailed discussion on the structure and stratigraphy of this part of the Andes. Reference is made to the geological map published by Renz (1959b) which covers part of the Andean structures which plunge below the Paleocene-Eocene Barquisimeto Trough.

The area between the Carora plain and the Río Tocuyo valley is dominated by two major structures, the San Pedro and the La Peña anticlines. The latter is bounded to the northwest by the prominent right lateral Hato Arriba fault. Both anticlines are disturbed by local faulting, which only becomes apparent after detailed mapping. At Hacienda Montevideo the Río Negro Formation onlaps continental sediments of the La Quinta Formation. It is conformably overlain by sediments which are a typical product of the shallow water Tibú environment. In spite of a comprehensive and methodical search no ammonites were found in the Tibú at this locality. Towards the Guayana Shield the amount of clastic components in the Tibú Formation rapidly increases. In the sandy facies of the Tibú exposed in the core of the La Peña anticline (stop 10 of the excursion guide map by Renz, 1959b), *Choffatella* is still present in calcareous intercalations. The Tibú is separated from the overlying Peñas Altas Formation (lower to middle Albian) by a rather thick, black, silty, micaceous interval representing the Guáimaros Formation. This occasionally contains some small pelecypods and plant remains, but no ammonites.

The Peñas Altas Formation consists of two lithologically similar sandstone members separated by an alternation of sands, black shales and thickly bedded skeletal limestones intercalated with biostromes of caprinids and an interval with *Orbitolina*. There are also subordinate layers of oolites which indicate intervals of highly agitated environments. The sandstone of the Peñas Altas Formation are partly cross bedded, orthoquartzites, composed of angular to semi-rounded, river-transported, partly frosted quartz grains. Grains of blue quartz derived from the Guayana Shield, which are well known in Paleocene sands, are absent. It would appear that the rocks from which the blue quartz was derived had not been exposed for erosion at that time.

There is a sharp, morphologically well expressed contact at the top of the Peñas Altas, which separates it from the overlying La Puya Formation (Text fig. 33). The La Puya begins with 2 to 10 cm of hardground consisting of iron oxide which indicates a period of non-deposition. This is followed by a conspicuous, 2 to 4 m thick interval of black shale with no trace of fossils. This is in turn overlain by a sequence of thick bedded, very fossiliferous shallow-water limestones, containing intercalations of locally nodular marly layers. These contain abundant pelecypods, mainly oysters *(Exogyra),* rudists and locally caprinids, small *Terebratula* and some echinoids. Corals are restricted to small solitary species; algae were not observed. A rich ammonite fauna is present, confined to a single layer in the upper part of the limestone. The ammonites are accompanied by an impoverished assemblage of small gastropods and lamellibranchs which persist into the lower part of the Aguada Member of the La Luna Formation. It may be considered as a transitional hemipelagic facies between shallow, well aerated and anoxic environments.

An ammonite association which is comparable to that of the Vraconian (latest Albian) of Europe (England to Sardinia) is found in the lower part of the Aguada Member, 20 to 30 m above its base. Some of the ammonite genera are the same as those found in the Chejendé syncline (State of Trujillo) and at Barbacoas. Typical genera occur, such as *Anisoceras, Lechites* and *Mortoniceras* with four rows of tubercules.

The preservation of the ammonites was initially adversely affected by sediment compaction, during which many shells were crushed. They suffered further deformation during the Andean orogeny, by tectonic compression and jointing, mainly along the narrow axes of the synclines and anticlines. The body chambers are filled with sediment, whereas the phragmocones remained void and were only later filled with sparry calcite crystals. Sporadically thermally altered oil occurs in the phragmocones, a phenomenon which is common in the ammonites of the La Luna Formation.

The La Luna and Colón Formations are exposed in the synclinal depression between the San Pedro and La Peña anticlines. The Colón is divided into a lower and an upper shale interval by the Cujizal sandstone Member, which represents an important terrigenous contribution from the Guayana Shield. Locally younger limestones of Paleocene age are preserved.

The core and southeastern flank of the La Peñas structure, comprising a relatively undisturbed sequence of the

La Luna, the Colón and the Paleocene Humocaro Formations which are well exposed in the Quebrada La Porra. The Humocaro is subdivided into a lower part with *Venericardia* and an upper part containing layers with *Lithothamnium* and the foraminifera *Ranikothalia*. In the direction of the Barquisimeto Trough, the Humocaro grades into a thick *Lithothamnium-Ranikothalia* reef which marks the edge of the platform (Text fig. 46).

Family Desmoceratidae Zittel, 1895

Subfamily Desmoceratinae Zittel, 1895

Genus *Desmoceras* Zittel, 1884

Subgenus Desmoceras Zittel, 1884

Desmoceras (D.) latidorsatum latidorsatum (Michelin)
Pl. 6, Fig. 3a–b, Text fig. 28

1838 *Ammonites latidorsatus* Michelin, p. 101, pl. 12, fig. 9, 9a, p. 101.
1841 *Ammonites latidorsatus* Michelin, d'Orbigny, p. 270, pl. 80, fig. 1–4.
1848 *Ammonites latidorsatus* Michelin, Pictet, p. 300, pl. 3, fig. 4,5.
1865 *Ammonites latidorsatus* Michelin, Stoliczka, p. 148, pl. 74, fig. 1–4.
1897 *Desmoceras latidorsatum* Michelin, Kossmat, p. 172, pl. 25, fig. 2–5.
1897 *Desmoceras latidorsatum* Michelin, Parona and Bonarelli, p. 79, pl. 10, fig. 8.
1903 *Puzosia latidorsata* Michelin, Choffat, p. 21, pl. 6, fig. 1.
1906 *Desmoceras latidorsatum* Michelin, Boule, Lemoine and Thevenin, p. 16, pl. 2, fig. 4.
1916 *Puzosia (Latidorsella) latidorsata* Michelin, H. Douvillé, p. 105, pl. 12, fig. 4–6.
1923 *Desmoceras latidorsatum* Michelin, Spath, p. 40, pl. 2, fig. 2.
1930 *Latidorsella latidorsata* Michelin, Passendorfer, p. 640, pl. 3, fig. 48.
1954 *Desmoceras latidorsatum* (Michelin), Matsumoto, p. 248, pl. 6, fig. 5.
1957 *Desmoceras latidorsatum* Michelin, Almela and Revilla, p. 26, pl. 6, fig. 4.
1961 *Desmoceras (Latidorsella) latidorsatum* Michelin, Collignon, p. 59, pl. 24, fig. 1.
1963 *Desmoceras latidorsatum* Michelin, Collignon, p. 84, pl. 273, fig. 1176.
1968 *D. (Desmoceras) latidorsatum* (Michelin), Wiedmann and Dieni, p. 131.
1972 *D. (Desmoceras) latidorsatum latidorsatum* (Michelin), Renz, p. 717, pl. 8, fig. 5a–d; pl. 9, fig. 2a–b; pl. 10, fig. 1a–b, 2a–b.

Holotype: Ammonites latidorsatum Michelin, 1838. Cooper and Kennedy (1979, fig. 36) refigured the original of d'Orbigny (1841, pl. 80, fig. 5) from the middle Albian of France.

Remarks: All the varieties of *D. latidorsatum* distinguished to date can be found in the lower and middle Albian of the Serranía del Interior. In contrast, all specimens from the upper Albian of the Andes are large and notably uniform in size. The measurements of a great number of individuals vary within very narrow limits which approximate those of the type specimen. The species is typically represented by the relatively small sample MBJ21066 which has its test mostly preserved.
The large size of *D. latidorsatum* in the Andes may be due to a more favourable environment than the black shale facies of middle Albian age which prevailed in the Serranía del Interior.

Suture (Text fig. 28) typical for genus (compare Schindewolf, 1966, fig. 370, p. 605; Wiedmann and Dieni, 1968, p. 134, fig. 81).
Desmoceras (Desmoceras) latidorsatum is one of the most common ammonites of the assemblage, and represents about 10% of the total number of specimens obtained.

Distribution: Almost world-wide.

Genus *Bhimaites* Matsumoto, 1954

Type species: Ammonites bhima Stoliczka, 1865, pl. 69, fig. 1, 1a.

Occurrence: Southern India, Madagascar, Sardinia (Wiedmann and Dieni, 1968), Venezuela.

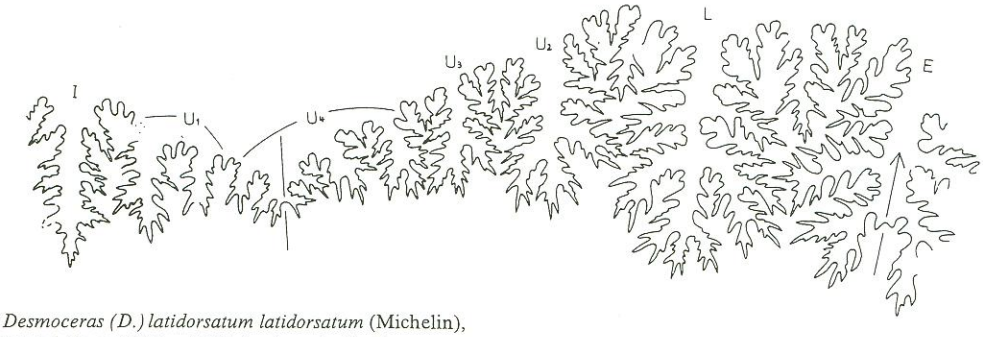
Bhimaites aontzyensis Collignon
Pl. 6, fig. 4a–b, 6; Text fig. 29a–b

1961 *Bhimaites aontzyensis* Collignon, p. 37, pl. 6, fig. 2, 2a.
1972 *Bhimaites aontzyensis* Collignon, Renz, p. 714, pl. 7, fig. 3a–b; pl. 8. fig. 1a–b, 3a–b, 4; pl. 9, fig. 1a–b; text fig. 7a, 8 (suture).

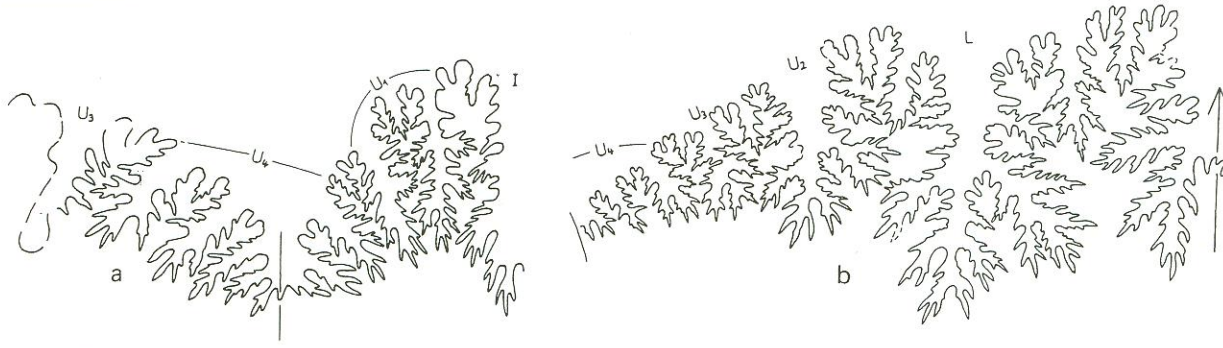
Location: Upper layer of La Puya Formation, in Quebrada Cerro Gordo section, 4 km NNE of Barbacoas. Late Albian, *H. orbignyi* Zone.

Description: MBJ28516, Pl. 6, Fig. 4a–b. Inner whorls with fragments of test. Conch compressed. Whorl section sub-oval, distinctly higher than wide, thickest just below mid-flank. Sides gently convex, flattened. Venter broadly arched, grading into flank without definable shoulder. Umbilicus 20% of diameter. Umbilical wall steep, with sharp, narrowly rounded edge. Sculpture reduced to sigmoidally curved, faint constrictions, beginning at a late stage of growth (about 40 mm diameter). They cross venter in a wide, forwardly projected, chevron-like arch.

Distribution: Southern India, South Africa (Zululand), Madagascar, Sardinia, Venezuela.
MBJ21053, Pl. 6, Fig. 6. La Aguada. Outer whorl, with beginning of body chamber. Faint ribbing between constrictions begins at 70 mm diameter on internal mould and considerably earlier on test (at about 40 mm diameter). Bifurcation of ribs on outer half of flank can be recognised. Towards body chamber ribs gradually change into distinct folds, the strength of which increases adorally, This feature, which is not restricted on the present species, was also observed on body chambers of



Text fig. 28
Suture line of *Desmoceras (D.) latidorsatum latidorsatum* (Michelin), MBJ21069, refigured Renz (1972, p. 718), La Aguada, La Puya Limestone, 2×.



Text fig. 29
Bhimaites aontzyensis Collignon:
a. MBJ21053, Pl. 6, Fig. 6, internal suture, 2×.
b. MBJ20745, refigured Renz (1972, p. 716) external suture, La Aguada, La Puya Limestone, 2×.

other specimens. Suture (Text fig. 29a–b) typical for *Desmoceras*.

Measurements: MBJ28516, Dm 65 mm, Wh 31 (0.48), Ww 23 (0.35), U 13 (0.20)

Distribution: Madagascar, Venezuela.

Bhimaites stoliczkai (Kossmat)
Pl. 6, Fig. 5a–b

1865 *Ammonites Beudanti* Brongniart, Stoliczka, p. 142, pl. 71, fig. 3, 3a only.
1897 *Puzosia stoliczkai* Kossmat, p. 119, pl. 24, fig. 6.
1936 *Puzosia stoliczkai* Kossmat, Venzo, p. 69, pl. 11, fig. 1.
1954 *Bhimaites stoliczkai* Kossmat, Matsumoto, p. 113.
1961 *Bhimaites stoliczkai* Kossmat, Collignon, p. 36, pl. 6, fig. 1.
1965a *Bhimaites stoliczkai* Kossmat, Collignon, p. 56, pl. 332, fig. 1496.
1968 *Bhimaites stoliczkai* (Kossmat), Wiedmann and Dieni, p. 123, pl. 17, fig. 13.
1972 *Bhimaites stoliczkai* (Kossmat), Renz, p. 716, pl. 7, fig. 1a–b, 2a–c; pl. 8, fig. 2a–b.

Lectotype: Ammonites Beudanti Brongniart, in Stoliczka, 1865, pl. 71, fig. 3; separated by Matsumoto, 1954.

Location: Barbacoas syncline between the houses of La Leona and Los Corales, upper part of La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20747. Test only partly preserved. Flanks converging towards sub-fastigate, narrowly arched venter. Whorl section thickest within inner third of flank. Umbilicus 23% of diameter. Umbilical wall steep rounding into flank. Sculpture on test reduced to faint sigmoidal periodic ribs, difficult to distinguish from growth lines on flank. They rise over venter to form low ribs slightly adorally projected. Suture not preserved.

Measurements: MBJ20747, Dm 52 mm, Wh 25 (0.50), Ww 18 (0.34), U 12 (0.23).

Subfamily Puzosiinae Spath, 1922

Genus *Puzosia* Bayle, 1878

Subgenus *Anapuzosia* Matsumoto, 1954

Type species of subgenus: *Puzosia buenaventura* Anderson, 1938.

Occurrence: California, Venezuela.

Puzosia (Anapuzosia) tucuyensis (von Buch)
Pl. 7, Fig. 1a–b, 2a–b; Text fig. 30a–b

1850 *Ammonites tucuyensis* von Buch, p. 342, pl. 10 (refigured Text fig. 1).
1972 *Puzosia (Anapuzosia) tucuyensis* (von Buch), Renz, p. 704, pl. 1, fig. 1–3; pl. 3, fig. 2; text fig. 1.

Holotype: Ammonites tucuyensis von Buch, pl. 10, collected by Karsten (1849) and deposited in the Institute of

Paleontology, Humboldt University, East Berlin (Text fig. 1).

Location: Upper limestone layer of La Puya Formation, north of Barbacoas (State of Lara), near the houses of La Aguada, late Albian, *H. orbignyi* Zone.

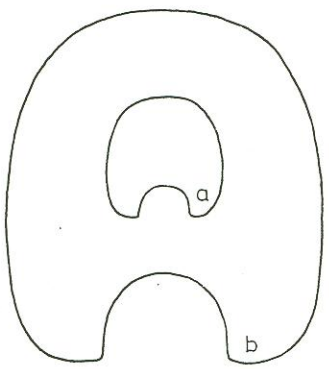
Description: MBJ20749. Large-sized ammonite. Body chamber destroyed. Test mostly preserved. Whorl section subcircular (Text fig. 30b), slightly higher than wide, thickest near mid-flank (B/H = 0.86). Venter broadly arched, shoulder indistinct. Umbilicus about 30% of diameter; umbilical wall steep, rounding into flank without umbilical edge. Costation faintly prorsiradiate, stronger on test than on internal mould. Ribs slightly sigmoidally curved, crossing straight over venter. Bifurcation, occasionally trifurcation as well as incipient branching, occurs above mid-side, at different levels. On test of outer volution seven strong periodical ribs, corresponding to low constrictions on internal mould. They rise over venter, steepening adorally. On last volution of phragmocone 115 ribs cross venter and 60 reach umbilical margin. Suture not preserved (compare Renz, 1972, text fig. 3, p. 708). Juvenile stage (MBJ21044, Pl. 7, Fig. 2a–b; Text fig. 30a) mostly covered by test on which constrictions are subdued. Ribbing begins late, at about 35 mm diameter.

Measurements: MBJ20749, Dm 155 mm, Wh 63 (0.41), Ww ?54 (0.35), U 47 (0.30).

Distribution: Venezuela.

Puzosia (Anapuzosia) saintoursi Collignon
Pl. 7, Fig. 3a–b, 4a–b

1963 *Puzosia saint-oursi* Collignon, p. 68, pl. 263, fig. 1150, pl. 266, fig. 1157, p. 61, 68.
1972 *Puzosia (Anapuzosia) saintoursi* Collignon, Renz, p. 711, pl. 4, fig. 2a–b; pl. 5, fig. 1a–b, 2a–b; pl. 6, fig. 1a–d, 2a–b; suture fig. 6.



Text fig. 30
Puzosia (Anapuzosia) tucuyensis (von Buch), whorl sections:
a. MBJ21044, Pl. 7, Fig. 2, 1×.
b. MBJ20749, Pl. 7, Fig. 1, 1×.

Holotype: Puzosia saint-oursi Collignon, pl. 266, fig. 1157.

Location: Upper layer of La Puya Formation. MBJ20753 near the houses of La Aguada. MBJ21052 near the houses named Vano. Late Albian, *H. orbignyi* Zone.

Description: MBJ20753. Test preserved, body chamber destroyed. Whorl section almost circular (B/H = 0.96), thickest slightly below mid-flank. Umbilicus 31% of diameter (holotype 37%). Six outstanding periodical ribs on outer volution. Intermediate ribs increase in density adapically. On outer volution 64 slightly sigmoidal ribs begin above rounded umbilical margin. Most of them bifurcate or start to bifurcate on outer third of flank, in such a way that 126 ribs cross broadly arched venter in a faintly forward directed bow. Periodical ribs first appear at about 5 mm diameter, ribs developing from growth lines at about 25 mm diameter (Pl. 7, Fig. 4). Juvenile stage (MBJ21052) shows incipient constrictions at an early stage. Costation appears much later, at about 30 mm diameter.

Measurements: (MBJ20753) Dm 126 mm, Wh 52 (0.41), Ww 54 (0.43), U 39 (0.31).

Distribution: Madagascar, Venezuela.

Family Engonoceratidae Hyatt, 1900

Roughly 20% of the ammonite fauna obtained from the La Puya Formation belong to the family Engonoceratidae. Preservation of phragmocones is generally favourable. Body chambers, however, are generally crushed by compaction. Phragmocones were not filled with surrounding sediment after deposition, in most specimens. The cavities were densely filled by coarse grained sparry calcite cement later. Part of the organic material has been thermally altered, probably into impsonite, which can be observed between the calcite crystals in the cavities of some specimens.

Genus *Parengonoceras* Spath, 1924

Type species: Ammonites ebrayi de Loriol, 1882.

Occurrence: England, France (Destombes, 1965), Spain, Venezuela, Colombia, Peru, North Africa (Destombes, 1969).

Parengonoceras discoides Renz
Pl. 8, Fig. 2a–b; Pl. 9, Fig. 2a–c

1970 *Parengonoceras discoides* Renz, p. 1032, pl. 1, fig. 1a–b, holotype; 2a–c; pl. 2, fig. 1, 2a–b; pl. 4, fig. 2a–b.

Location: Barbacoas syncline, near the houses of La Aguada, 4 km northwest of the village of Barbacoas. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20689 (Pl. 8, Fig. 2), MBJ20664 (Pl. 9, Fig. 2) juvenile stage. Large-sized ammonites reaching diameters of up to 500 mm. Shell slender-discoidal, involute. Venter flattened, square-shouldered, rounding when growth proceeds. Whorl section high-subtrapezoidal, thickest between mid-flank and umbilical margin. Flanks moderately convex, converging towards venter. Sculpture at early growth stage, to about 40 mm diameter (MBJ20664), consists of small tubercles on umbilical margin, from where flat folds commence, broadening club-shaped when approaching venter. Indistinct bifurcations at different levels may occur near mid-flank. Folds end in spirally elongated, sharp-crested clavi, alternating along lateral edges of venter. Flanks become progressively smoother as growth proceeds. Feebly falcate growth lines, which strongly curve forward on outer fourth of flank, cross straight over venter. Suture shows somewhat less frilled saddles than on *Parengonoceras pernodosum* from the middle Albian part of the Chimana Formation in the Serranía del Interior. First lateral saddle with two adventitious lobes. Lobe formula: E A_2 A_1 L U_2 U_3/U_1 I (Renz, 1970, p. 1031).

Measurements:	Dm	Wh	Ww	U
MBJ20689, Pl. 8, Fig. 2	121 mm	71 (0.58)	33 (0.27)	6.5 (0.05)
MBJ20664, Pl. 9, Fig. 2	74 mm	42.5 (0.57)	21 (0.28)	5.5 (0.07)

Parengonoceras elegans Renz
Pl. 8, Fig. 3; Pl. 9, Fig. 1a–c

1970 *Parengonoceras elegans* Renz, p. 1036, pl. 3, fig. 1a–c, 2a–b holotype; pl. 4, fig. 1, 3a–b; Text fig. 4a–g.

Location: Barbacoas syncline, near the houses of Vano (MBJ20688) and Cerro Gordo section (MBJ20675), La Puya Formation, late Albian.

Description: MBJ20675 (Pl. 9, Fig. 1). Large-sized ammonites. Test preserved. Shell broadly discoidal. Whorl section subtrapezoidal. Venter square-shouldered, distinctly concave. Flanks moderately convex. Early stage (up to about 60 mm diameter) with umbilical tubercles, from which club-shaped flat folds branch near mid-flank, as on *Parengonoceras discoides.* After an interval without sculpture, a group of about three pronounced tubercles appears (at 123 mm diameter). They are placed within the lower third of flank, on low bulges which fade towards venter.

On a large specimen from Vano (MBJ20688, Pl. 8, Fig. 3) venter becomes rounded at 160 mm diameter. Ventrolateral clavi displace sidewards. Their longitudinal axis form angles of about 45° with edges bounding venter. Suture with slightly less frilled saddles than on *Parengonoceras discoides.*

Measurements:	Dm	Wh	Ww	U
MBJ20675, Pl. 9, Fig. 1	164	89 (0.54)	50 (0.30)	15 (0.09)
MBJ20688, Pl. 8, Fig. 3	198	112 (0.56)	64 (0.32)	17 (0.09)

Parengonoceras duplicatum Renz
Pl. 8, Fig. 1a–b; Pl. 9, Fig. 3a–b, 4a–b

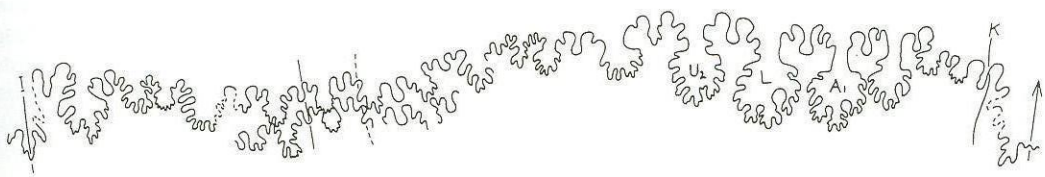
1970 *Parengonoceras duplicatum* Renz, p. 1038, pl. 5, fig. 1–4; pl. 6, fig. 1–2; pl. 7, fig. 3, holotype; pl. 8, fig. 2; text fig. 5a–g, 6.

Location: Barbacoas syncline, near the houses of La Aguada (MBJ20706) and Vano (MBJ20692 and 20693). La Puya Formation, late Albian.

Description: MBJ20693, Pl. 8, Fig. 1, MBJ20692, Pl. 9, Fig. 3, juvenile stage. Large-sized species. Test partly preserved. Shell broadly discoidal. Whorl section trapezoidal, widest on the tubercles slightly above umbilical margin. Venter square-shouldered, broadly concave. Umbilicus about 10% of diameter. On early stage, up to about 40 mm diameter, broad, low folds are distinctly stronger and bifurcations slightly more distinct than on *Parengonoceras elegans.* After an interval without sculpture, to about 90 mm diameter (one volution), tuberculation above umbilical margin reappears (MBJ20706, Pl. 9, Fig. 4). Tubercles are here placed on broad, fold-like, bulges, which branch indistinctly and end in long bullae, along lateral edges of squared venter. After one volution, at 130 mm diameter, tuberculation fades and flanks become smooth. Saddles on suture seem to be less frilled than on *Parengonoceras elegans.*

Measurements:	Dm	Wh	Ww	U
MBJ20692, Pl. 9, Fig. 3	54	28 (0.52)	15 (0.30)	6 (0.11)
MBJ20693, Pl. 8, Fig. 1	116	58 (0.50)	37 (0.32)	13 (0.11)

Remarks: Most abundant species of *Parengonoceras.* The holotype was found in a horizontal position, on the surface of the upper limestone layer of the La Puya Formation, at the precise contact against the La Luna Formation.



Text fig. 31
Suture line of *Parengonoceras barbacoense* Renz, holotype MBJ20685, Pl. 10, Fig. 1, 1×.

Parengonoceras barbacoense Renz
Pl. 10, Fig. 1a–c, 2a–b; Text fig. 31

1970 *Parengonoceras barbacoense* Renz, p. 1041, pl. 6, fig. 3a–b; pl. 7, fig. 1–2; Text fig. 7a–c.
?1970 *Knemiceras andinum* Renz, p. 1047, pl. 10, fig. 1a–b; fig. 3.
?1970 *Parengonoceras* sp. Renz, p. 1045, pl. 8, fig. 1a–b.

Holotype: Parengonoceras barbacoense Renz, 1970, pl. 6, fig. 3; pl. 7, fig. 1 (outer volution of holotype).

Location: Barbacoas syncline, near the houses of La Aguada (MBJ20685, holotype; MBJ20687 = *Parengonoceras* sp., Renz, 1970). La Puya Formation, late Albian.

Description of holotype, MBJ20685 (Pl. 10, Fig. 1a–c): Test largely preserved. Whorl section broad-trapezoidal. On inner juvenile, tuberculated stage whorl section widest on umbilical tubercles, later widest below mid-flank. Venter broadly flattened, slightly concave, square-shouldered. Flanks converging towards venter, concavely impressed before reaching ventrolateral edge. The outer volution of the holotype (Pl. 10, Fig. 1c) has been removed to free the tuberculated early stage (Pl. 10, Fig. 1a–b). This lasts to about 65 mm diameter. It is characterized by outstanding conical tubercles above umbilical margin, placed on broad folds branching around mid-flank and ending in elongate clavi along ventral edge. On suture line (Text fig. 31) frilling of saddles is more reduced than on *Parengonoceras duplicatum,* approaching bifid saddles which characterize *Hypengonoceras whorthi* Kossmat, 1895 (compare also Arias and Wiedmann, 1977, fig. 4, p. 10).

Measurements:	Dm	Wh	Ww	U
MBJ20685, Pl. 10, Fig. 1	155 mm	82 (0.53)	55 (0.35)	14 (0.09)
MBJ20687, Pl. 10, Fig. 2	111 mm	60 (0.54)	47 (0.42)	11 (0.10)

Remarks: This species differs from *Parengonoceras discoides* by a coarser and longer lasting ornamentation of the early stage and by a greater width of whorl sections.

Knemiceras andinum Renz (1970, p. 1047, pl. 10, fig. 1a–b), with its suture not preserved, cannot be grouped with any certainty, either with the genus *Parengonoceras* or with *Knemiceras.* It may, however, be related to *Parengonoceras barbacoense* Renz.

Genus *Knemiceras* Böhm, 1898

Type species: Ammonites syriacus von Böhm, 1898.

Occurrence: France, Spain, Portugal, North Africa, Middle East, South America.

This genus, which is widespread in South America, is known since many years (Gabb, 1877; Paulcke, 1903; Douvillé, R., 1906; Sommermeier, 1910; Lissón, 1908, 1925; Knechtel et al., 1947; Benavides-Cáceres, 1956). Breistroffer (1952, p. 2633) assumed that Peru might be one of the regions in which *Knemiceras* originated.

Knemiceras compressum Hyatt
Pl. 10, Fig. 3a–b, 4a–b; Pl. 11, Fig. 1a–b

1903 *Knemiceras compressum* Hyatt, p. 149, pl. 16, fig. 9, 10, holotype, 15–18.
1937 *Knemiceras compressum* Hyatt, Basse, p. 172, pl. 11, fig. 7, Text fig. 73 (suture).
1940 *Knemiceras compressum* Hyatt, Basse, p. 429, fig. 3a.
1952 *Knemiceras compressum* Hyatt, Mahmoud, p. 83.
1955 *Knemiceras compressum* Hyatt, Mahmoud, p. 58, pl. 4, fig. 2.
1956 *Knemiceras compressum* Hyatt, Benavides-Cáceres, p. 451.
1970 *Knemiceras* aff. *compressum* Hyatt, Renz, p. 1046, pl. 9, fig. 1a–b, 2a–b, 3a–b, 4; Text fig. 9a–d.

Location: Barbacoas depression, all specimens from the La Aguada section, La Puya Formation, late Albian.

Description: MBJ20672, 20732, 20673, juvenile stages. Test preserved in most cases. Shell moderately inflated. Whorl section high-trapezoidal, widest on lateral tubercles just above umbilical margin. Umbilicus 10 to 15% of diameter. Umbilical wall steep, margin distinct. Venter square-shouldered. Eight prominent, rounded, blunt lateral tubercles are located on few, broad folds. Some seem to branch from lateral tubercles, others to begin around mid-flank. All folds end in elongate clavi which alternate on ventrolateral edges. Suture poorly preserved. Saddles bifid, fairly rounded.

Measurements:	Dm	Wh	Ww	U
MBJ20672, Pl. 11, Fig. 1	84 mm	42 (0.50)	31 (0.37)	13 (0.15)
MBJ20673, Pl. 10, Fig. 4	48 mm	24 (0.50)	18 (0.37)	7 (0.14)
MBJ20732, Pl. 10, Fig. 3	79 mm	42 (0.53)	25 (0.31)	8 (0.10)

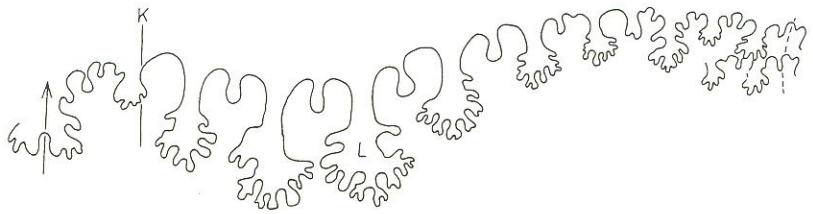
Knemiceras laraense Renz
Pl. 11, Fig. 2; Text fig. 32

1970 *Knemiceras laraense* Renz, p. 1049, pl. 11, fig. 2; pl. 12, fig. 1 holotype; Text fig. 11a–c.

Location: Barbacoas depression, houses of La Aguada. La Puya Formation, late Albian.

Description: MBJ20667, holotype. Partly covered by test. Whorl section subrectangular, widest at lateral tubercles above umbilical margin. Venter flattened, slightly concave, square-shouldered. Umbilicus 13% of diameter. Seven lateral tubercles are placed on broad folds, which bulge slightly below mid-flank. From here the folds are indistinctly divided and flatten, rising again into a third row of low, obliquely placed clavi, situated just below ventral edge. They begin at about 80 mm shell diameter. From these clavi ribs turn forward, ending in distant, elongate ventrolateral clavi. The ribs seem to branch very indistinctly from the lower lateral tubercles above the umbilical edge. The suture shows bifid rounded saddles which are characteristic for *Knemiceras* (Text fig. 32).

Measurements, holotype: Dm 150 mm, Wh 80 (0.53), Ww 50 (0.33), U 21 (0.13).



Text fig. 32
Suture line of *Knemiceras laraense* Renz, MBJ20667, Pl. 11, Fig. 2, 1.5×.

Family Lyelliceratidae Spath, 1921

Genus *Neophlycticeras* Spath, 1921

Type species: Ammonites brottianus d'Orbigny, 1841.

Occurrence: France, England, North Africa, Madagascar, Ecuador (Breistroffer, 1952), Venezuela.

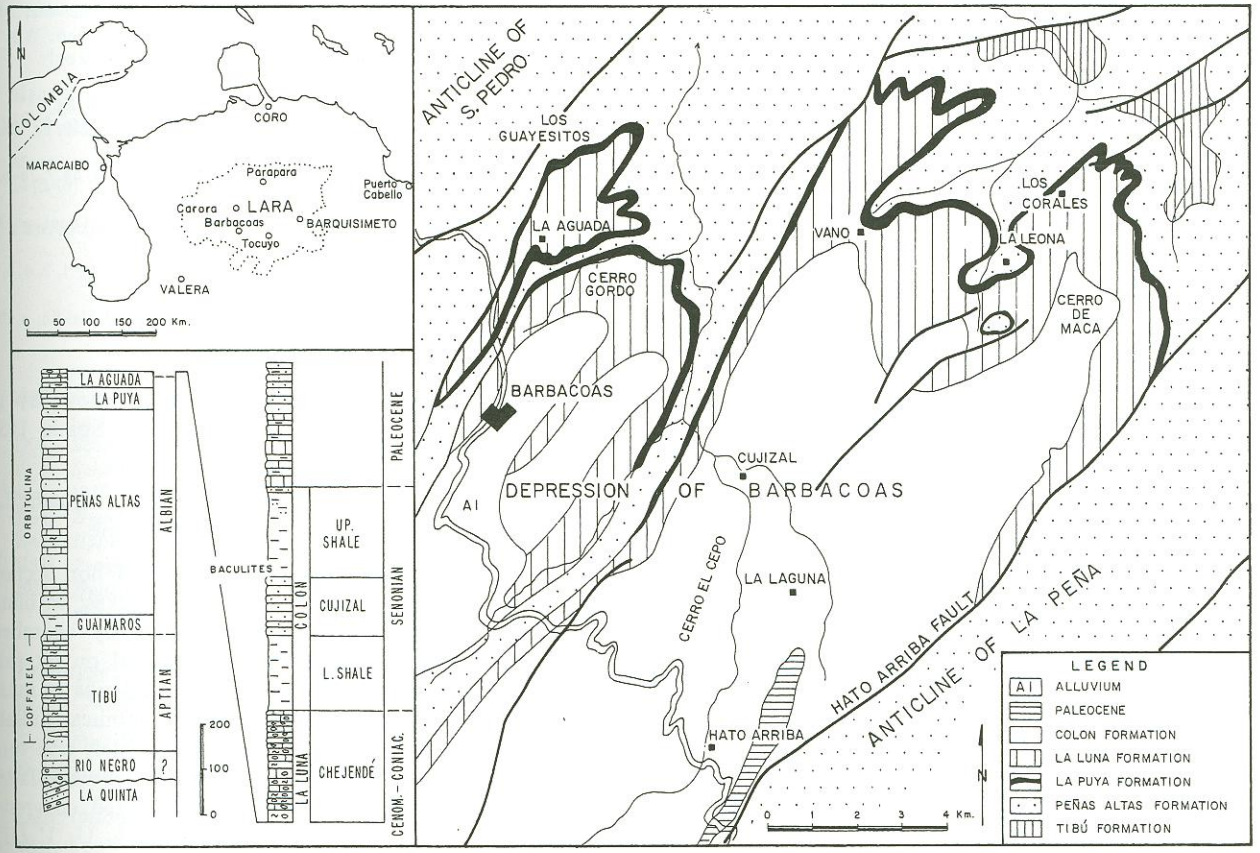
Neophlycticeras are rare ammonites which represent only about 0.5% of the ammonite assemblage so far known from the La Puya Formation.

Neophlycticeras madagascariense (Collignon)
Pl. 11, Fig. 4a-b, 5a-b

1932 *Tissotia (Protissotia) madagascariensis* Collignon, p. 12, pl. 1, fig. 12-16.
1957 *Protissotia = Neophlycticeras,* Wright, in Treatise, p. L410.
1963 *Protissotia madagascariensis* Collignon, p. 181, pl. 316, fig. 1340.
1970 *Neophlycticeras madagascariense* (Collignon), Renz, p. 1053, pl. 12, fig. 3a-b, 4a-d, 5a-b.
1975 *Neophlycticeras (Protissotia) madagascariense* (Collignon), Amedro, p. 109.

Lectotype: Tissotia (Protissotia) madagascariensis Collignon, pl. 1, fig. 14a-b, selected by Renz, 1970, p. 1053.

Location: Barbacoas syncline, near the houses of La Aguada, in upper layer of La Puya Formation, found in association with *Hysteroceras orbignyi,* late Albian.



Text fig. 33
Ammonite locations in the region of Barbacoas (State of Lara).

Description: MBJ20735, MBJ20736. Small-sized ammonites, rather involute. Whorl section on phragmocone broad-oval, venter with high siphonal crests on body chamber. Umbilical slope falls off evenly, without margin. Towards the body chamber the whorl section on ribs gradually becomes flat-sided, with parallel flanks and prominent ventrolateral tubercles on shoulder. Umbilicus 27% of diameter (MBJ20735). Ribs radial, straight, broadly round-topped. Some are single, others branch below or above mid-flank. Intercalatory ribs occur which also end around mid-side. Towards the body chamber ribs strengthen and widen conspicuously, rising into ventrolateral tubercles and ending in the highly elevated siphonal crests. Ontogeny of suture (Renz, 1970, p. 1053, fig. 12) as in *Lyelliceras* (U_2, U_3, U_5/U_4, U_1 I). Owing to the small size of *Neophlycticeras madagascariense* (whorl height where suture was analyzed, about 5 mm) the suture appears "primitive" (Amedro, 1975, p. 109). Lobe formula: E L U_2 U_3 U_5 U_6/U_4 U_1 I (Renz, 1970, p. 1053).

Measurements:	Dm	Wh	Ww	U
MBJ20735, Pl. 11, Fig. 4	26 mm	11 (0.42)	8 (0.31)	7 (0.27)
MBJ20736, Pl. 11, Fig. 5	21 mm	9 (0.43)	6,5 (0.31)	5.5 (0.26)

Distribution: Madagascar, Venezuela.

Neophlycticeras cf. *duffaudi* Destombes
Pl. 11, Fig. 3

1969 *Neophlycticeras duffaudi* Destombes, p. 51, pl. 1, fig. 1–3, Text fig. 2.
1970 *Neophlycticeras* cf. *brottianum* (d'Orbigny), Renz, p. 1054, pl. 12, fig. 7a–b.

Location: Barbacoas syncline, near the houses of La Aguada in upper layer of La Puya Formation, found in association with *Hysteroceras orbignyi,* late Albian.

Description: MBJ20738. Single specimen, diagonally deformed during Andean orogeny. Shell moderately involute. Body chamber about three fourths of outer whorl, apparently scaphitoid-like egrading on its outer quarter. Aperture, as far as exposed simple, following last rib which is reduced in width. Whorl section oval near end of phragmocone and on body chamber. Sides declining gently towards umbilical seam without margin. Undeformed ribs roughly cross straight over venter, rising on phragmocone into elongated siphonal tubercles. Few intercalatory ribs exposed on first third of body chamber. Ribs tend to broaden and flatten as they approach the end of the body chamber where they fade towards the venter, which here is rounded, without siphonal tubercles. Suture poorly preserved on opposite side of specimen.

Distribution: Morocco, Venezuela.

Family Brancoceratidae Spath, 1933

Subfamily Brancoceratinae Spath, 1933

Genus *Hysteroceras* Hyatt, 1900

Type species: Ammonites varicosus J. de C. Sowerby, 1824.

Occurrence: Europe, Nigeria, Angola, South Africa, Madagascar, Iran, Pakistan (Spath, 1930), Greenland, (Spath, 1946), Mexico, Venezuela.

In Venezuela the known occurrence of the genus is restricted to the La Puya Limestone and to the lowermost part of the Aguada Member in Lara and Trujillo. After *Venezoliceras* and *Parengonoceras* this genus is the most common of the ammonites found in the La Puya Formation.

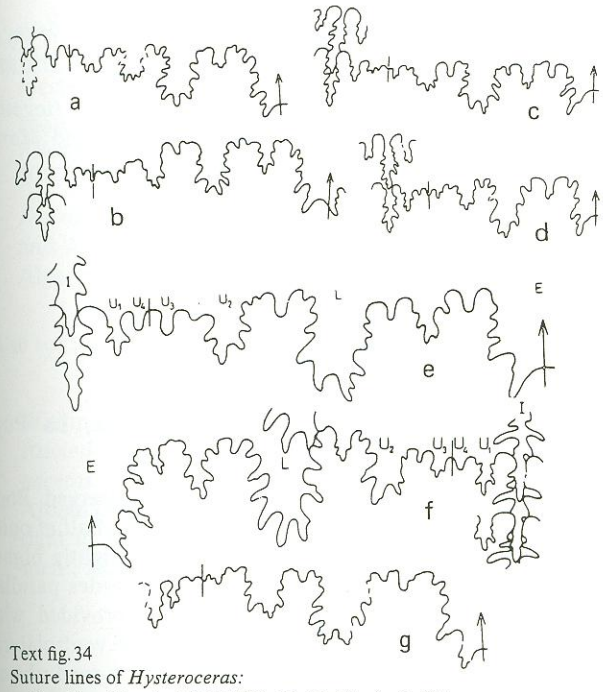
Hysteroceras orbignyi Spath
Pl. 11, Fig. 6a–b; Text fig. 34a

1841 *Ammonites varicosus* Sowerby, d'Orbigny, p. 294, pl. 87, fig. 3 only.
1847 *Ammonites varicosus* Sowerby, Pictet in Pictet and Roux, p. 356, pl. 9, fig. 3 only.
1922 *Brancoceras orbignyi* Spath, p. 22.
1934 *Hysteroceras orbignyi* (Spath), p. 483, pl. 49, fig. 4; pl. 50, fig. 2–5; pl. 52, fig. 2, 4, 8; pl. 56, fig. 15; Text fig. 161a–d, 166a, cum synonymy.
1936 *Hysteroceras choffati* Spath, Venzo, p. 98, pl. 9, fig. 6 only.
1942b *Hysteroceras orbignyi* (Spath), Haas, p. 26.
1955a *Hysteroceras orbignyi* (Spath), Reyment, p. 28, pl. 4, fig. 1.
1963 *Hysteroceras orbignyi* Spath, Collignon, p. 123, pl. 289, fig. 1262–1264.
1966 *Hysteroceras orbignyi* Spath, Collignon, p. 17, pl. 3, fig. 7, 7a–b.
1966 *Hysteroceras orbignyi* (Spath), Schindewolf, p. 707.
1968 *Hysteroceras orbignyi* (Spath), Wiedmann and Dieni, p. 137, pl. 13, fig. 1–3.
1971 *Hysteroceras orbignyi* (Spath), Renz, p. 578, pl. 1, fig. 1, 2, 4, 6, 7, 8; pl. 3, fig. 4–6.
1976 *Hysteroceras orbignyi* (Spath), Marcinowski and Naidin, p. 103, pl. 12, fig. 1, 3, 4.

Holotype: Ammonites varicosus J. de C. Sowerby in d'Orbigny, 1841, pl. 87, fig. 3, refigured in Spath, 1934 (fig. 166a, p. 485).

Location: Barbacoas syncline, houses of La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20801. Test preserved. Whorl section on end of phragmocone subquadratic, thickest on blunt umbilical tubercles which flatten on body chamber. Umbilicus 46% of diameter. Distinct keel on internal volutions fades out over body chamber. 31 ribs on outer whorl, the majority bifurcating from umbilical bullate tubercles but occasionally single. On venter, ribs turn forward against keel; on body chamber, where keel fades out, ribs connect to form forward directed chevrons. Suture (Text fig. 34a) typical for genus (E, L, U_2, U_3/U_4, U_1, I). U_1 is not further split. Sutural lobes are not developed. Single umbilical lobes show an alternating



Text fig. 34
Suture lines of *Hysteroceras:*
a. *H. orbignyi* Spath, MBJ20801, Pl. 11, Fig. 6a–b, 3×.
b. *H.* aff. *aguilerae* Böse, MBJ20777, Pl. 11, Fig. 8a–b, 3×.
c. *H. carinatum* Spath, MBJ20783, Pl. 11, Fig. 11a–b, 3×.
d. *H.* aff. *subbinum* Spath, MBJ20772, Pl. 11, Fig. 12, 3×.
e. *H.* aff. *bucklandi* Spath, MBJ20794, Pl. 12, Fig. 4a–c, 3×.
f. *H. andinum* Renz, MBJ20767, Pl. 12, Fig. 1a–c, 3×.
g. *H. choffati* Spath, MBJ20784, Pl. 12, Fig. 2a–b, 3×.

arrangement.A very long internal lobe (Schindewolf, 1966, p. 707) is an additional characteristic.

Measurements: MBJ20801, Dm 30 mm, Wh 9 (0.30), Ww 11 (0.36), U 14 (0.46).

Distribution: Europe, Africa, Madagascar, Venezuela.

Hysteroceras aff. *aguilerae* Böse
Pl. 11, Fig. 7a–c, 8a–b; Text fig. 34b

1895 *Schloenbachia* aff. *inflata* Sowerby, Castillo y Aguilera, p. 18, fig. 1.
1906 *Schloenbachia* aff. *inflata* Sowerby, Burckhardt, p. 8.
1923 *Schloenbachia Aguilerae* Böse, p. 167, pl. 11, fig. 33–36.
non 1928 *Pervinquieria aguilerae* Böse, Adkins, p. 233, p. 12, fig. 6.
1934 *Hysteroceras aguilerae* Böse, Spath, p. 487.
1942b *Hysteroceras aguilerae* Böse, Haas, p. 41.
?1955 *Pervinquieria aguilerae* Böse, Eristavi, p. 141, pl. 6, fig. 3.
1971 *Hysteroceras* aff. *aguilerae* (Böse), Renz, p. 582, pl. 1, fig. 9–12; pl. 3, fig. 7–9; text fig. 2f–i, 3b.

Lectotype: Schloenbachia Aguilerae Böse, 1923, pl. 11, fig. 33, 35, 36, selected by Renz, 1971, p. 582.

Location: Syncline of Barbacoas, La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20790, MBJ20777. The author agrees with Spath's view (1934, p. 487) that the description by Böse (1923) of *H. aguilerae* may just as well be applicable for *H. orbignyi.*

The rib number on the outer whorl of *H. orbignyi* (MBJ20801) is 31, and of *H. aguilerae* (MBJ20790) 38. The ribs may thus just be slightly closer together on *H. aguilerae.* Umbilicus 46% of diameter, against 0,50 on *H. aguilerae.* For a final decision on the taxonomic status of *H. aguilerae* better preserved material from the type locality (Camacho, in Zacatecas, Mexico) would be required. Suture as on *H. orbignyi* (Text fig. 34b).

Measurements, end of phragmocone:	Dm	Wh	Ww	U
MBJ20790, Pl. 11, Fig. 7	33 mm	9.8 (0.30)	10 (0.30)	16 (0.50)
MBJ20777, Pl. 11, Fig. 8	27 mm	8 (0.30)	9,5 (0.35)	13.5 (0.50)

Distribution: Mexico, Venezuela.

Hysteroceras carinatum Spath
Pl. 11, Fig. 9a–b, 10a–b, 11a–b; Text fig. 34c

1841 *Ammonites varicosus* d'Orbigny, p. 294, pl. 87, fig. 4.
1930 *Inflaticeras varicosum* Sowerby, Besairie, p. 633, pl. 67, fig. 6–8 only.
1934 *Hysteroceras carinatum* Spath, p. 482, pl. 51, fig. 5; pl. 53, fig. 4, 5, 10, 11; text fig. 161m–n, 166d.
1936 *Hysteroceras subbinum* Spath, Venzo, p. 98, pl. 8, fig. 4.
1942 *Hysteroceras carinatum* Spath, Haas, p. 37, pl. 5, fig. 7–17; pl. 6, fig. 12–14; pl. 9, fig. 2; text fig. 5a.
1963 *Hysteroceras carinatum* Spath, Collignon, p. 124, pl. 289, fig. 1265.
1966 *Hysteroceras carinatum* Spath, Collignon, p. 16, pl. 3, fig. 3, 4, 4a–b.
1968 *Hysteroceras carinatum* Spath, Wiedmann and Dieni, p. 136, pl. 17, fig. 12.
1971 *Hysteroceras carinatum* Spath, Renz, p. 583, pl. 1, fig. 13–17; pl. 2, fig. 1–3; pl. 3, fig. 10–12.

Location: Barbacoas syncline, La Aguada (MBJ20769 and 20783); Los Guayesitos (MBJ20792), La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: Test preserved. Whorl section subrectangular, slightly higher than wide (MBJ 20769) or as wide as high (MBJ20792).
Costation close, with 43 ribs on MBJ20769 and with only 37 ribs on MBJ20792. The latter, fewer-ribbed variety, may represent a transitional form to *H. orbignyi.* Ribs more sigmoidal than on *H. orbignyi;* umbilical bullae faintly developed. The keel which begins earliest in ontogeny persists on body chamber as far as preserved. Suture (Text fig. 34c) same as on *H. orbignyi* (Text fig. 34a).

Measurements:	Dm	Wh	Ww	U
MBJ20769, pl. 11, Fig. 9	27.5 mm	9 (0.33)	8 (0.29)	12.5 (0.45)
MBJ20792, pl. 11, Fig. 10	28.5 mm	8.5 (0.30)	9 (0.31)	12 (0.45)

Distribution: England, France, Sardinia, Madagascar, Zululand, Angola, Venezuela.

Hysteroceras aff. *subbinum* Spath
Pl. 11, Fig. 12a–b; Text fig. 34d

1934 *Hysteroceras subbinum* Spath, p. 481, pl. 52, fig. 5–7; pl. 53, fig. 6, 7; pl. 56, fig. 3, 4.

1936 *Hysteroceras subbinum* Spath, Venzo, p. 98, pl. 8, fig. 3a–b only.
1942 *Hysteroceras* cf. *subbinum* Spath, Haas, p. 34, pl. 4, fig. 23; pl. 6, fig. 8 (suture).
1947 *Hysteroceras subbinum* Spath, Breistroffer, p. 52.
1950 *Hysteroceras* cf. *subbinum* Spath, Collignon, p. 72, fig. 5, 5a.
1971 *Hysteroceras* aff. *subbinum* Spath, Renz, p. 586, pl. 2, fig. 5–9; pl. 3, fig. 13; text fig. 2m–o, 3g–h.

Holotype: Hysteroceras subbinum Spath, 1934, pl. 56, fig. 3.

Location: Barbacoas syncline, Los Guayesitos (MBJ20772); La Puya Formation, late Albian *H. orbignyi* Zone.

Description: MBJ20772. Test preserved, influencing whorl height, and strength of ribs. All Venezuelan specimens are of small size in comparison with the holotype from Folkestone, England. They can best be compared with those from Glynde in Sussex (Spath, 1934, pl. 53, fig. 6, 7). Whorl height surpasses whorl width. Sides parallel, flattened. Venter keeled, also on body chamber. Umbilical bullae appear stronger than on *H. carinatum,* as ribs are lower, especially near mid-flank. Suture typical for genus (Text fig. 34d).

Measurements: MBJ20772, pl. 11, fig. 12: Dm 20 mm, Wh 7 (0.35), Ww 6 (0.30), U 8 (0.40).

Distribution: England, France, Madagascar, Angola, South Africa (Zululand), Venezuela.

Hysteroceras bucklandi (Spath)
Pl. 12, Fig. 3a–b, 4a–b; Text fig. 34e

1922 *Brancoceras bucklandi* Spath, p. 99.
1934 *Hysteroceras bucklandi* (Spath), p. 488, pl. 56, fig. 1; text fig. 169b–c, 170.
1947 *Hysteroceras Bucklandi* Spath, Breistroffer, p. 52.
1971 *Hysteroceras bucklandi* (Spath), Renz, p. 588, pl. 2, fig. 10–13; pl. 3, fig. 14; text fig. 2q–r, 3e.
1971 *Hysteroceras,* group of *H. bucklandi* (Spath), Renz, p. 590, pl. 3, fig. 3a–c; text fig. 2s, 3f.

Holotype: Hysteroceras bucklandi Spath, 1934, (refigured after Buckland, 1836, text fig. 170a–b, p. 489).

Location: Barbacoas syncline, La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20775, MBJ20794. The present determination is based on a specimen from the Isle of Wight figured by Spath (1934, text fig. 170c–d, p. 489). It is a larger sized *Hysteroceras.* Test only partly preserved. Whorl section about as high as wide, thickest at umbilical tubercles. Sides rather flattened, rounding into widely arched venter. Venter with distinct median keel. Keel fades towards end of body chamber, where ribs nearly touch, forming chevrons, similarly as in *H. orbignyi.* Umbilicus 45 to 50% of diameter. Venter of specimen MBJ20794 (Pl. 12, Fig. 4) faintly grooved on both sides of keel. 37 to 41 ribs on outer volution. Suture as on other *Hysteroceras* (Text fig. 34e).

Measurements:	Dm	Wh	Ww	U
MBJ20775, Pl. 12, Fig. 3	34 mm	10 (0.30)	11.5 (0.34)	15.5 (0.45)
MBJ20794, Pl. 12, Fig. 4	50 mm	13.5 (0.27)	14 (0.29)	25 (0.50)

Distribution: England (*auritus* Zone), France (together with *H. orbignyi, H. carinatum, H. subbinum* and *Mortoniceras pricei;* Breistroffer, 1947, p. 52).

Hysteroceras andinum Renz
Pl. 12, Fig. 1a–c, Text fig. 34f

1971 *Hysteroceras andinum* Renz, p. 591, pl. 3, fig. 1a–c; text fig. 2u, 3k.

Location: Barbacoas syncline, La Aguada, La Puya Limestone, late Albian, *H. orbignyi* Zone.

Description: MBJ20767, holotype. Test preserved. Body chamber, slightly crushed diagonally, forms half of outer volution. Whorl section sub-rectangular, slightly higher than wide, broadest on umbilical bullae. Sides parallel, flattened, rounding into venter. Latter provided with prominent keel which rises above level of ventrolateral shoulder. Costation dense; 50 sigmoidally curved ribs on outer volution, strongly projected forward, from shoulder towards keel on venter. Most ribs begin in pairs from umbilical bullae within lower third of flank. Short intercalatory ribs end around mid-flank. Suture (Text fig. 34f) characterized by exceptionally slender, elongate internal lobe provided with a pair of conspicuous lateral folioles.

Measurements of holotype: Dm 40 mm, Wh 12.5 (0.31), Ww 12 (0.30), U 18 (0.45).

Remark: None of the forms described here are comparable with the numerous species of *Hysteroceras* figured by van Hoepen (1944) from South Africa.

Hysteroceras choffati Spath
Pl. 12, Fig. 2a–b; Text. 34g

1905 *Schloenbachia varicosa* Sowerby, Choffat, p. 34, pl. 4, fig. 6a–b.
1922 *"Schloenbachia varicosa"* Choffat non Sowerby, Spath, p. 107, 157.
1925a *Hysteroceras choffati* Spath, p. 187, pl. 28, fig. 1a–b, 4, holotype; pl. 30, fig. 5a–b.
1934 *Hysteroceras choffati* Spath, p. 489.
1939 *Mortoniceras (Hysteroceras) Choffati* Spath, Laffite, p. 165.
1942b *Hysteroceras choffati* Spath, Haas, p. 29, pl. 4, fig. 8, 9.
1947 *Hysteroceras choffati* Spath, Breistroffer, p. 52.
1971 *Hysteroceras choffati* Spath, Renz, p. 590, pl. 2, fig. 14a–b.

Location: Barbacoas syncline, La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20784. Single specimen with partly preserved test. Whorl section nearly rounded, widest on umbilical tubercles. Venter rounded, without keel on exposed whorl section. 37 ribs on outer whorl cross straight over venter and are faintly depressed on siphonal line; on sides rib-pattern identical to that of other *Hysteroceras.* Traces of original keel indicated on inter-

spaces as on holotype and specimens from Angola (Haas, 1942, p. 19). Suture (Text fig. 34g) comparable to other species of genus.

Measurements:	Dm	Wh	Ww	U
Holotype, based on figure	47 mm	15 (0.32)	14 (0.30)	20 (0.42)
MBJ20784, Pl. 12, Fig. 2	31 mm	10 (0.32)	10 (0.32)	12.5 (0.40)

Distribution: France (with other species of *Hysteroceras* and *Mortoniceras pricei* Spath; Breistroffer, 1947, p. 52), Algeria, Angola, Venezuela.

Subfamily Mortoniceratinae Spath, 1925

Within the La Puya Limestone Mortoniceratinae are restricted to *Prohysteroceras* and *Mortoniceras*. *Neoharpoceras* Spath 1921, which is abundant in the upper Albian of Europe and *Neokentroceras* Spath, 1921, abundant in the upper Albian of Angola (Haas, 1942; Reyment, 1955) have not been observed in Venezuela.

Genus *Prohysteroceras* Spath, 1921

Subgenus *Goodhallites* Spath, 1932

Type species: Ammonites goodhalli J. Sowerby, 1820.

Occurrence: England, France, Algeria, Madagascar, Angola, Texas (Adkins, 1928), Queensland (Whitehouse, 1926).

Prohysteroceras (Goodhallites) goodhalli (J. Sowerby) Pl. 12, Fig. 7; Text fig. 35

1820 *Ammonites Goodhalli* J. Sowerby, p. 100, pl. 255.
1849 *Ammonites Goodhalli* J. Sowerby, Brown, pl. 14, fig. 10.
1934 *Prohysteroceras (Goodhallites) goodhalli* (J. Sowerby), Spath, p. 447, pl. 50, fig. 1; pl. 56, fig. 9; text fig. 153–155, 158a, p. 447, cum synon.
1939 *Mortoniceras (Prohysteroceras) Goodhalli* J. Sowerby, Laffite, p. 164.
1947 *Neoharpoceras (Goodhallites) Goodhalli* Sowerby, Breistroffer, p. 52.
1971 *Prohysteroceras (Goodhallites) goodhalli* (J. Sowerby), Renz, p. 593, pl. 3, fig. 15; text fig. 15.

Holotype: Ammonites Goodhalli J. Sowerby, 1820, refigured by Spath, 1934, text fig. 154, p. 450.

Occurrence: England, France, Algeria, Madagascar, Angola, Texas (Young, 1957), Venezuela, Australia (Whitehouse, 1926).

Location: Barbacoas syncline, La Aguada, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20820. Large, entirely chambered specimen. Whorl section compressed, high-rectangular, parallel sides. Venter subtabulate with prominent keel, elevated above ventrolateral shoulder. Ribs feebly sigmoidal, bi- and occasionally tri-furcating from umbilical bullae; commonly single towards end of outer volution. All ribs are tuberculated on ventrolateral shoulder, from where they bend forward against high keel. External suture (Text fig. 35) as drawn by Spath (1934, text fig. 158a, p. 461).

Distribution: England, France, Venezuela.

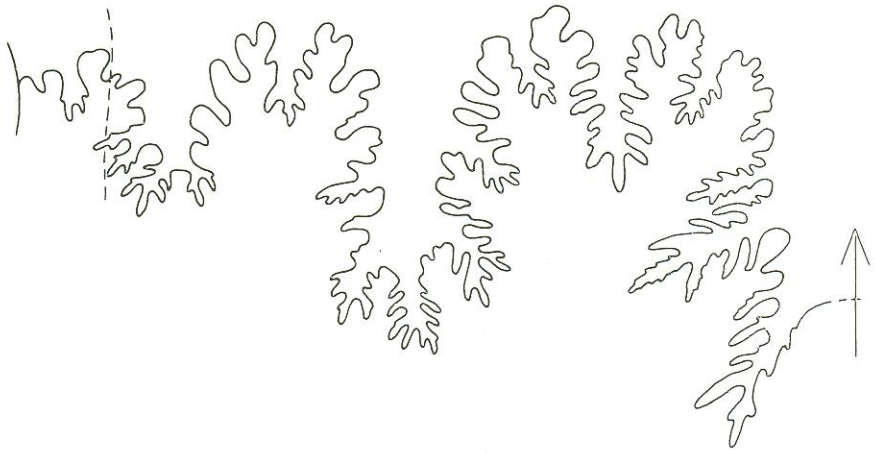
Remark: Prohysteroceras (G.) richardsi Whitehouse (1926, p. 222, pl. 36, fig. 2) appears to be comparable to the present species (Spath, 1932, p. 452).

Genus *Mortoniceras* Meek, 1876

Type species: Ammonites vespertinus Morton, 1834.

Occurrence: Europe, Africa, India, North and South America.

The genus represents an evolutionary sequence beginning with simple, bituberculate forms much as *Morto-*



Text fig. 35
Suture line of *Prohysteroceras (Goodhallites) goodhalli* (J. Sowerby), MBJ20820, Pl. 12, Fig. 7, 2×.

niceras (M.) pricei, followed by trituberculate species such as *M. (M.) inflatum,* and ending in the uppermost Albian (Vraconian) with forms possessing four rows of tubercles much as *M. (Durnovarites).* The species known from Venezuela are mainly bituberculate. The presence of trituberculate forms is doubtful and only one species with four rows of tubercles, is known from the lower Aguada Member (Vraconian).

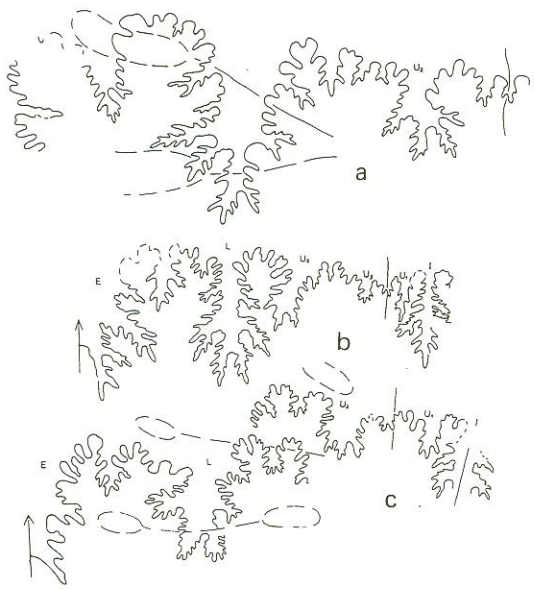
Remark: The genus *Drakeoceras* Young (1957b, p. 19) which has a pair of tubercles on the ventrolateral shoulder, and is abundant in the upper Albian of Texas, has so far not been found in Venezuela.

Subgenus *Mortoniceras* Meek, 1876

Mortoniceras (Mortoniceras) pricei Spath
Pl. 13, Fig. 2a–b; Text fig. 36b

1922 *Subschloenbachia pricei* Spath, p. 101.
1932 *Mortoniceras (Pervinquieria) pricei* Spath, p. 391, pl. 36, fig. 11, 12; Pl. 37, fig. 3; text fig. 130c, 131.
1933 *Mortoniceras (Pervinquieria) Pricei* Spath, Breistroffer, p. 234.
1939 *Mortoniceras (Pervinquieria) Pricei* (Spath, Laffite, p. 164.
1955 *Mortoniceras (Mortoniceras) pricei* (Spath), Reyment, p. 31, pl. 4, fig. 5.
1966 *Mortoniceras (Pervinquieria) pricei* Spath, Collignon, p. 23, pl. 9, fig. 5.
1971 *Mortoniceras (Mortoniceras) pricei* (Spath), Renz, p. 95, pl. 4, fig. 2a-b; pl. 8, fig. 2a–b; pl. 9, fig. 2a–b.
1976 *Mortoniceras (Mortoniceras) pricei* Spath, Marcinowski and Naidin, p. 106, pl. 2, fig. 8–9.

Holotype: Mortoniceras (Pervinquieria) pricei Spath, 1922; figured 1932, text fig. 131, p. 393.



Text fig. 36
Suture lines of *Mortoniceras:*
a. *M. (D.) prerostratum* (Spath), MBJ20822, Pl. 14, Fig. 2, 1×.
b. *M. (M.) pricei* (Spath), MBJ20824, Pl. 13, Fig. 2, 1×.
c. *M. (D.) mokarahaense* (Collignon), MBJ20825, Pl. 14, Fig. 1, 1×.

Location: Near the houses Vano, 18.5 km northeast of Barbacoas. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20824. Whorl section high-rectangular; sides parallel, flat; venter square, slightly grooved on both sides of high median keel. Umbilicus 35% of diameter. Umbilical wall steep, rounding into flank. 44 sigmoidally curved ribs occur on outer volution, irregularly or incipiently branching from umbilical tubercles. On ventrolateral shoulder ribs rise into clavi-like tubercles which increase rapidly in size with advancing growth. Spiral striation (notching on ribs) distinct. External suture (Text fig. 36b) shows two umbilical lobes from which U_3 is only rudimentarily developed.

Measurements: MBJ20824, Pl. 13, Fig. 2, Dm 65 mm, Wh 26 (0.40), Ww 24 (0.37), U 23 (0.35).

Distribution: England (*orbignyi* Zone), France (Zone of *M. pricei* and *H. carinatum,* Breistroffer, 1933), Crimea, Nigeria, Morocco, Algeria.

Mortoniceras (Mortoniceras) densecostatum (van Hoepen)
Pl. 14, Fig. 3a–b

1946 *Rusoceras densecostatum* van Hoepen, p. 243, fig. 245–247.
1971 *Mortoniceras* sp., group of *M. (M.) pricei* (Spath), Renz, p. 606, pl. 11, fig. 3a–b.

The single specimen (BJ21041) can best be compared with the holotype of *Rusoceras densecostatum* van Hoepen. It was collected by H. P. Schaub from the La Puya Formation in the Distrito Escuque (State of Trujillo), at a locality situated 18 km WSW of the village of Escuque, between the Ríos Mimbós and Buena Vista.

The specimen differs from *M. (M.) pricei* by a closer and thinner costation (48 ribs on outer volution, against 40 to 42 on *M. (M.) pricei*). It may best be considered as a variety of *M. (M.) pricei.* Ribs less sigmoidally curved, projected forward over venter behind ventral tubercles. Strength of umbilical bullae irregular; ribbing pattern less balanced than on *M. pricei.* Bifurcations often distinct, at different levels between umbilical bullae and mid-flank. Many ribs remain single, ending below mid-flank.

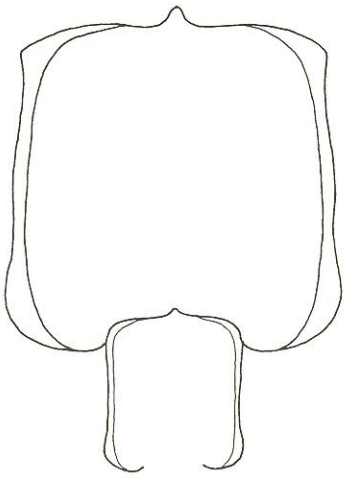
Measurements: Dm 141 mm, Wh 62 (0.44), Ww 52 (0.37), U 40 (0.28).

Occurrence: South Africa, Venezuela.

Mortoniceras (Mortoniceras) aff. *pachys* (Seeley)
Pl. 15, Fig. 2a–b; Text fig. 37

1932 *Pervinquieria pachys* Seeley, 1865, Spath, p. 405, fig. 130d, 138–139.

Location: Type locality of La Puya Formation, southwest of Escuque (Estado Trujillo), late Albian.



Text fig. 37
Whorl section of *Mortoniceras (Mortoniceras)* aff. *pachys* (Seeley), Re745, Pl. 15, Fig. 2, 1×.

Description: Re745. Fully septate. Inner whorls as high as wide, without a third row of tubercles (Text fig. 37). Costation dense as on *M. (M.) pricei.* On outer part of phragmocone costation more distant. Strong, single, short and long ribs alternate. Faint, low, elongate mediolateral elevations (partly affected by erosion) are indicated. Suture partly visible.

Remark: The specimen may be interpreted as a transition form between *M. (M.) pricei* to *M. (M.) pachys* (Seeley), (compare Spath, 1930, p. 405).

Measurements after reconstruction: Dm 155 mm, Wh 56 (0.36), Ww 53 (0.34), U 54 (0.35).

This *Mortoniceras* proves that the upper Albian in ammonite facies extends considerably southwestwards, towards the culmination of the Mérida Swell.

Mortoniceras (Mortoniceras) arietiforme (Spath)
Pl. 13, fig. 1a–b

1888 *Schloenbachia* cf. *lenzi* Szajnocha, Choffat, p. 65, pl. 1, fig. 6a.
1922 *Elobiceras arietiforme* Spath, p. 137, pl. 2, fig. 6a–b.
1931 *Elobiceras arietiforme* Spath, Airaghi, p. 850, pl. 2, fig. 4.
1942 *Pervinquieria arietiformis* (Spath), Haas, p. 90, pl. 18, fig. 1–4; pl. 19, fig. 1, 2; pl. 20, fig. 1, 2; pl. 22, fig. 3–7.
?1951 *Pervinquieria* aff. *arietiforme* Spath, Sornay, p. 274, pl. 2, fig. 1, 2.
1971 *Mortoniceras (Mortoniceras) arietiforme* (Spath), Renz, p. 598, pl. 4, fig. 1; text fig. 5b, 7e.

Location: Barbacoas syncline, section Quebrada Cerro Gordo, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20827. Inner whorl with test preserved. Body chamber on last half of outer whorl without indication of aperture. Whorl section compressed (Pl. 13, Fig. 1b), subrectangular, considerably higher than wide, thickest near umbilical bullae, of somewhat irregular strength. Venter subtabulate with high median keel (mostly eroded on outer volution). On inner volutions faintly curved ribs bifurcate irregularly from umbilical bullae also of slightly variable strength. Later, towards body chamber, umbilical bullae flatten and ribs remain single. From ventrolateral tubercles ribs are bent adorally towards keel. Suture with U_3 distinctly developed as in Haas (1942, p. 93, fig. 10).

Measurements: Dm 185 mm, Wh 62 (0.33), Ww 43 (0.23), U 78 (0.42).

Distribution: Angola, Venezuela.

Mortoniceras (Mortoniceras) arietiforme andranofotsyense
Collignon
Pl. 13, Fig. 3a–c

1951 *Pervinquieria arietiformis* var. *andranofotsyensis* Collignon, p. 30, fig. 1, 1a; 2, 2a.
1971 *Mortoniceras (Mortoniceras) arietiforme andranofotsyense* Collignon, Renz, p. 599, pl. 5, fig. 1a–b, 2a–b; text fig. 5d, 7a.

Lectotype: Pervinquieria arietiformis var. *andranofotsyensis* Collignon, pl. 5, fig. 2, 2a; selected by Renz, 1971, p. 599.

Location: Barbacoas syncline, La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20828 differs from type by greater whorl width (Pl. 13, Fig. 3c). On suture line a possible U_3 is not exposed (Renz, 1971, text fig. 7a).

Measurements: Dm 128 mm, Wh 51 (0.40), Ww 40 (0.31), U 46 (0.36).

Distribution: Madagascar (upper Albian), Venezuela.

Subgenus *Deiradoceras* van Hoepen, 1931

Type species: Subschloenbachia prerostrata Spath, 1921, p. 284.

Occurrence: France, South Africa, Madagascar.

Mortoniceras (Deiradoceras) prerostratum (Spath)
Pl. 14, Fig. 2a–b; Text fig. 36a

1921 *Subschloenbachia prerostrata* Spath, p. 284, pl. 24, fig. 10.
1931 *Deiradoceras prerostratum* Spath, van Hoepen, p. 52, fig. 11.
1941 *Deiradoceras prerostratum* Spath, van Hoepen, p. 72, fig. 29, p. 73, fig. 30–32; pl. 11.
1947 *Pervinquieria (Deiradoceras)* aff. *prerostrata* Spath, Breistroffer, p. 51.
1963 *Mortoniceras* (Deiradoceras) *prerostratum* Spath, Collignon, p. 170, pl. 311, fig. 1317.
1971 *Mortoniceras (Deiradoceras) prerostratum* (Spath), Renz, p. 602, pl. 8, fig. 1a–b; text fig. 6d, 7c.

Location: Barbacoas syncline, La Aguada. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20822. Single specimen crushed laterally along median line, destroyed keel. Test partly preserved. Evolute ammonite. Whorl section, after recon-

struction, subtrapezoidal, wider than high; thickest on high umbilical bullae. Ribs widely spaced and coarse with prominent ventrolateral and umbilical tubercles. Ribs bifurcate indistinctly from umbilical bullae; incipient branching predominates. Towards end of outer whorl, interspaces get wider and ribs remain single. Spiral striation and notching on ventrolateral tubercles inconspicuous (on internal mould, slightly weaker than on test). Suture (Text fig. 36a) typical for *Deiradoceras,* with reduced U_3.

Measurements: Dm 162 mm, Wh ?49 (0.30), Ww ?64 (0.40), U 64 (0.40).

Distribution: France, South Africa (Zululand), Venezuela.

Mortoniceras (Deiradoceras) cf. *exile* (van Hoepen)
Pl. 12, Fig. 5

1941 *Deiradoceras exile* van Hoepen, p. 78, pl. 14; text fig. 40, 41.
1950 *Deiradoceras* cf. *exile* van Hoepen, Collignon, p. 74, pl. 13, fig. 1, 1a; text fig. 4.
1971 *Mortoniceras (Deiradoceras)* cf. *exile* (van Hoepen), Renz, p. 602, pl. 11, fig. 1; text fig. 6e, 71.

Location: Barbacoas syncline, La Aguada, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20800. One deficiently preserved specimen, peripheral side mostly eroded. Whorl section subtrapezoidal on high umbilical bullae and ventrolateral tubercles. Ribs strong, separated by deep interspaces. On inner volution ribs turn rursiradiate from mid-flank onward. Keel not preserved on venter, reconstructed on text figure 6e (Renz, 1971, p. 601). Whorl section comparable with *M. (D.) prerostratum.*

Distribution: South Africa, Madagascar, Venezuela.

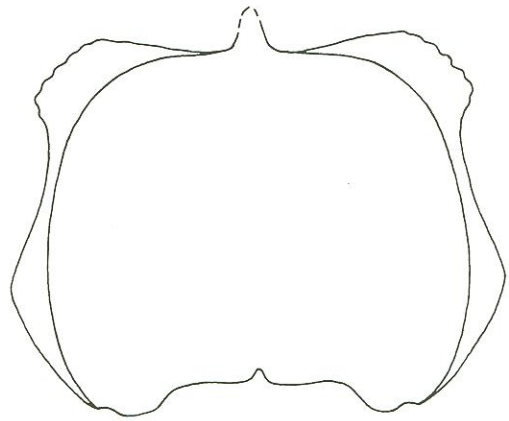
Mortoniceras (Deiradoceras) devonense Spath
Pl. 15, Fig. 1a–b; Text fig. 38

1933 *Mortoniceras (Deiradoceras) devonense* Spath, p. 419, pl. 41, fig. 5a–b; pl. 46, fig. 10a–b; pl. 47, fig. 5; text fig. 144b, c, 245a.
1936 *Mortoniceras (Deiradoceras) devonense* Spath, Venzo, p. 93, pl. 9, fig. 2; pl. 11, fig. 14.
1947 *Pervinquieria (Deiradoceras) devonensis* Spath, Breistroffer, p. 51.
1971 *Mortoniceras (Deiradoceras) devonense* Spath, Renz, p. 605, pl. 10, fig. 1; pl. 11, fig. 2; text fig. 6a–b, 7d, k.

Holotype: Mortoniceras (Durnovarites) devonense Spath, 1933, pl. 47, fig. 5.

Location: MBJ20829. Barbacoas syncline, La Aguada. La Puya Formation, late Albian, *orbignyi* Zone.

Description: MBJ20829. With 172 mm diameter (holotype 195 mm) still septate. Whorl section subquadrate, slightly wider than high, thickest at prominent umbilical tubercles (Text fig. 38). Venter flat, grooved on both sides of keel. Ribs widely spaced, 29 on outer volution; on



Text fig. 38
Whorl section of *Mortoniceras (Deiradoceras) devonense* Spath, MBJ20829, Pl. 15, Fig. 1, 1×.

inner whorls irregularly branching from high, bullate umbilical tubercles, further on, on outer whorl ribs predominantly single. Spiral notching on test limited to ventrolateral tubercles. Due to pronounced tuberculation elements of suture distorted (Renz, 1971, text fig. 7k).

Measurements:	Dm	Wh	Ww	U
Holotype	195 mm	0.36	0.32	0.42
MBJ20829, Pl. 15, Fig. 1	172 mm	59 (0.34)	67 (0.39)	77 (0.45)

Distribution: England (*orbignyi* and *varicosum* Zone), France (*varicosum* Zone), South Africa, Venezuela.

Mortoniceras (Deiradoceras) mokarahaense (Collignon)
Pl. 14, Fig. 1a–b; Text fig. 36c

1950 *Deiradoceras (?Mimoceras) mokarahaense* Collignon, p. 77, pl. 13, fig. 3; text fig. 8.
1963 *Mortoniceras (Deiradoceras) mokarahaense* Collignon, p. 172, pl. 312, fig. 1319.
1971 *Mortoniceras (Deiradoceras) mokarahaense* Collignon, Renz, p. 604, pl. 7, fig. 1a–c; text fig. 6c, 7b.

Location: Barbacoas syncline, near of houses Vano. La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ20825. On inner whorls test preserved, on outer partly broken off. Ornamentation on internal whorls conspicuously different from that on outer whorl. Collignon (1963, p. 172): "Cet exemplaire tire son intérêt des variations d'ornamentations visibles". Inner whorls subquadrate. Costation dense, ribs bifurcating from strongly bullate umbilical tubercles, strongly bending forward from ventrolateral tubercles towards keel as on *M. (M.) pricei.*

Collignon remarks: "côtes externes extrêmement serrées et très fortement projetées en avant." A change in sculpture sets in towards the outer whorl, coinciding with an increase in whorl width. Interspaces widen considerably, simultaneously ribs gain in strength and become single, like on *M. (D.) devonense.* External and internal suture preserved (Text fig. 36c). U_3 very reduced.

Measurements: MBJ20825, Dm 107 mm, Wh 38 (0.35), Ww 45 (0.42), U 42 (0.40).

Distribution: Madagascar, Venezuela.

Remark: Mortoniceras (D.) besairie Collignon, 1950. (Holotype: pl. 12, fig. 3–4), with a comparable whorl section, is distinct from the present species by ribs not turning forward over venter on juvenile stage.

Subgenus *Rusoceras* van Hoepen, 1946

Type species: Rusoceras nothum van Hoepen, 1946.

Wright, 1957 (Treatise, L. 406) mentions *Rusoceras* van Hoepen among the synonyms of *Mortoniceras.* The features distinguishing *Rusoceras* from *Mortoniceras* are a fastigate venter with a keel which is elevated far over the ventrolateral tubercles and a very distinct spiral notching over the ribs. For this reason the term *Rusoceras* is here maintained as a subgenus. It appears that *Rusoceras* represents a link towards *Elobiceras* Spath, 1922.

Occurrence: South Africa.

Mortoniceras (Rusoceras) nothum (van Hoepen)
Pl. 12, Fig. 6a–b; Text fig. 39

1946 *Rusoceras nothum* van Hoepen, p. 238, fig. 235–242.
1971 *Mortoniceras (Rusoceras) nothum* van Hoepen, Renz, p. 606, pl. 9, fig. 1a–b; text fig. 5a.

Holotype: Rusoceras nothum van Hoepen, fig. 235, 236.

Location: Barbacoas syncline, La Aguada. Surface of top layer of the La Puya Formation, late Albian, *orbignyi* Zone.

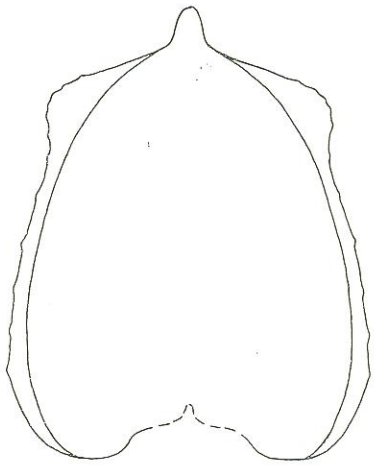
Description: MBJ21038. A fully septate fragment, for a large part covered by test. Whorl section subtrapezoidal, thickest above umbilicus (Text fig. 39). From here sides converge towards fastigate venter. High keel surpasses ventrolateral tubercles. Ribs irregularly sigmoidally curved, rising in prominent ventrolateral tubercles, becoming feeble towards keel. Long and shorter ribs alternate; branching at that stage does not occur. About eight rows of spirally elongated notches on ribs are conspicuous features. They are more distinct on test than on internal mould. Suture as far as preserved identical with *Mortoniceras (Mortoniceras).*

Distribution: South Africa, Venezuela.

Subfamily Mojsisovicsiinae Hyatt, 1903

Genus *Oxytropidoceras* Stieler, 1920

Type species: Ammonites roissyanus d'Orbigny, 1841.



Text fig. 39
Whorl section of *Mortoniceras (Rusoceras) nothum* (van Hoepen), MBJ21038, Pl. 12, Fig. 6, 1×.

Subgenus *Manuaniceras* Spath, 1925

Type species of subgenus: *Pseudophacoceras manuanense* Spath, 1921.

Occurrence: Texas, Peru (Douglas, 1921), Colombia, Venezuela.

Oxytropidoceras (Manuaniceras) peruvianum multifidum (Steinmann)
Pl. 16, Fig. 1

1881 *Ammonites multifidum* Steinmann, pl. 7, fig. 1, 1a–b.
1897 *Schloenbachia acutocarinata* Marcou, Gerhardt, pl. 5, fig. 19.
1929 *Oxytropidoceras peruvianum* var. *multifida* Steinmann, p. 135, fig. 156.
1936 *Oxytropidoceras acutocarinatum* var. *multifida* Steinmann, Collignon in Besairie, p. 181, pl. 20, fig. 1.
1947 *Oxytropidoceras (Manuaniceras) carbonarium* (Gabb), Knechtel et al., pl. 27, fig. 4.
1966 *Manuaniceras peruvianum multifidum* (Steinmann), Young, p. 98, pl. 37, fig. 1–3, 6; pl. 38, fig. 4.

Location: Trail Barbacoas-Curarigua, loose fragment, probably from base of the La Puya Formation.

Description: JG254. Body chamber with end of phragmocone preserved. Surface on outer whorl fragment abraded by weathering. Whorl section compressed, keel missing. Costation dense. Fine ribs bifurcating between umbilical margin and mid-flank, curved forward on outer fourth of flank. On inner whorl ribs angulate, conspicuously flat-topped and separated by very narrow interspaces. In Texas this species is mentioned from the middle Albian (Fredericksburg Division, *M. carbonarium* Zone, Young, 1966, p. 26).

Distribution: Peru, Colombia (Breistroffer, 1956), Venezuela, Texas, Madagascar.

Subgenus *Venezoliceras* Spath, 1925

Type species of subgenus: *Oxytropidoceras venezolanum* Stieler, 1920.

Occurrence: Peru, Ecuador, Colombia, Venezuela, Texas, Madagascar, South Africa (Kennedy and Klinger, 1975, p. 276), Morocco, France.

The subgenus has been described from the upper layer of the La Puya Formation in the surroundings of Barbacoas by Renz (1968b). The population shows a great diversification of forms ranging from compressed shells with fine, densely spaced, weakly tuberculated ribs to inflated specimens bearing coarse, highly tuberculated ribs. The ribs are always rounded, in contrast to the flat-topped form on *Manuaniceras.*

The group is still inadequately known, since it is difficult to obtain sufficient uncrushed material for satisfactory conclusions on taxonomy. For the same reason the ontogeny of the morphological features is still little known. It was observed that compressed species have weak costae and tubercles. With increasing inflation ribbing and tuberculation get progressively stronger.

Venezoliceras accounts for about one quarter of the ammonite assemblage known from the upper layer of the La Puya Formation. Most *Venezoliceras* are of large size. Their body chambers were frequently crushed by compaction and severely distorted by the Andean orogeny during the late Tertiary. All specimens are characterized by additional lateral bullate tubercles placed irregularly within the lower third of the flank. A sequence of fine ribbed to very coarse ribbed forms lived together in this place, suggesting the terminal phase of evolution of the genus *Oxytropidoceras.*

Oxytropidoceras (Venezoliceras) multicostatum Renz
Pl. 16, Fig. 4a–b

1968b *Oxytropidoceras (Venezoliceras) multicostatum* Renz, p. 631, pl. 1, fig. 1a–b (holotype), 2a–c; text fig. 5a.

Location: Barbacoas syncline, La Aguada, on surface of La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ17817, holotype. Large-sized ammonite. Diameter 232 mm. Body chamber not preserved. Whorl section high-keeled, shouldered (Pl. 16, Fig. 4b). Thickest on lateral tubercles. Umbilicus narrow, about 20% of diameter, steep, rounding into umbilical margin. Keel hollow, not floored. Costation fine, dense, slightly prorsiradiate, with strong forward curvatures towards keel. Ribs begin on umbilical seam and swell into faint, elongate bullae at umbilical margin, where a first bifurcation may occur. Additional bifurcations appear at several levels, to above mid-flank. Finally up to seven ribs may reach the ventrolateral shoulder. Towards outer whorl of phragmocone branching becomes less intense and more and more single ribs occur. From 150 mm diameter onward, ribs rise at irregular intervals, into elongate bullae, placed within lower third of side. There branching may occur. Characteristic ventrolateral clavi on shoulder appear at a late stage, from about 180 mm diameter. Juvenile specimens might therefore be interpreted as *Oxytropidoceras (Oxytropidoceras).* Suture partially preserved, typical for subgenus.

Measurements: Dm 232 mm, Wh 112 (0.50), Ww 57 (0.25), U 47 (0.20).

Distribution: Venezuela.

Oxytropidoceras (Venezoliceras) intermedium Renz
Pl. 17, Fig. 1a–b

1968 *Oxytropidoceras (V.) intermedium* Renz, p. 634, pl. 2, fig. 1a–b, 2a–b (holotype), 3; pl. 3, fig. 1; text fig. 5b, c.

Location: Barbacoas syncline, La Aguada. On surface of La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ17824. Test partly preserved. Last half of outer whorl belongs to body chamber. By reconstruction a diameter of 240 mm is to be expected. Whorl section compressed (Pl. 17, Fig. 1b), widest on lateral bullae above umbilical margin, otherwise below mid-flank. Sides convex, converging into high keel. Umbilicus 20% of diameter. Umbilical wall steep, rounding into flank. On inner whorls, up to 120 to 140 mm diameter, costation dense. Flexuous round-topped, fine ribs arranged in bi- and tri-furcating groups. Incipient branching is common. As growth proceeds, costation becomes more widely spaced and single ribs predominate on body chamber. Lateral bullae appear at 150 mm diameter and are placed on stronger ribs at irregular intervals, at different positions on each side. Ventrolateral clavi, characteristic for *Venezoliceras,* appear earlier. They are distinctly more pronounced than on *O. (V.) multicostatum.* Suture partly preserved.

Measurements: MBJ17824, Dm 160 mm, Wh 76 (0.48), Ww 45 (0.28), U 31 (0.20).

Distribution: Venezuela.

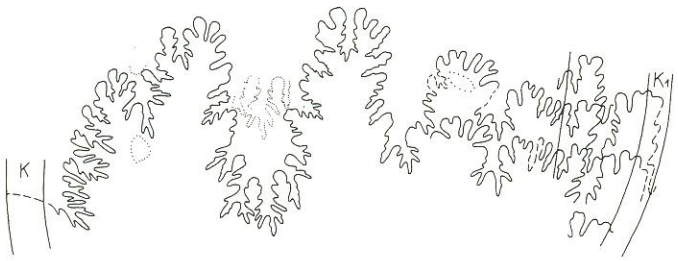
Oxytropidoceras (Venezoliceras) karsteni Stieler
Pl. 16, Fig. 2–3; Pl. 17, Fig. 2a–b, 3a–b; Text fig. 40

1920 *Oxytropidoceras Karsteni* Stieler, p. 395, fig. 8, 9.
1925a *Oxytropidoceras karsteni* Stieler, Spath, p. 182.
1957 *Venezoliceras karsteni* Stieler, Bürgl, p. 136.
1968b *Venezoliceras karsteni* Stieler, Renz, p. 636, pl. 3, fig. 2, 3a–b; pl. 4, fig. 1a–b; text fig. 5d–e, 6, 7a.

Holotype: Oxytropidoceras Karsteni Stieler, 1920; figured by Renz, 1968b, p. 637, fig. 6.

Location: Barbacoas syncline, La Aguada, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ17827, MBJ17830 and MBJ17852 (juvenile stage). Large-sized ammonites reaching diameters of up to 250 mm. Whorl section (Pl. 16, Fig. 3)



Text fig. 40
Suture line of *Oxytropidoceras (Venezoliceras) karsteni* Stieler, MBJ17886, La Aguada, La Puya Limestone, IX.

compressed. Venter angularly shouldered converging towards high keel. Costation on juvenile stage (Pl. 16, Fig. 2) bi- and tri-furcating; single and incipiently bifurcating ribs at an early stage. Ventrolateral clavi begin between 40 and 60 mm diameter. Lateral bullate tubercles are stronger on test than on internal mould, and placed irregularly on somewhat coarser, round-topped, ribs. Towards body chamber costation becomes stronger and interspaces wider. Suture line (Text fig. 40) fully recognizable. Umbilical lobes probably alternating (Schindewolf, p. 708).

Measurements: MBJ17827, Dm 115 mm, Wh 56 (0.50), Ww 32 (0.27), U 25 (0.22).

Distribution: Venezuela, Colombia.

Oxytropidoceras (Venezoliceras) venezolanum Stieler
Pl. 18, Fig. 3a–c

1911 *Schloenbachia (Mortoniceras) inflata* Sowerby, Schlagintweit, fig. 1, 2, p. 79.
1920 *Oxytropidoceras venezolanum* Stieler, p. 394.
1925a *Venezoliceras venezolense* (Stieler), Spath, p. 182.
1951 *Venezoliceras venezolense* Stieler, Collignon, p. 19.
non 1956 *Venezoliceras venezolanum* (Stieler), Benavides-Cáceres, p. 459, pl. 53, fig. 5.
1966 *Venezoliceras venezolanum* (Stieler), Young, p. 65.
1968b *Oxytropidoceras (Venezoliceras) venezolanum* Stieler, Renz, p. 644, pl. 8, fig. 2a–c; text fig. 5m.

Holotype: Schloenbachia (Mortoniceras) inflata Sowerby, 1911, lost.

Neotype: Oxytropidoceras (Venezoliceras) venezolanum Stieler (selected by Renz, 1968, pl. 8, fig. 2a–c).

Location: Barbacoas syncline, La Aguada, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ17844, neotype. Partly covered by test. Whorl section (costal section, Pl. 18, Fig. 3c) subtrapezoidal, with angular shoulder, owing to prominent ventrolateral clavi, thickest on lateral bullae, above narrowly rounded umbilical margin. Keel very high and impressed on its lower half, as with other *O. (Venezoliceras)*. Costation distant. 35 radial, straight, high, narrowly round-topped ribs, separated by wide interspaces. On inner volution most ribs are single, later some branching occurs, just on umbilical edge. Ribs gradually increase in width towards venter, becoming club-shaped, narrowly round-topped, and ending at spirally elongate ventrolateral clavi.

Measurements: (restored) Dm 80 mm, Wh 36 (0.45), Ww 25 (0.31), U 21 (0.26).

Distribution: Venezuela, Peru.

Oxytropidoceras (Venezoliceras) bituberculatum Collignon
Pl. 18, Fig. 1a–b

1966 *Oxytropidoceras (Tarfayites) bituberculatum* Collignon, p. 19, pl. 8, fig. 1.
1968b *Oxytropidoceras (Venezoliceras) bituberculatum* Collignon, Renz, p. 643, pl. 8, fig. 1a–b; text fig. 5l.

Location: Barbacoas syncline, Cerro Gordo section, 3.5 km NNE of Barbacoas, La Puya Formation, late Albian.

Description: MBJ17842. Last seven ribs belong to body chamber, which is markedly crushed. Test partly preserved; keel destroyed. Whorl section subtrapezoidal, thickest at lateral tubercles (Pl. 18, Fig. 1b). Sides convex, converging towards ventrolateral clavi. Umbilicus one quarter diameter. Umbilical wall low, but steep. Costation slightly prorsiradiate. Ribs begin just above umbilical seam and curve slightly forward on outer third of flank. On inner whorls ribs bifurcate or incipiently bifurcate above umbilical margin. Towards outer whorl ribs become single, narrow and round-topped. Seven somewhat stronger ribs on outer whorl are provided with a bullate lateral tubercle placed on lower third of flank. Ventrolateral clavi very pronounced. Suture not preserved.

Measurements:	Dm	Wh	Ww	U
Holotype	185 mm	85 (0.46)	51 (0.28)	47 (0.25)
MBJ17842	190 mm	81 (0.41)	47 (0.24)	49 (0.24)

Distribution: Tarfaya Basin in southwestern Morocco; Venezuela.

Oxytropidoceras (Venezoliceras) madagascariense (Collignon)
Pl. 18, Fig. 2a–c

1951 *Venezoliceras madagascariense* Collignon, p. 19, pl. 2, fig. 1.
1963 *Venezoliceras madagascariense* Collignon, p. 140, pl. 296, fig. 1284.
1968b *Oxytropidoceras (Venezoliceras) madagascariense* (Collignon), Renz, p. 646, pl. 9, fig. 2a–b, 3; pl. 10, fig. 1, 3a–b, 4; text fig. 5n.

Location: Barbacoas syncline, La Aguada, La Puya Formation, late Albian, *H. orbignyi* Zone.

Description: MBJ17848. Test partly preserved. Whorl section (Pl. 18, Fig. 26) subtrapezoidal, thickest above umbilical margin on prominent lateral bullae. Venter flattened with high, laterally impressed keel. Costation widely spaced. Coarse ribs, predominantly single, sharp

crested, sloping markedly steeper adorally than adaptically. About half begin on umbilical seam and cross flank straight or indistinctly flexuous, augmenting gradually in width, assuming a club-like outline. Some weaker, intercalated ribs on inner whorl, indistinctly branch from stronger ribs on umbilical margin. All ribs end at prominent ventrolateral clavi. Outstanding lateral bullate tubercles are placed on stronger ribs. Suture partly preserved.

Measurements: MBJ17848, Dm 170 mm, Wh 80 (0.47), Ww 60 (0.35), U 46 (0.27).

Distribution: Madagascar, Venezuela.

Oxytropidoceras (Venezoliceras) sp. indet.
Pl. 15, Fig. 3

A single fragment of a *Venezoliceras* (JG475) has been collected by J.G. de Jong in 1949, in the Chejendé syncline, along the road from Chejendé to Mitón. As long as better preserved specimens are lacking it may be compared with an unnamed fragment described by Renz (1968, p. 648, pl. 11, fig. 1a–c).

Oxytropidoceras (Venezoliceras) robustum Renz
Pl. 18, Fig. 4; Pl. 19, Fig. 1

1968b *Oxytropidoceras (Venezoliceras) robustum* Renz, p. 647, pl. 10, fig. 2a–b, holotype.

Location: Barbacoas syncline, La Aguada. On surface of uppermost layer of La Puya Formation, late Albian, *H. orbignyi* Zone.

The holotype is the only available specimen. It seems to represent the last stage of an evolutionary line ranging from very fine ribbed and faintly tuberculated species towards very coarse ribbed and strongly tuberculated forms. So far there is no contrary evidence that these types all lived together during deposition of the upper layer of the La Puya Formation.

Description of holotype: MBJ17856. Test mostly preserved. Last rib belongs to body chamber. If body chamber (half whorl) is reconstructed a diameter of 310 mm is obtained. Whorl section (Pl. 18, Fig. 4) wider than high, if very high keel is not considered. Costation very coarse. On outer volution of phragmocone 25 single prominent, straight to slightly sigmoidally curved ribs, faintly leaning forward. Ribs asymmetric in section with steep adoral face and gentle adaptical slope. They begin near umbilical seam and gradually widen to end in high ventrolateral clavi. Each second or third rib is provided with a prominent lateral bullate tubercle, situated above rounded umbilical margin. Eight such ribs are present on outer volution.

Measurements: Dm 200 mm, Wh 86 (0.43), Ww 68 (0.34), U 45 (0.27).

Distribution: Venezuela.

Oxytropidoceras (? Venezoliceras) sp.
Text fig. 41a–c

Location: Southeastern flank of the La Peña anticline, near houses named El Hatillo. About 30 m above base of La Luna Formation, age late Albian. Coll. G. Viterbo.

Description: Re6925. Small-sized, flat-pressed and laterally deformed *Oxytropidoceras.* Rib pattern comparable with that of *O. (Venezoliceras) multicostatum* (Pl. 16, Fig. 4). Ribs dividing from elongated umbilical bullae, and bifurcating again ventrally at various levels up to above mid-flank (Text fig. 41a–b). Keel partly preserved on specimen shown on Text figure 41c, which displays wider spaced and stronger ribs, branching from more pronounced umbilical bullae.

Remarks: Along the southwestern flank of the La Peña anticline, west of El Tocuyo (Text fig. 33), the La Puya Formation, characterized by late Albian ammonites, was found not to be developed. Based on the occurence of *Oxytropidoceras,* described here from the lower La Luna exposed near El Hatillo, it may be assumed that a lateral facies change took place in a southeasterly direction, from shallow water La Puya lithology into limestone of La Luna type. This implies a further increase in age towards the southeast of the La Luna Formation, exposed in the Barbacoas syncline.

In the El Hatillo section no further ammonite occurrences are known from the autochthonous La Luna section which here is overlapped with no visible unconformity by the Barquisimeto flysch. Tne upper part of the La Luna, as well as the Colón Formation, are missing here. This situation appears comparable to that exposed at the "Carora sub-aquatic slide" near Carora (see chapter E-1, p. 65, Text fig. 44).

Subgenus *Laraiceras* Renz, 1968

Type species: Oxytropidoceras (Laraiceras) laraense Renz.

Occurrence: Venezuela.

All available specimens originate from the lower part of the Aguada Member of the La Luna Formation, which, in this part of the Andes, is considered to be still of late Albian age. Owing to the scarcity and poor preservation of the ammonites, the boundary between the *orbignyi* and the *dispar* Zones (Vraconian) could not be established in the field. The ammonites are generally crushed by sediment compaction and therefore difficult to prepare. No diversification of the foraminiferal fauna is observed.

Oxytropidoceras (Laraiceras) laraense Renz
Pl. 19, Fig. 2a–b

1968b *Oxytropidoceras (Laraiceras) laraense* Renz, p. 650, pl. 12, fig. 1a–b.

Text fig. 41a–c
Oxytropidoceras (?Venezoliceras) sp., Re6925-1 to 3, caserío El Hatillo, 4 km west of El Tocuyo, basal La Luna Formation. 1×.

Location: Barbacoas syncline, section on northwestern slope of Cerro Gordo, 3.5 km NNE of the village of Barbacoas, late Albian.

Description: MBJ17861, holotype. Test mostly preserved. Fully chambered. After reconstruction, a diameter of about 210 mm results for phragmocone. Conch discoidal. Whorl section (Pl. 19, Fig. 2b) widest on lateral tubercles. Venter fastigate, rising into high keel, which partly is lost. Sides convex, rounding into rather gently sloping umbilical wall. Costation differentiated into primary ribs with umbilical, mediolateral and clavate ventrolateral tubercles, alternating with shorter, secondary ribs, which fade out below mid-flank and bear only ventrolateral clavate tubercles. Exposed ribs faintly inclined forward, irregularly, slightly sigmoidally curved, round-topped on test. On holotype every primary rib corresponds to a secondary rib on opposite side of shell. Suture not preserved.

Measurements (after reconstruction of holotype): Dm 210 mm, Wh 95 (0.44), Ww 47 (0.22), U 43 (0.20).

Distribution: Venezuela.

Oxytropidoceras (Laraiceras) nodosum Renz
Pl. 19, Fig. 3a–b

1968b *Oxytropidoceras (Laraiceras) nodosum* Renz, p. 651, pl. 12, fig. 2a–b, pl. 13, fig. 1a–b, holotype.

Location: Barbacoas syncline, section on northwestern slope of Cerro Gordo, 3.5 km NNE of the village of Barbacoas, late Albian.

Description: MBJ17862, holotype. Test partly preserved. Fragment considerably crushed as indicated by fracture on ventral right side. Whorl width (Pl. 19, Fig. 3b), therefore doubtful. On interspaces, sides flat-convex, rounding into gentle umbilical slope. Costation differentiated into primary and secondary ribs as with *O. (L.) laraense.* Ribs straight, separated by interspaces nearly twice as wide as ribs. Primaries with prominent, subconically rounded, umbilical and mediolateral tubercles, situated slightly below mid-flank. Secondary ribs, without such tubercles, fade out towards umbilical margin. All ribs are low and broadly rounded, ending in high ventrolateral clavate tubercles which form umbilical shoulder on costal section. Suture not preserved.

Distribution: Venezuela.

d) Albian to Cenomanian transition, Vraconian (States of Trujillo and Lara)

Nowhere in the Venezuelan Andes has it been possible to obtain a representative suite of ammonites which spans the Albian to Cenomanian boundary. Thus the exact limit between the two stages is difficult to establish from ammonites in the field. According to the present knowledge, it is assumed that the boundary may lie within the lower part of the Aguada Member, probably somewhere between 10 and 25 m above the contact with the underlying La Puya Formation.
Not only are the ammonites rare over this interval, they are generally poorly preserved, problematical to extract from the rock, and difficult to prepare in the laboratory. Nevertheless some species can be determined and are described. Their vertical range, however, is little known.
The restricted assemblage can best be compared with the fauna from the Cambridge Greensand in England and the Vraconian in France, and also from the type section of the Vraconian in Switzerland (compare Spath, 1923–43; Breistroffer, 1940; Renz, 1968a and Scholz, 1979). In Texas this interval may correlate with the Pawpaw Formation at the top of the Washita Group (Adkins, 1928, p. 6; Mancini, 1979).
Pelagic foraminifera can only be studied in thin-section. They are generally represented by a poor fauna of specifically undeterminable *Hedbergella,* which do not permit the distinction between Albian and Cenomanian to be made either (Renz, 1970, fig. 1, p. 1025).

Family Baculitidae Meek, 1876

Subfamily Baculitinae Meek, 1876

Genus *Lechites* Nowak, 1908

Type species: Baculites gaudini Pictet and Campiche, 1861.

Occurrence: World-wide, late Albian to early Cenomanian.

Lechites aff. *gaudini* Pictet and Campiche
Pl. 20, Fig. 7a–b

1861 *Baculites gaudini* Pictet and Campiche, p. 112, pl. 45, fig. 5–9.
1865 *Baculites gaudini* Pictet and Campiche, Stoliczka, p. 199, pl. 91, fig. 7–9.

1923 *Baculites gaudini* Pictet and Campiche, Böse, p. 157.
1936 *Baculites gaudini* Pictet and Campiche, Venzo, p. 118, pl. 10, fig. 3.
1941 *Lechites gaudini* (Pictet and Campiche), Spath, p. 662, pl. 72, fig. 4–7, 9, 10; text fig. 242.
1968a *Lechites gaudini* (Pictet and Campiche), Renz, p. 80, pl. 17, fig. 1–5.
1968 *Lechites gaudini* (Pictet and Campiche), Wiedmann and Dieni, p. 62, pl. 6, fig. 1–5, 7–9.
1977 *Lechites gaudini* (Pictet and Campiche), Cooper and Kennedy, p. 644, fig. 1 (1–38), fig. 2 (1–30), fig. 4 (1–18), fig. 5 (1–15), fig. 6, fig. 8 (16–26), with synonymy.
1979 *Lechites gaudini* (Pictet and Campiche), Scholz, p. 12, pl. 1, fig. 1–9.

Location: Section south of caserío La Ceiba, west of Chejendé, Aguada Member, about 10 m above contact with La Puya Formation, transition Albian to Cenomanian.

Description: JG436. Internal mould, dorsally crushed, fragment of body chamber. Section compressed, oval. Ribs weak, densely spaced, prorsiradiate, inclined at an angle of 55° against longitudinal axis. Across venter ribs faintly variable in breadth; effaced on dorsum.

Remarks: The specimen may be compared with varieties 33 to 35 from the Cambridge Greensand on figure 1 of Cooper and Kennedy (1977). The European specimens do not show the slightly variable strength of ribs over venter.

Genus *Hamites* Parkinson, 1811

Type species: Hamites attenuatus J. Sowerby, 1814.

Occurrence: World-wide.

Subgenus *Hamites* Parkinson, 1811

Hamites (Hamites) cf. *virgulatus* Brongniart
Pl. 20, Fig. 5a–b, 11

1861 *Hamites virgulatus* (Brongniart?) d'Orbigny, Pictet and Campiche, p. 85, pl. 54, fig. 6, 7.
1941 *Hamites (Stomohamites) virgulatus* (Brongniart?), Pictet and Campiche, Spath, p. 635, pl. 71, fig. 7–10; pl. 72, fig. 11.
1968a *Hamites (Stomohamites) virgulatus* Brongniart, Renz, p. 65, pl. 11, fig. 9, 10.
1968 *Hamites (Stomohamites) virgulatus* Brongniart, Wiedmann and Dieni, p. 53, pl. 5, fig. 1, 2, 10; pl. 7, fig. 1, 2, cum synon.
1979 *Hamites virgulatus* Brongniart, Cooper and Kennedy, p. 227, fig. 16F, H, 32B–C.

Neotype: Hamites virgulatus Brongniart in Pictet and Campiche, 1861, pl. 54, fig. 6, selected by Wiedmann and Dieni, 1968, p. 53.

Location: Road from Chejendé to Mitón. Aguada Member, above contact with La Puya Formation, transition Albian to Cenomanian (Vraconian).

Description: JG391a (Pl. 20, Fig. 5) and JG238 (Pl. 20, Fig. 11). Both specimens have most of body chambers preserved, however, considerably crushed laterally. Shaft planispiral. Section compressed, oval; sides flattened; venter narrowly arched. Ribs radial, single, sharp, attenuating on dorsum. On slightly excentric body chamber ribs get more distant and much stronger, mainly over venter; towards end of body chamber ribs attenuate again. Suture not exposed.

Distribution: Europe, Africa (Angola), USA, Venezuela.

Hamites (Hamites) sp. indet.
Pl. 20, Fig. 6a–c; Text fig. 42

Location: Chejendé syncline, San Felipe, lower Aguada Member, transition Albian–Cenomanian (Vraconian).

Description: JG391b. Costation on two fragments compares well with *H. (H.) virgulatus.* About four sharp, slightly prorsiradiate ribs within an interval, corresponding to the whorl height. Ribs attenuate over dorsum. The present form differs from *H. (H.) virgulatus* by its single collared aperture. Suture as on *H. (H.) virgulatus* (Text fig. 42).

Family Anisoceratidae Hyatt, 1900

Subfamily Anisoceratinae Hyatt, 1900

Genus *Anisoceras* Pictet, 1854

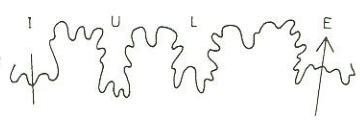
Type species: Hamites saussureanus Pictet, 1847

Occurrence: World-wide.

Subgenus *Anisoceras (Anisoceras)* Pictet, 1854

Anisoceras (Anisoceras) perarmatum Pictet and Campiche
Pl. 20, Fig. 1a–b, Fig. 3

1861 *Anisoceras perarmatum* Pictet and Campiche, p. 65, pl. 48, fig. 7, 8; pl. 49, fig. 1.
1862 *Hamites (Anisoceras) perarmatus* Pictet and Campiche, Hauer, p. 644, pl. 2, fig. 2–4.
1866 *Anisoceras armatus* Sowerby, Stoliczka, p. 174, pl. 81, fig. 8–10.
1875 *Anisoceras perarmatum* Pictet and Campiche, Neumayr, p. 30.
1923 *Anisoceras perarmatum* Pictet, Böse, p. 144.
1932 *Anisoceras perarmatum* Pictet and Campiche, Barbu, p. 16.
1938 *Anisoceras perarmatum* Pictet and Campiche. Roman, p. 52.
1939 *Anisoceras perarmatum* Pictet and Campiche, Spath, p. 548, pl. 59, fig. 1–3; pl. 61, fig. 3–7; Text fig. 192.
1962 *Anisoceras perarmatum* Pictet and Campiche, Swensen, p. 67, pl. 4, fig. 1, 3, 7.
1963 *Anisoceras perarmatum* Pictet and Campiche, Collignon, p. 50, pl. 259, fig. 1126.



Text fig. 42
Suture line of *Hamites (Hamites)* sp. indet., JG391b, Pl. 20, Fig. 6, whorl height 7 mm, 6×.

1968 *Anisoceras (A.) perarmatum* Pictet and Campiche, Wiedmann and Dieni, p. 65, pl. 6, fig. 14; pl. 7, fig. 9.
1968a *Anisoceras perarmatum* Pictet and Campiche, Renz, p. 74, pl. 13, fig. 5a–c; pl. 14, fig. 1, 3, 5.
1979 *Anisoceras (A.) perarmatum* Pictet and Campiche, Cooper and Kennedy, p. 196, fig. 12A–H, 13C–D, 14A–C, 15C–F, 16B.
1979 *Anisoceras (A.) armatum* (Sowerby), Scholz, p. 24, pl. 2, fig. 9–10, morphotype *perarmatum*.

Lectotype: Anisoceras perarmatum Pictet and Campiche, 1861, pl. 49, fig. 1; separated by Spath, 1939, p. 550; refigured by Renz, 1968a, pl. 13, fig. 5.

Location: Barbacoas, about 15 m above top of La Puya Formation. Type section of Aguada Member, transition Albian–Cenomanian.

Description: JG227, Pl. 20, Fig. 1; JG258b, Pl. 20, Fig. 3. Specimens partly with test preserved. Coiling anisoceratid. Section hexagonal on tuberculated ribs, about circular on interspaces. Costation on juvenile sector with one, or more frequently, two untuberculated, finer ribs between tuberculated, stronger ones; later, on straight shaft, intermediate ribs get lost. Towards end of body chamber section ovate, ribs becoming finer, closer and untuberculated. Main ribs quadrituberculate. Tubercles connected by loops over venter and on sides. On dorsum ribs faintly recognizable on test. Suture not preserved.

Distribution: England, France, Switzerland, Hungary, Sardinia, Tunisia, Nigeria, Angola, South Africa, Madagascar, India, Texas.

Remarks: In Europe *A. perarmatum* is closely related with *A. armatum* Sowerby, both species occurring together. In Venezuela only *A. perarmatum* has been found so far.

Anisoceras (Anisoceras) sp. indet.
Pl. 20, Fig. 2

A fragment of an *Anisoceras* (JG258a), characterized by numerous untuberculated ribs intercalated between slightly tuberculated ones, originates from the same layer as *A. (A.) perarmatum*. Poor preservation forbids assignment of this fragment to a species.

Anisoceras (Anisoceras) picteti Spath
Pl. 20, Fig. 4a–b

1861 *Anisoceras armatum* (Sowerby), Pictet and Campiche, p. 62, pl. 48, fig. 1, 2, 4, 6.
1926b *Anisoceras picteti* Spath, p. 432.
1939 *Anisoceras picteti* Spath, p. 554, pl. 59, fig. 4; pl. 61, fig. 8, pl. 63, fig. 3, 8; text fig. 194.
1947 *Anisoceras jacobi* Breistroffer, p. 62, 96.
1968a *Anisoceras picteti* Spath, Renz, p. 76, pl. 13, fig. 8, 9; pl. 14, fig. 6–9, pl. 15, fig. 4; text fig. 27c, 28f.
1971 *Anisoceras picteti* Spath, Nagy, p. 19, pl. 1, fig. 10.

Lectotype: Anisoceras armatum Pictet and Campiche, 1861, pl. 48, fig. 1; separated by Spath, 1939, p. 554; refigured by Renz, 1968a, pl. 14, fig. 6.

Location: Barbacoas, about 15 m above contact with La Puya Formation, together with *A. perarmatum*. Transition Albian to Cenomanian.

Description: JG216. Similar to *A. armatum*, with intermediate non-tuberculated ribs. Coiling helical as lectotype. Fragment septate. Ornamentation consists of one lateral and a pair of strong, blunt ventral tubercles, connected by looped ribs. Intercalated non-tuberculated ribs between pairs of ribs are present. Costation attenuates towards dorsum. Suture not visible.

Distribution: A characteristic form of the *dispar* Zone (Vraconian) in Europe.

Family Turrilitidae Meek, 1876

Genus *Mariella* Nowak, 1916

Type species: Turrilites bergeri Brongniart, 1822.

Occurrence: World-wide.

Subgenus *Mariella* Brongniart, 1822

Mariella (Mariella) worthensis (Adkins and Winton)
Pl. 20, Fig. 8

1920 *Turrilites worthensis* Adkins and Winton, p. 44, pl. 7, fig. 10, 11, 13.
1920 *Turrilites worthensis* Adkins, p. 78, pl. 3, fig. 1, 6.
1926 *Turrilites bergeri* Brongniart, Scott, p. 144, pl. 2, fig. 2.
1928 *Turrilites worthensis* Adkins and Winton, p. 215, pl. 21, fig. 1.
1947 *Paraturrilites worthensis* Adkins and Winton, Breistroffer, p. 66.
1965 *Mariella (Mariella) worthensis* (Adkins and Winton), Clark, p. 41, pl. 11, fig. 3, 6; pl. 12, fig. 1–9; pl. 16, fig. 4, 5 (cum synon.).

Location: Barbacoas, type section of Aguada Member, 15 m above contact with La Puya Formation. Transition Albian–Cenomanian.

Description: JG247. Juvenile, dextral specimen. Apical angle 41°. Four rows of tubercles faintly connected by feebly indicated, oblique ribs, especially on early volutions. Two middle rows very slightly wider spaced. Tubercles on test predominantly rounded-conical, on lower row evenly pointed. Twenty ribs per volution between 16 and 8 mm whorl height. Position of sipho and suture not exposed.

Distribution: Texas, Venezuela.

Remark: Spath (1937, p. 514) mentions a great resemblance of *M. worthensis* with immature specimens of *M. bergeri*.

Mariella (Mariella) sp., aff. *bergeri* (Brongniart), 1822
Pl. 20, Fig. 9a–b

Location: Barbacoas, type section of Aguada Member, together with *M. (M.) worthensis* and *Anisoceras*. About 30 m above lower limit of member.

Description: JG213a dextral (Pl. 20, Fig. 9a) and Re6910, sinistral (Pl. 20, Fig. 9b) fragment with pronounced, oblique, distinctly sigmoidally curved ribs, with four about equidistant rows of bullate tubercles connected by ribs. The specimens are too incomplete for a reliable determination.

Subgenus *Plesioturrilites* Breistroffer, 1953

Mariella (Plesioturrilites) brazoensis (Roemer)
Pl. 20, Fig. 10

1852 *Turrilites brazoensis* Roemer, p. 37, pl. 3, fig. 2.
1904 *Turrilites brazoensis* Roemer, Lasswitz, p. 233, pl. 14, fig. 2.
1920 *Turrilites brazoensis* Roemer, Adkins and Winton, p. 45, pl. 7, fig. 14, 15.
1927 *Turrilites brazoensis* Roemer, Böse, p. 199, pl. 1, fig. 1.
1928 *Turrilites brazoensis* Roemer, Adkins, p. 214, pl. 21, fig. 10.
1953 *Paraturrilites (Plesioturrilites) brazoensis* Roemer, Breistroffer, p. 1351.
1961 *Mariella (Plesioturrilites) brazoensis* (Roemer), Perkins, p. 90, pl. 32, fig. 2; pl. 33, fig. 4, 5.
1965 *Mariella (Plesioturrilites) brazoensis* (Roemer), Clark, p. 45, pl. 14, fig. 3–5; pl. 16, fig. 1, 6.

Location: Culmination of road from Barbacoas to San Pedro, section of Aguada Member below road, 15 m above contact with La Puya Formation. Transition Albian–Cenomanian.

Description: Re6897. A dextrally coiled single fragment. Four rows of tubercles of which the upper and lower row consist of small nodes. Two middle rows are separated by a broad, concave, smooth band. Tubercles above band obliquely placed and bullate, below the band rounded and blunt. Suture not preserved.

Distribution: Texas, Venezuela.

Family Brancoceratidae Spath, 1933

Subfamily Mortoniceratinae Spath, 1925

Genus *Mortoniceras* Meek, 1876

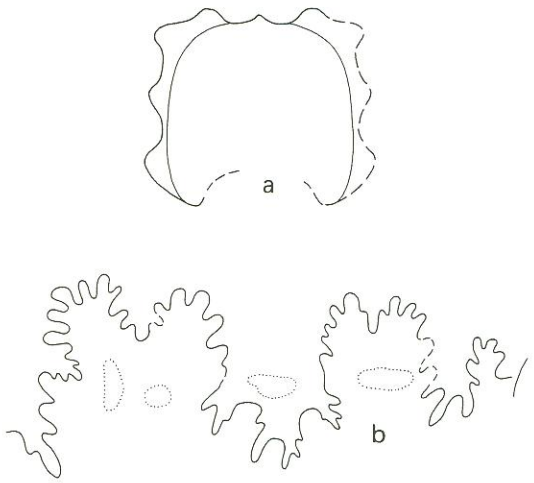
Subgenus *Durnovarites* Spath, 1932

Type species: Subschloenbachia perinflata Spath, 1921.

Occurrence: Europe, Africa, Texas.

Mortoniceras (Durnovarites) subquadratum Spath

Holotype: M. (Durnovarites) subquadratum Spath, 1933.



Text fig. 43
Mortoniceras (Durnovarites) subquadratum venezolanum n. ssp., Re6821, Pl. 20, Fig. 12, holotype.
a. Whorl section 1.5×, b. Suture line 3×.

Mortoniceras (Durnovarites) subquadratum venezolanum n. ssp.
Pl. 20, Fig. 12; Text fig. 43a–b

Holotype: Re6821, deposited with Maraven S.A., Caracas.

Location: Road Chejendé–Mitón, south of La Morita. Base of Aguada Member.

Age: Transition zone from Albian to Cenomanian (Vraconian).

Description of holotype: Internal mould. Whorl section subquadrate, venter sulcate with pronounced keel (Text fig. 43). Umbilicus evolute, 40% of diameter. Costation wide-spaced. Strong, rectiradiate ribs. Tuberculation consists of prominent umbilical and mediolateral bullate tubercles and high, paired ventrolateral elevations, composed of a dorsal spinous tubercle and a ventral, much lower, subdued, clavus. Keel bound by sulcate depressions. Suture with broad external saddle, typical for genus. Due to high relief, suture somewhat distorted (Text fig. 43b).

Measurements: Dm 49 mm, Wh 17 (0.34), Ww 16 (0.32), U 21 (0.40)

Remarks: The subspecies differs from the type, which is characteristic for the *dispar* Zone, by its larger size and the asymmetric ventrolateral tubercles.

Pervinquieria msougari Collignon (1968, p. 20, pl. 1, fig. 11a) is larger and differs from our specimen by a ventrolateral tubercle which is not paired. *Mortoniceras worthense* from the lower Pawpaw Formation of Texas (Adkins, 1920, p. 91, fig. 19, 26) seems to be related to the present subspecies. *Mortoniceras (Durnovarites) neokentroides* Wiedmann and Dieni (1968, p. 146, pl. 13, fig. 5) possesses no mediolateral tubercles.

E. Late Cretaceous

1. Stratigraphic review of the La Luna Formation and time equivalent units

Text fig. 2, 3 and 4

Under the euxinic conditions which prevailed in western Venezuela during Cenomanian, Turonian and Coniacian times, sediments collectively referred to as La Luna Formation (Garner, 1926, Hedberg, 1931) accumulated. The fauna consists of strictly pelagic assemblages of foraminifera, ammonites, fish remains and, occasionally, bones of saurians, accompanied by inoceramids and dwarfed pelecypods which indicate an anoxious and reducing environment. Neither plant remains nor detrital material supplied by continental erosion were observed.

The lithology suggests slight regional subsidence during this period, resulting in an extended, closed, poorly aerated basin. Subsidence began during the late Albian in the Andes, during the deposition of the Aguada Member of the La Luna Formation (States of Lara and Trujillo) and of the La Grita Formation (State of Táchira). Subsidence gradually progressed northwards, to involve the Maracaibo Platform and the northern Perijá area, during the Cenomanian and early Turonian times. Later during the early Coniacian, it reached as far north as the southern Guajira Peninsula in Colombia.

Throughout this period the depth of the basin remained far above the calcium carbonate compensation depth, but considerably below the photic zone and wave action.

In all sections studied in western Venezuela the La Luna Formation rests on massively bedded, micritic, skeletal or biohermal limestones, with a sharp, apparently conformable contact. This is the La Puya Formation (upper Albian), which overlies the Peñas Altas Formation (lower and middle Albian) in the Andes; the Maraca Formation (Cenomanian), which overlies the Lisure Formation in the Perijá (Machiques Trough) and the Cogollo Formation on the Maracaibo Platform, in the northern Perijá area (Río Guasare) and in southern Guajira. Here the La Luna limestones with spheroidal concretions and black chert, and of Coniacian age, overlie a thick sequence of limestones of Cogollo-type lithology, the upper part of which is assumed to be of Turonian age. This cannot, however be substantiated by ammonites (Renz, 1960a, fig. 3, section a).

Whilst the regional subsidence was taking place in the area of the present Andes, the northern parts of the Guayana Shield were subjected to uplift and erosion. The erosion products were swept into the subsiding basin to accumulate as extensive fan-like bodies comprising alternations of quartz sands and silty shales. Distally the fan-sediments become intercalated with massively bedded biostromal limestones. The northern edge of the fan was penetrated by wells in the Río de Oro oil field (Notestein et al., 1944) whereas its eastern limit occurs in the Andes between the villages of Torondoy and Monte Carmelo (Renz, 1977, sections 40–41, fig. 3). Its geometrical configuration and north-eastern limits may be deduced from the stratigraphic sections shown in Text figures 3 and 4.

The fan sediments have been divided into two major lithological units, the *Seboruco Member* (Renz, 1959a) below, and the *Guayacán Member* (Notestein et al., 1944) above.

The Seboruco Member overlies a thin sequence of black concretionary limestones referred to as the *La Grita Member* (Renz, 1959a), which is roughly the time equivalent of the Aguada Member in Trujillo and Lara. It should be emphasized that the Seboruco reflects a sedimentologically distinct phase to that of the underlying La Grita. It comprises a sequence of uniform, black, partly micaceous silty shales which so far have not yielded age-indicative fossils. On regional grounds it is likely to be of Cenomanian to early Turonian age. In spite of its unimportant aspect in the field, the La Grita is of significance in the interpretation of the sedimentary evolution during the Cretaceous Period in western Venezuela.

A conspicuous interval of grey massive limestones containing shell fragments and associated with layers of glauconitic sandstones occurs within the Seboruco Shales. The interval has been recognized from the Schlumberger logs in wells of the Río de Oro oil field (Notestein et al., 1944) and is referred to informally as "Zone 3". Towards the Barinas area the interval becomes progressively more sandy, and is there identified as the *Escandalosa Formation* (Renz, 1959a).

The Guayacán Member which overlies the Seboruco Shales, is a skeletal limestone containing *Exogyra* bioherms, interbedded with dark shales and sandy layers. The presence of large *Coilopoceras* indicates a late Turonian age. A time correlation with the upper part of the Chejendé Member of the La Luna Formation in Trujillo-Lara is therefore suggested.

The La Luna Formation along the Perijá foothills

The lithology of the La Luna Formation, the most prolific oil source rock in Venezuela, has been studied

and described by many geologists. Its ammonite assemblages indicate a Turonian and Coniacian age. The genera *Hoplitoides, Neoptychites, Eucalycoceras* (Sutton, 1946), are indicative of the Turonian and *Barroisiceras, Peroniceras, Gauthiericeras* and *Prionocyclus* of the Coniacian. The La Luna terminates in a conspicuous glauconite interval devoid of ammonites. Paleontological evidence suggests that this horizon may represent a period of reduced sedimentation corresponding to the Santonian (Sutton, 1946; Sellier de Civrieux, 1952).

The La Luna Formation in Táchira

Southwest of the Mérida Swell, in the State of Táchira, the Cenomanian and Turonian, as mentioned above, are represented by the Seboruco and Guayacán Members. In Táchira only the interval Coniacian in age is developed as a La Luna facies comparable to that found in the type section in the Perijá area. The lower part of the La Luna Formation consists, in Táchira, of typical dark limestones with ellipsoidal concretions which conformably overlie the Guayacán. The ammonites are represented by the genera *Lenticeras, Gauthiericeras, Prionocyclus* and *Peroniceras* of Coniacian age. The concretionary limestones are overlain by an interval of thinly bedded black cherts, interbedded by thin, irregular layers of phosphatized fish-bone breccia, designated as the *Táchira Member* by Renz (1959a). Whereas no ammonites have been found, the cherts contain an abundance of poorly preserved silicified foraminifera, namely *Globotruncana, Guembelina* and *Globigerina.* Determinable radiolarians have not been observed.

The silica-rich Táchira Member of the La Luna Formation is overlain by a layer of fish-bone breccia and glauconite of variable thickness, which is in turn followed by the *Colón Formation* (Liddle, 1928). In the Quebrada Buenaña in Táchira (Renz, 1977, section 32, fig. 2) the glauconitic interval splits into several layers and becomes interbedded with black limestones of a La Luna facies, containing the ammonite genus *Andersonites* indicative of a late Coniacian age.

Towards the Barinas foothills the limited La Luna sequence grades laterally into dark shales, referred to as the *La Morita Formation* (Renz, 1959a; Gaenslen, 1962). On the evidence of the ammonite genus *Barroisiceras* these shales are of Coniacian age. The overlying Táchira Member passes laterally into the *Quevedo Member* (Renz, 1959a), which rests directly on basement along the southern Barinas foothills.

The Colón Formation of Campanian and Maastrichtian age contains, in its upper part, the ammonite genus *Sphenodiscus,* which was found at several localities in Táchira, but of which no samples are available. A lateral transition from shales into alternating sands and sandy shales, towards the southwestern foothills of the Andes, is referred to as *Burgüita Formation* (Renz, 1959a; Gaenslen, 1962).

The La Luna Formation in Trujillo and Lara

To the northeast of the Mérida Swell, in the direction of the Barquisimeto flysch basin, the Guayacán and Seboruco gradually loose their identity as they pass laterally into a concretionary limestone development of typical La Luna character. The area of transition, where an interfingering of the Seboruco Shales into the limestone can be observed, lies in the neighbourhood of Torondoy and can be followed eastwards into the Chejendé syncline. In this region, there is evidence that the euxinic conditions under which the La Luna was deposited already existed in late Albian time and as a consequence, the formation is considerably thicker here. It has been subdivided into three members (Renz, 1959a): The *Aguada Member* of late Albian to Cenomanian age, the *Chejendé Member* of late Cenomanian to Turonian age and the *Timbetes Member* of Coniacian to ?Santonian age. All three members are well exposed also in the Barbacoas region.

The contact between the Aguada Member and the underlying La Puya is abrupt and is clearly expressed in the topography. The Aguada comprises a sequence of dark, platy limestones, concretionary towards the top and which weathers to a light grey colour. The lower part contains late Albian ammonites such as *Oxytropidoceras (Laraiceras)* and *Hysteroceras,* together with the foraminifera *Guembelina* and *Hedbergella.* Higher in the section, concretions, which locally reach diameters in excess of one meter, appear. Ammonites are less common, the assemblage comprising the genera *Mortoniceras (Durnovarites), Mariella, Hamites* and *Anisoceras* with *Sharpeiceras* appearing towards the top. All indicate a latest Albian to Cenomanian age. *Hedbergella* and related forms are the most common foraminifera.

The interval of the La Luna which is assigned a late Albian age is confined to the lowest third of the Aguada Member. This diminishes in thickness towards the southwest as it becomes progressively replaced by what was termed as the La Puya Formation by Renz (1959a).

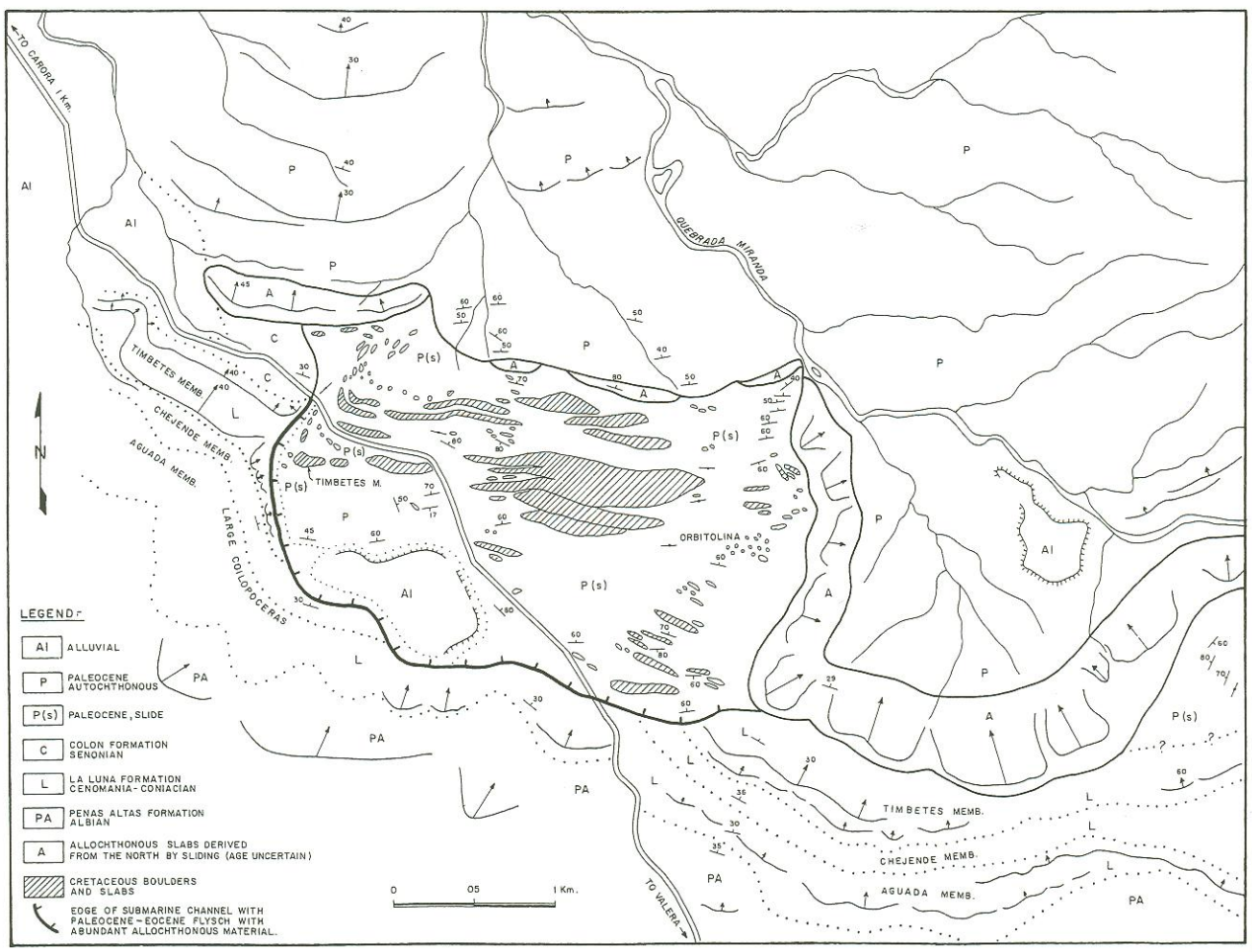
The Chejendé Member is a sequence of marls and dark, platy limestones, the lower part containing small concretions. The interval yields *Inoceramus* and abounds with a variety of ammonites of early Turonian age. The genera *Hoplitoides, Mammites, Pseudaspidoceras, Benueites, Vascoceras, Nannovascoceras, Fagesia, Neoptychites, Mitonia* and *Pseudoneoptychites* are all represented. Towards the top of the member, large specimens of *Coilopoceras* and rare *Hourcquia,* indicating a late Turonian age, appear in most sections in Trujillo and Lara.

The Timbetes Member is distinguished by an abundance of black chert, present as lenses and seams within a platy limestone sequence which contains many medium sized to very large concretions. The ammonite genera *Paralenticeras, Barroisiceras, Forresteria, Peroniceras, Gauthiericeras, Prionocycloceras, Subprionotropis, Baculites,* indicate a Coniacian age. The pelagic foraminiferal assemblage is dominated by large *Rugoglobigerina* as well as double keeled *Globotruncana.* Radiolarians are not known.

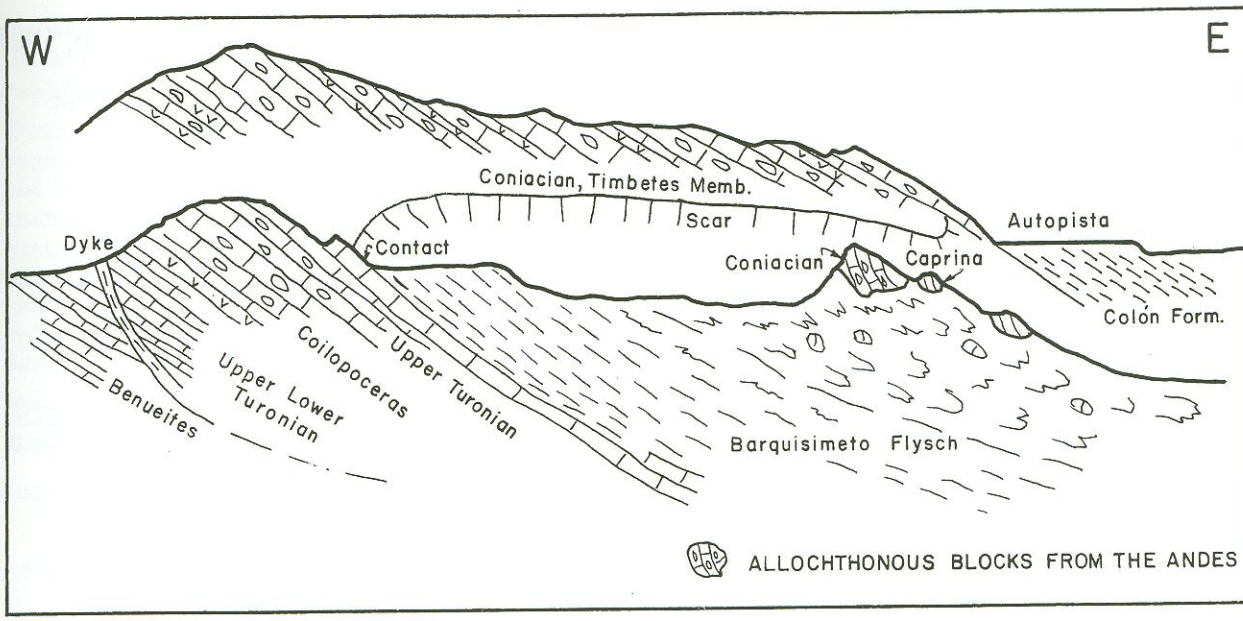
The La Luna Formation here, as in all other areas of western Venezuela, is capped by a conspicuous interval rich in phosphate and glauconite which ranges in thickness from less than one meter to several meters.
It should be noted that the author now would favour the elevation of the La Grita, Seboruco, Guayacán and Quevedo Members to the rank of Formations. Hereafter they will be given this rank in the text and also in the figures.

Allochthonous slabs of the La Luna Formation in the flysch of the Barquisimeto Trough
(Text fig. 44, 45 and 46)

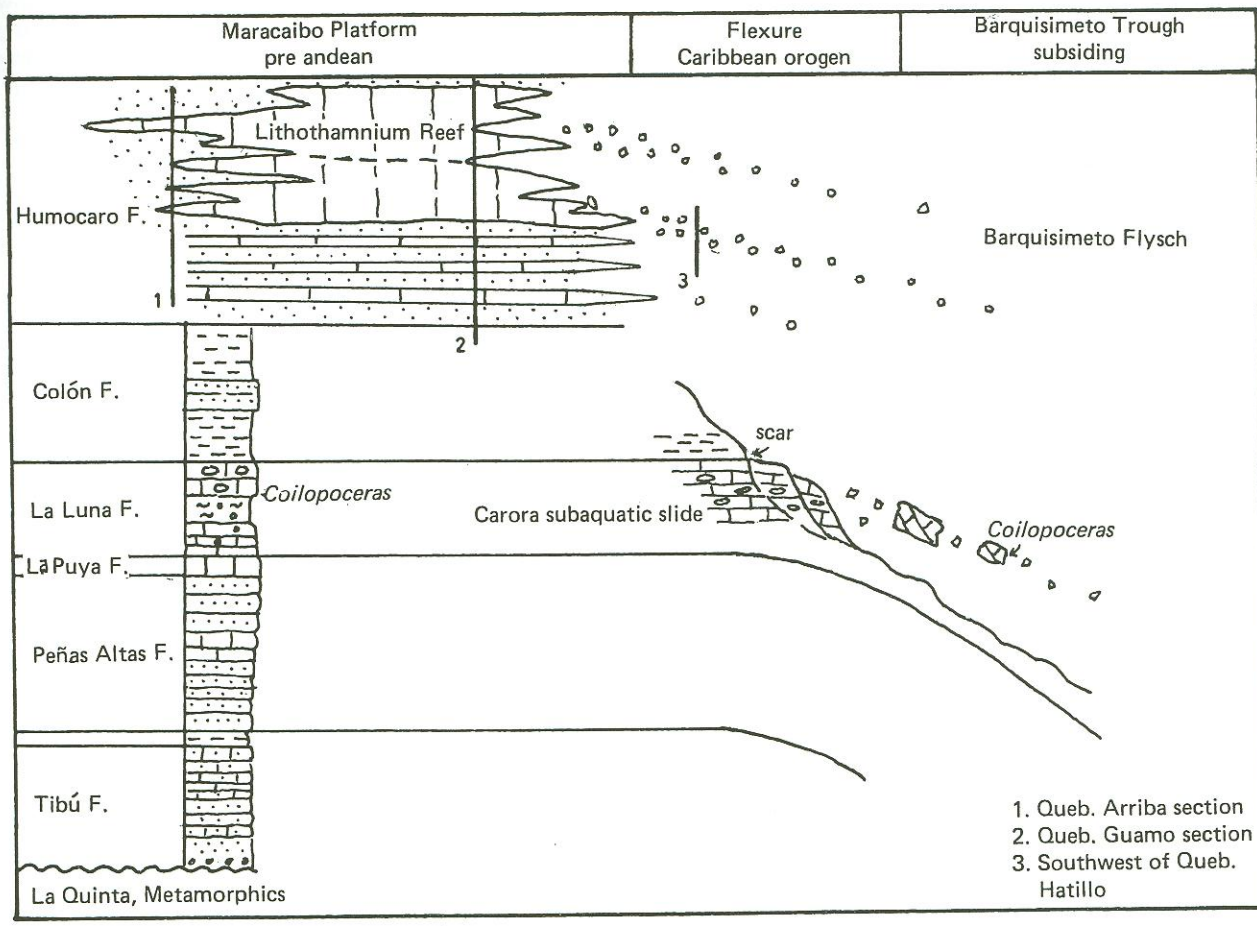
Towards the end of the Cretaceous Period, western Venezuela, including the present Andes, formed part of the stable Maracaibo Platform. In early Tertiary time the area came under the influence of the Caribbean orogeny. The Cordillera de la Costa came into existence and rapid subsidence of the Barquisimeto Trough was accompanied by flexuring of the eastern margin of the once stable platform. Large slabs of rigid Cretaceous sediments became detached and slid under the influence of gravity into the adjacent Trough. The scar left by one of these detached blocks can be seen at an outcrop of autochthonous La Luna (Timbetes Member) along the new highway leading from Carora to Barquisimeto (Text fig. 44, 45). The La Luna within the scar is onlapped by normally layered flysch sediment on which follows a thick flow of chaotically contorted flysch containing numerous heterogene rock debris, amongst which also large blocks of limestone representing the Timbetes Member are included.
The detached slabs of Timbetes Limestone are well exposed in the Puente Torres region, both along the old Barquisimeto road and along the new highway. Being more resistant to erosion, they tend to be preserved on top of the hills formed by the flysch sediments. The most significant ammonites to be found in these allochthonous slabs are the large *Coilopoceras* which indicate a late Turonian age (Pl. 33, Fig. 1).



Text fig. 44
Subaquatic sliding during Paleocene time southeast of the town of Carora (State of Lara), based on Renz et al., 1955.



Text fig. 45
Schematic section across the subaquatic slide of Carora. The figure shows the gliding of Andean material with ammonites into the Barquisimeto Trough and the exposure of the contact between the early Coniacian limestone and the Paleocene flysch. Allochthonous slabs which originate from the north are not shown. No scale.



For a more complete discussion of the foregoing, the reader is referred to the paper on submarine sliding in western Venezuela by Renz et al. (1955 and 1981).

a. Systematic description of Cenomanian ammonites

In Venezuela, Cenomanian ammonites are restricted to the Andes in the States of Trujillo and Lara. Along the Perijá foothills and over the Maracaibo Platform, the Cenomanian is developed in a shallow water limestone facies (top Cogollo and Maraca Formations). In the southwestern part of the Andes, in the State of Táchira, the Cenomanian is represented by the terrigenous Seboruco Formation in which no determinable ammonites have been found. Towards the northeast, the major part of the Seboruco Shale grades laterally into sediments deposited in an euxinic environment, the Aguada Member of the La Luna Formation (States of Trujillo and Lara). The upper part of the Seboruco, however, forms a wedge which extends as far as the Chejendé syncline, where it overlies the Aguada Member (Text fig. 62). In the Barquisimeto flysch basin, fragments of Cenomanian *Turrilites* were observed by the author in allochthonous blocks, e.g. in the Parapara region.

Ammonite genera which are widespread in the Cenomanian of Europe, such as *Stoliczkaia, Hyphoplites, Calicoceras, Mantelliceras* and *Schloenbachia,* have not been found in Venezuela to date. The majority of the Cenomanian ammonite specimens have been adversely affected by diagenesis. The original aragonite has been replaced by coarse calcite crystals, a process which destroyed the septa and the suture lines, thus making generic determination difficult. The assemblage of Cenomanian ammonites described in this monograph was collected in the synclinal regions of Chejendé (State of Trujillo) and Barbacoas (State of Lara; Text fig. 33 and 63). Few of the specimens are well preserved most having been badly crushed by compaction. Consequently it is impossible to extract and isolate the fossils from the hard limestone matrix. Specimens of the genus *Acanthoceras* are found to grow to very large size as can be seen on the right side of the road from Chejendé to Mitón where it crosses the La Puya Formation, which normally overlies the Peñas Altas Formation.

Largely because of the state of preservation, an ammonite zonation comparable to that by Thomel (1965) for the Cenomanian of southern France or by Marcinowski (1980) from eastern Europe cannot be recognized in Venezuela.

Text fig. 46
Lateral transition of a Paleocene *Lithothamnium-Ranikothalia* reef developed along the edge of the Maracaibo Platform, into basinal Barquisimeto flysch. Schematized, without scale.

Family Gaudryceratidae Spath, 1927

Genus *Anagaudryceras* Shimizu, 1934

Type species: Ammonites sacya Forbes, 1846.

Occurrence: Probably world-wide.

Anagaudryceras buddha (Forbes)
Pl. 20, Fig. 14a–b; Text fig. 47

1846 *Ammonites Buddha* Forbes, p. 112, pl. 14, fig. 9.
1846 *Ammonites Sacya* Forbes, p. 113, pl. 14, fig. 10.
1865 *Ammonites Sacya* Forbes, Stoliczca, p. 154, pl. 75, fig. 5–7.
1959a *Anagaudryceras Sacya* (Forbes), Matsumoto, p. 72, pl. 22, fig. 4, 5a–c.
1979 *Anagaudryceras buddha* (Forbes), Kennedy and Klinger, p. 146, pl. 8, fig. 1–3; pl. 9, fig. 1–3; pl. 10, fig. 1–6, pl. 11, fig. 1–2.

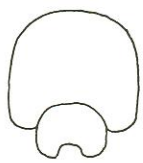
Holotype: Ammonites Buddha Forbes, pl. 14, fig. 9; refigured by Kennedy and Klinger, pl. 8, fig. 2a–b.

Location: Barbacoas, type section of Aguada Member, about 15 m above the top of the La Puya Formation, early Cenomanian.

Description: MBJ28508. Inner whorls coiling serpenticone. Umbilicus 35% of diameter, whorl section subrounded (Text fig. 47), sides faintly flattening towards end of outer volution on body chamber. Sculpture restricted to six faint, straight constrictions, slightly inclined forward. Fine growth lines are visible on test. Suture not exposed.

Measurements:	Dm	Wh	Ww	U
MBJ28508	43 mm	16 (0.37)	17 (0.40)	15 (0.35)
Holotype	?32 mm	0.35	0.41	0.41

Distribution: world-wide (Kennedy and Klinger, 1979, p. 152).
Time range: middle Albian to Maastrichtian.



Text fig. 47
Whorl section of *Anagaudryceras buddha* Forbes, MBJ28508, Pl. 20, Fig. 14a–b, 1×.

Family Desmoceratidae Zittel, 1895

Subfamily Desmoceratinae Zittel, 1895

Genus *Desmoceras* Zittel, 1884

Desmoceras cf. *chimuense* Benavides-Cáceres

Pl. 21, Fig. 3a–b

1956 *Desmoceras chimuense* Benavides-Cáceres, p. 438, pl. 41, fig. 5–8, holotype: fig. 7 and 8.

Location: Barbacoas, type section of Aguada Member, about 15 m above the top of the La Puya Formation, early Cenomanian.

Description: Re6824. Body chamber without test, partly compressed by compaction. Phragmocone retained the test. Whorl section rounded with slightly flattened sides, grading into semi-circular venter. Umbilical edge distinct, umbilical wall steep. Umbilicus 23% of diameter, thus noticeably wider than in *D. latidorsatum complanatum* Jacob (1908). Six constrictions, faintly developed on test of phragmocone, against five on holotype from Peru. Suture covered by test.

Measurements: Dm 55 mm, Wh 24 (0.43), Ww 22 (0.40), U 13 (0.23).

Distribution: Peru, Venezuela.

Family Schloenbachiidae Parona and Bonarelli, 1897

Genus *Niceforoceras* Basse, 1948

Type species: Niceforoceras colombianum Basse, 1948.

Occurrence: Colombia, ?Japan (Matsumoto, 1965a, p. 71).

Niceforoceras umbulaziforme Basse
Pl. 21, Fig. 2a–b

1948 *Niceforoceras umbulaziforme* Basse, p. 691, pl. 25, fig. 3–5.
1957 *Schloenbachia*(?) n. sp., Bürgl, p. 137, pl. 12, fig. 3a–b (early Cenomanian).
?1979 *Niceforoceras boyacaense* Etayo-Serna, p. 92, pl. 14, fig. 7.

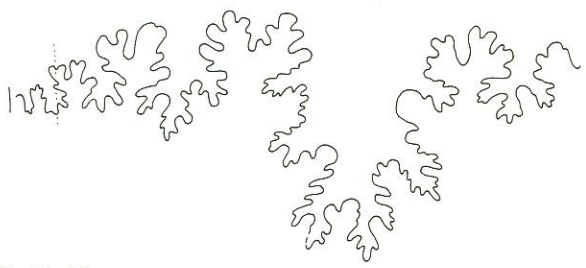
Location: Barbacoas syncline, Aguada Member, near type section, early Cenomanian.

Description: MBJ28511. Small specimen with test and peristome preserved. Whorl section compressed, thickest near mid-flank, flat-sided with fastigate venter. Umbilicus narrow, 14% of diameter; umbilical wall steep, grading narrowly into flank. Very fine, thin ribs or striae, parting from faint umbilical bullae. They cross flank in a biconcave curve and rise on shoulder, in obliquely placed, elongate small clavi, from which ribs project chevron-like forward over distinctly serrated keel. Suture not visible, as covered by test.

Measurements: Dm 28 mm, Wh 14.2 (0.51), Ww 7.2 (0.26), U 4 (0.14).

Distribution: Colombia, Venezuela.

Remarks: Abundant associated pelagic foraminifera, mainly *Hedbergella* and *Guembelina* are observed in thin sections.



Text fig. 48
Suture line of *Sharpeiceras occidentale* Benavides-Cáceres, JG394, Pl. 21, Fig. 1, 2×.

Family Acanthoceratidae de Grossouvre, 1894

Subfamily Mantelliceratinae Hyatt, 1903

Genus *Sharpeiceras* Hyatt, 1903

Type species: Ammonites laticlavius Sharpe, 1855.

Occurrence: Europe, South Africa, Madagascar, Syria, Iran (Kennedy et al., 1979), southern India, Texas, Brazil (Reyment and Tait, 1972), Peru, Venezuela.

Sharpeiceras occidentale Benavides-Cáceres
Pl. 21, Fig. 1; Text fig. 48

1956 *Sharpeiceras occidentale* Benavides-Cáceres, p. 465, pl. 54, fig. 5–6.

Location: Near Hacienda San Felipe, along road from Chejendé to Mitón. Upper Aguada Member, Cenomanian.

Description: JG394. Large sized, considerably crushed ammonite. Phragmocone attained about 150 mm diameter. Part of damaged outer volution which still belonged to phragmocone has been removed, to obtain additional information on venter. Whorl section, after reconstruction, high and compressed, subrectangular flat-sided, thickest at median lateral tubercles. Umbilicus 26% of diameter, widening towards living chamber. Flank gradually declining towards umbilical seam, without a clear edge. Venter concave between upper, large, spirally elongated ventrolateral clavi. About 28 single, radial ribs commence on umbilical slope, rising into subdued umbilical bullate elevations. Shorter intermediate ribs extend towards umbilicus or fade out around mid-flank. Mediolateral and lower ventrolateral tubercles conical. External suture with broad external saddle partly preserved (Text fig. 48).

Distribution: Peru, Venezuela.

Remarks: A very large *Sharpeiceras* (Re6833) reaching about 400 mm diameter after reconstruction, has been collected from the type section of the Aguada Member, about 10 m below its upper limit. The specimen is worn and not specifically determinable.

Subfamily Euomphaloceratinae Cooper, 1978

Genus *Romaniceras* Spath, 1923

Type species: Ammonites deverianus d'Orbigny, 1841.

Occurrence: Europe, Middle East, North Africa, Nigeria, Madagascar, southern India, Japan, British Columbia, USA, Mexico, Venezuela (Kennedy, Wright and Hancock, 1980).

Subgenus *Romaniceras (Romaniceras)* Spath, 1923

Romaniceras (Romaniceras) cf. *deverianum* (d'Orbigny)
Pl. 21, Fig. 7a–b; Text fig. 49

1841 *Ammonites deverianus* d'Orbigny, p. 346, pl. 110, fig. 1–2.
1857 *Ammonites deverianus* d'Orbigny, Sharpe, p. 43, pl. 19, fig. 3a–b.
1865 *Ammonites medlicottianus* Stoliczka, p. 77, pl. 43, fig. 1–1b.
1872 *Ammonites Deverianus* d'Orbigny, Fritsch, p. 32, pl. 7, fig. 4–5.
1894 *Acanthoceras pseudodeverianum* Jimbo, p. 178, pl. 21, fig. 1–1b.
1913 *Acanthoceras deverianum* d'Orbigny, Roman and Mazeran, p. 25, pl. 3, fig. 1–1a, 2–2a.
1939 *Romaniceras deveriai* d'Orbigny, Collignon, p. 93, pl. 8, fig. 2, 3–3a, pl. 9, fig. 1–1a.
1958 *Acanthoceras deverianum* (d'Orbigny), Zázvorka, pl. 1, fig. 1, 2.
1965a *Romaniceras deveriai* d'Orbigny, Collignon, p. 22, pl. 384, fig. 1655.
1980 *Romaniceras (Romaniceras) deverianum* (d'Orbigny), Kennedy, Wright and Hancock, p. 332, pl. 39, fig. 7–10; pl. 41, fig. 1–6; pl. 42, fig. 1–7; pl. 43, fig. 1–3; with full synonymy.

Location: Perijá foothills, Quebrada Tisine, a southern tributary of Río Yasa (23 km southeast of Machiques), 9 m above lower limit of La Luna Formation, ?late Cenomanian to early Turonian.

Description: Re2479. Internal mould. Living chamber well preserved, phragmocone entirely destroyed. Costal whorl section quadrate, moderately depressed, widest at lower lateral tubercles. Intercostal section convex, grading towards umbilical seam without a definable edge, and rounding into flat venter. Ribs bear four rows of tubercles: low bullae above umbilical seam, prominent lower lateral tubercles below mid-flank, low upper lateral tubercles and high ventrolateral clavate tubercles, at which ribs end. Along median line of venter elongate clavi, in line with ventrolateral clavi (Text fig. 49). Two short intermediate ribs arise gently up the sides and become equal to the long ribs from the upper lateral tubercles onwards.

Distribution: Europe, Algeria, Madagascar, southern India, Japan, Venezuela.

Subfamily Acanthoceratinae de Grossouvre, 1894

Genus *Acanthoceras* Neumayr, 1875

Subgenus *Pseudacanthoceras* Thomel, 1972

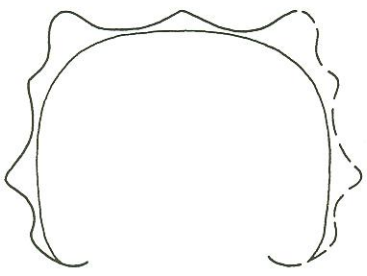
Type species: Acanthoceras tapara Wright, 1963.
Typical feature of subgenus: Siphonal tubercles disappear early in ontogeny.

Acanthoceras (Pseudacanthoceras) wintoni Adkins
Pl. 20, Fig. 13a–b; Text fig. 50a–b

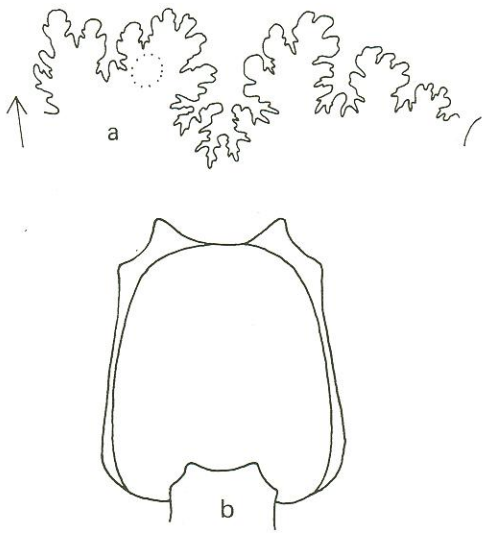
1927 *Acanthoceras* aff. *rothomagense* (Defrance), Moreman, p. 92, pl. 13, fig. 1.
1928 *Acanthoceras wintoni* Adkins, p. 243, pl. 25, fig. 2–3, holotype.
1942 *Acanthoceras wintoni* Adkins, Moreman, p. 202.
1951 *Acanthoceras wintoni* Adkins, Adkins and Lozo, p. 163, pl. 2, fig. 1.
1952 *Acanthoceras wintoni* Adkins, Stephenson, p. 200, pl. 45, fig. 7–8; pl. 46, fig. 1; pl. 47, fig. 1–2.
1970 *Acanthoceras wintoni* Adkins, Kennedy and Hancock, p. 487.
1972 *Acanthoceras (Pseudacanthoceras) wintoni* Adkins, Thomel, p. 153.

Location: Near type section of Aguada Member, in the Barbacoas syncline, Cenomanian. About 35 m above lower limit of member.

Description: MBJ28503. Conch of moderate size, compared with the very large *Acanthoceras* spread over the



Text fig. 49
Whorl section of *Romaniceras (Romaniceras)* cf. *deverianum* (d'Orbigny), Re2479, Pl. 21, Fig. 7. 3/4×.



Text fig. 50
Acanthoceras (Pseudacanthoceras) wintoni (Adkins), MBJ28503, Pl. 20, Fig. 13, a. suture line 2×; b. whorl section 1×.

Aguada Member. Phragmocone 68 mm diameter. Whorl section (Text fig. 50b) compressed, rapidly augmenting in height, flat-sided, widest below mid-flank. Venter concave, between strong ventrolateral clavi. Umbilicus 21% of diameter, with steep wall, rounding gently into flank. Ten long, about radial, straight, partly faintly flexuous ribs arise above umbilical seam and are elevated bullae-like on umbilical margin. They are intercalated by one or two short ribs which fade near or below mid-flank. Each rib bears a dorsal, rounded, ventrolateral tubercle, from where ribs project forward, ending at high peripheral clavi. Suture (Text fig. 50a) typical for genus.

Measurements: Dm 89 mm, Wh 32 (0.35), Ww 39 (0.43), U 19 (0.21).

Distribution: Texas, Venezuela.

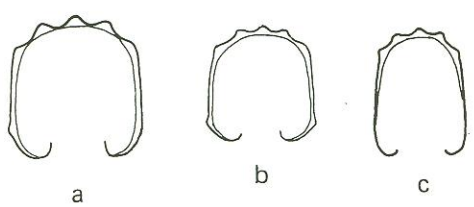
Genus *Protacanthoceras* Spath, 1923

Type species: Ammonites Bunburianus Sharpe, 1853.

Occurrence: England, France, North Africa (Furon, 1935), Syria, southern India, ?Madagascar.

Protacanthoceras bunburianum (Sharpe)
Pl. 20, Fig. 15a–b, 16a–b; Pl. 21, Fig. 4a–b, 5a–b, 6a–b; Text fig. 51a–c

1896 *Ammonites (Acanthoceras) hippocastum* Sharpe var. *compressum* in Jukes-Browne, p. 157, pl. 5, fig. 4, 4a.
1923 *Protacanthoceras compressum* (Jukes-Browne), Spath, p. 139, 149.
1925 *Acanthoceras hippocastum* (Sowerby) var. *compressa* Jukes-Browne and Hill, Diener, p. 161.
1946 *Protacanthoceras* ?cf. *Lyelliceras sheibei* Riedel, Sutton, p. 1650, pl. 5, fig. 3, 5 (Quebrada La Luna).
?1957 *Tarrantoceras* cf. *rotatile* Stephenson, Bürgl, pl. 12, fig. 2a–d.
1966 *Protacanthoceras compressum* (Jukes-Browne), Porthault, Thomel and Villoutreys, p. 430.
1969a *Protacanthoceras compressum* (Jukes-Browne), Thomel, p. 649.
1970 *Protacanthoceras* Spath, Kennedy and Hancock, definitions, p. 465.
1971 *Protacanthoceras compressum* (Jukes-Browne), Kennedy, p. 98, pl. 32, fig. 2a–d.
1972 *Protacanthoceras* (Jukes-Browne), Thomel, p. 100.
1976 *Protacanthoceras compressum* (Jukes-Browne), Kennedy and Hancok, pl. 12, fig. 5a–b.
1980 *Protacanthoceras bunburianum* (Sharpe), Wright and Kennedy, p. 91, fig. 29–33, 41–43, 48, with synonymy.



Text fig. 51
Whorl sections of *Protacanthoceras bunburianum* (Sharpe), a. JG439a, Pl. 21, Fig. 6; b. JG439b, Pl. 21, Fig. 5; c. JG439c, Pl. 21, Fig. 4, 2×.

Lectotype: Jukes-Browne, 1896, pl. 5, fig. 4, 4a, selected by Kennedy, 1971, p. 98.

Location: Chejendé region between La Ceiba and La Vichú, upper part of Aguada Member, late Cenomanian.

Description: Re6828, JG439a to c. Small moderately evolute ammonites with most of their living chambers preserved. Test predominantly retained. Whorl section on costae squared. Umbilical whorl low and steep. Umbilicus 31 to 34% of diameter. Early growth stages smooth up to about 7 mm diameter. Ribs branch irregularly and indistinctly from eleven bullate umbilical tubercles. Then they rise into lower, about conical to clavate ventrolateral tubercles, from which they turn slightly forward to rise again into upper ventrolateral clavi, ending at siphonal clavate tubercles. Shorter ribs mostly fade out below mid-flank, some terminate near umbilical margin. Several feeble single ribs without or with reduced tuberculation are restricted to body chambers. Suture not preserved.

The five specimens figured show that the ornament as well as the whorl sections (Text fig. 51a–c) vary considerably, mainly in density of ribs and in strength and shape of tubercles. None of the specimens at hand are identical in every feature.

Measurements:	Dm	Wh	Ww	U
JG439a, Pl. 21, Fig. 6	26 mm	10 (0.40)	11 (0.42)	8.5 (0.31)
JG439b, Pl. 21, Fig. 5	23.5 mm	9 (0.40)	7.5 (0.38)	8 (0.34)
JG439c, Pl. 21, Fig. 4	21 mm	8 (0.40)	8 (0.40)	7 (0.33)
JG439d, Pl. 20, Fig. 15	18.5 mm	7.5 (0.40)	7 (0.38)	6 (0.34)
Re6828, Pl. 20, Fig. 16	30 mm	12.5 (0.40)	11 (0.37)	10 (0.33)

Distribution: England, France, Venezuela.

Remark: P. compressum is found associated with the first small *Hoplitoides* and with ?*Nannovascoceras.*

Subfamily Metoicoceratinae Hyatt, 1903

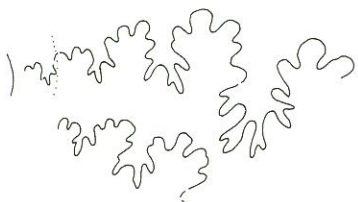
Genus *Metoicoceras* Hyatt, 1903

Type species: Ammonites swallowi Shumard, 1859.

Occurrence: Texas, Venezuela, India (Sastry and Matsumoto, 1967), western Europe (Leriche, 1905).

Metoicoceras sp., indet.
Pl. 20, Fig. 17a–b; Text fig. 52

Location: Barbacoas, lower Aguada Member, late Cenomanian.



Text fig. 52
Suture line of *Metoicoceras* sp., juvenile specimen, JG213c, Pl. 20, Fig. 17, 3×.

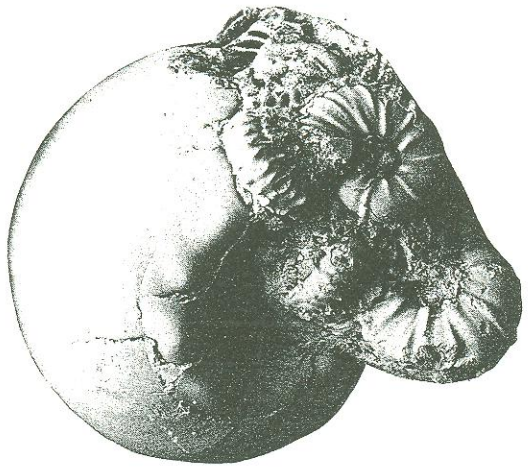
Description: JG213c. Juvenile compressed specimen with test partly retained. Whorl section, high-rectangular, thickest at umbilical margin. Sides parallel, flat. Venter tabulate, slightly elevated along median line. Ribs begin at umbilical margin and irregularly cross flank sigmoidally. Some branch indistinctly above umbilical margin; all end at blunt ventrolateral clavi. Suture partly preserved (Text fig. 52).

Measurements: Dm 27 mm, Wh 14.5 (0.50), Ww 9 (0.33), U 5 (0.19).

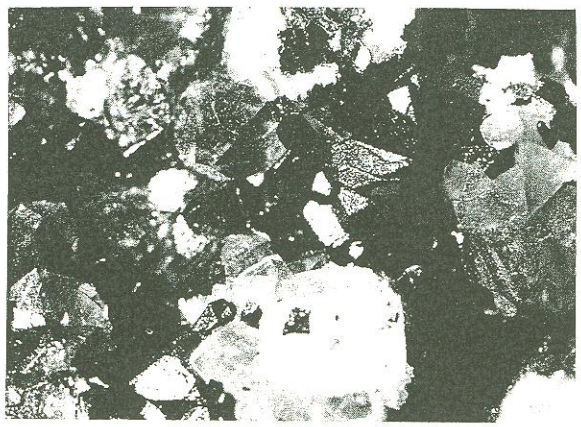
Remark: The small specimen described here can be compared with the inner whorls of *Metoicoceras muelleri* Cobban (1952, p. 49, pl. 8, fig. 1–2) in which the umbilicus, however, is narrower.

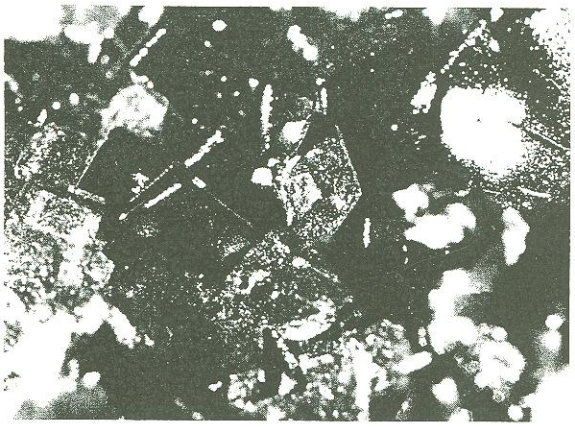
b. Systematic description of early Turonian ammonites
Text fig. 62, 63, 91

In western Venezuela most sections of the La Luna Formation contain ammonites of Turonian age. In the river sections which cross the foothills of the Perijá Range, several geologists have collected Turonian ammonites (Sutton, 1946; Rod and Maync, 1954; Renz, 1959a). In Táchira, where the Turonian and Cenomanian equivalents of the La Luna Formation are mainly developed in a shallow-water, mixed carbonate and clastic lithology, referred to as Guayacán limestone and as Seboruco shale Formations, conditions were not favourable for ammonites. A suitable environment, however, did prevail at that time in the Andes northeast of the Mérida Swell, in the States of Trujillo and Lara.
Towards the Barquisimeto Trough, to the east, the La Luna Formation gradually increases in thickness and shows a sedimentological diversification, which allows a subdivision into three members, from top to bottom:
Timbetes Member (Coniacian)
Chejendé Member (early and late Turonian)
Aguada Member (late Albian to Cenomanian)
In the Andes, the La Luna Formation has been investigated in great detail, especially in the Chéjende and Barbacoas regions. In the surroundings of the type sections of the Chejendé and Timbetes Members, between the villages of Chejendé and Mitón (Renz, 1959a, fig. 15, 16), the limestones which form the Aguada Member are conformably followed by a conspicuous interval of black shale of about 10 meters in thickness. This is interpreted as a northeastern wedge-like extension of the Seboruco Formation, which is exposed in Táchira and Mérida. The shale interval is overlain by black, light grey to reddish weathering marls, in which lenticular black, limestone layers are intercalated. These limestones, which contain abundant, partly ferruginous (pyritic), calcareous concretions of variable size (reaching up to one meter diameter) form part of the Chejendé Member. Large sized inoceramids such as *Mitiloides mitiloides* (Mantell), *Mitiloides opalensis elongatus* (Seitz) *Mitiloides subhercynicus?* (Seitz), can be seen on exposed surfaces. The examples quoted here are from the collection of R. Rutsch and were determined by E.C. Kauffman (1980).
Within the Chejendé Member, four distinct ammonite assemblages have been recognized. The oldest, *Assemblage 1,* is found within irregularly shaped concretions, up to 30 cm in diameter, which form a layer some two meters above the base of the member (Text fig. 62). The outcrop which yielded most of the specimens covers a surface area of some 50 m² and is situated a short distance away from the road between Chejendé and Mitón. It is close to the type section on the eastern flank of the syncline.
The manner in which this very rich assemblage, comprising species belonging to ten different genera, was concentrated together and preserved, is open to speculation. Transport and dumping of the ammonites by current action is suggested (Text fig. 53) and by the damaged state of the majority of the specimens. The phragmocones of the adult ammonites, having been cracked, were penetrated by sediment containing juvenile forms (Pl. 22, Fig. 20). The ammonite remains then become incorporated in lumps of carbonate mud which, by current action, were concentrated in depressions and hollows in the sea floor. This provides an explanation for the patchy, irregular distribution of the fossil occurrences today.
In addition to the exceptionally rich ammonite content, the concretions, composed of dark grey to black limestone, contain an abundance of other fossils. Small gastropods, heteropods, local clusters of small bivalves, inoceramids and a few poorly preserved pelagic foraminifera, notably *Rugoglobigerina,* are all present.
Traces of thermally altered oil are commonly observed associated with euhedral quartz crystals within the calcite filling the interior of the phragmocones (Text fig. 54). More rarely, larger cavities may be partially filled with the altered oil, the free surface being level. This phenomenon allows the attitude or orientation of the ammonite in the sediment at the time of thermal alteration to be deduced (Text fig. 55a).



Text fig. 53
Chaotic arrangement of ammonites within concretions. Exposed are *Fagesia, Nannovascoceras, Mitonia* and a juvenile *Vascoceras,* 1×.





Text fig. 54
Brittle, light reflecting bitumina (?impsonite) between bipolar quartz crystals (left) and covering calcite rhombohedra (right), 8× and 14.5×. Deposited within a chamber of *Sharpeiceras* (Pl. 21, Fig. 1).

The richness of Assemblage 1 and the presence of a complete mixture of maturity stages, from embryonic to adult, would suggest that the ammonites were surprised by an event which caused their premature deaths. Such an event could be envisaged as an upwelling of oxygen-deficient bottom waters.

It seems that such upwellings occurred periodically in this region of the basin (States of Trujillo and Lara) and also in the area of origin of the allochthonous blocks of the Guárico flysch near Ortiz. Similar occurrences are known from Trinidad (Late Cretaceous components in the Eocene Plaisance Conglomerate).

The juvenile ammonites are fully preserved with their living chambers. A great number of juvenile stages of *Vascoceras* and other genera are found together with relatively few adult specimens of the respective species. For the definition of juvenile specimens it is indispensable to obtain internal whorls of adult ones by preparation.

Assemblage 1 comprises the following genera which can be assumed to have cohabited during a comparatively limited time interval: *Fagesia, Vascoceras, Nannovascoceras, Pseudaspidoceras, Paramammites, Pseudoneoptychites, Mitonia, Mammites* and *Hoplitoides.*

Specimens of a number of ammonite genera which characterise Assemblage I have been made available to the author from the collection of Ch. Beck. These were collected on the Cerro de El Peñon, southeast of the town of Altagracia de Orituco in the State of Guárico, about 100 km southeast of Caracas. The assemblage consists of *Vascoceras venezolanum*, n.sp., forma b (umbilical tuberculation persists until the adult stage), *Paramammites polymorphus pinguis* (Pervinquière), *Mitonia venezolana* Renz and Alvarez, *Nannovascoceras constrictum* and *N. costatum* Renz and Alvarez, and a small fragment of *Hoplitoides.*

The presence of identical forms at localities separated by a distance of some 450 km. (Chejendé to Altagracia de Orituco) testifies to the uniform and stable conditions which prevailed during the Turonian.

The specimens which constitute *Assemblage 2* were collected along a trail leading from La Morita to Los Mamones, from a horizon some 15 m stratigraphically higher than Assemblage 1. The concretions in which the ammonites occur, are rather flat and lenticular and reach a diameter of around 30 cm. They are all rich in pyrite aggregations commonly weathered to a powdered iron oxide which has caused the fossils to be released from the matrix. The essential components of the fauna are small sized *Mammites nodosoides* (Schlotheim), *Nannovascoceras, Hoplitoides, Watinoceras* and a few small *Vascoceras.* Here also the ammonite-bearing concretions are found over a very limited area, outside of which the state of preservation is rather poor.

Assemblage 2a was collected from a concretionary horizon, intermediate in stratigraphic position between the levels which furnished Assemblages 2 and 3. The outcrop is located near a house named La Paragua. Its ammonite content, with forms which appear to link *Mammites* with *Benueites,* is of considerable interest and is comparable to that found in a boulder of the Eocene Plaisance Conglomerate in Trinidad.

Assemblage 2a is made up of small sized *Gaudryceras,* small highly diversified *Mammites spinosus* which pass through a series of intermediate forms into coarse ribbed *Benueites, Watinoceras, Neoptychites, Pseudaspidoceras* and ribbed *Hoplitoides,* not found in older sediments. *Vascoceras, Nannovascoceras* and *Pseudoneoptychites* common in Assemblage 1, are not found. The presence of a new species of *Mitonia,* a genus which would not be expected so high in the section is of particular interest. The concretions of Assemblage 2a consist of a hard, partly siliceous black limestone which appears rather uniform and devoid of foraminifera. On the other hand, the limestone abounds with small, undetermined bivalves and gastropods, which represent the major part of the sediment.

Assemblage 3 is found in small elliptical concretions of hard, black partly siliceous limestone rich in pyrite and concentrated in a zone close to the top of the Chejendé Member and just below a limestone of late Turonian age

containing large *Coilopoceras*. The ammonites of this assemblage, dominated by fine ribbed *Benueites*, were collected from an outcrop located near La Paragua. Associated with the ammonites are poorly preserved, specifically undeterminable globigerinids.
Genera such as *Collignoniceras* and *Prionocyclus*, abundant in the middle and upper Turonian from the Western Interior of the United States (Cobban and Hook, 1979, p. 7) do not appear in the La Luna Formation in Venezuela. Instead, the equivalent time interval in Venezuela is characterized by the presence of *Benueites*, the difference probably being a reflection of environmental conditions. For further sedimentological information on the La Luna Formation, the reader is referred to the publication of Ford and Houbolt (1963).

Distribution of ammonite genera from the lower Turonian section near La Morita (Assemblages 1, 2, 2a and 3).
Assemblage 1:
Nannovascoceras 40%
Vascoceras 25%
Pseudoneoptychites 15%
Mitonia 8%
Hoplitoides 5%
Pseudaspidoceras 2%
Paramammites 2%
Fagesia 1%
Mammites 1%
Puzosia 1%
Assemblage 2:
Mammites 40%
Nannovascoceras 24%
Vascoceras 18%
Hoplitoides 8%
Neoptychites 5%
Pseudaspidoceras 2%
Anagaudryceras 2%
Fagesia 1%
Assemblage 2a:
Mammites 40%
Benueites 33%
Hoplitoides 20%
Watinoceras 2%
Anagaudryceras 2%
Pseudaspidoceras 1%
Nannovascoceras 1%
Kamerunoceras ("Schindewolfites") 1%
Assemblage 3:
Benueites 100%

Family Diplomoceratidae Spath, 1926

Genus *Glyptoxoceras* Spath, 1925

Type species: Hamites rugatus Forbes, 1845.

Occurrence: Southern India, South Africa (Klinger and Kennedy, 1980), Venezuela.

Glyptoxoceras cf. *indicum* (Forbes)
Pl. 22, Fig. 7, 8

1846 *Hamites indicus* Forbes, p. 116, pl. 11, fig. 4.
1865 *Anisoceras Indicum* Stoliczka, p. 181, pl. 85, fig. 1-5.

Location and age: La Paragua, Chejendé Member, Assemblage 2a, early Turonian.

Description: Re6881. Spiral loosely coiled, as far as preserved planispiral. First stage of growth not available. Long, straight, final shaft represents body chamber. Section oval. Ribs close, round-topped, sharp, straight, as wide as interspaces, at right angles to longitudinal axis of shaft. Suture not visible.

Remarks: An identical specimen showing a more juvenile segment of the spiral was obtained from an allochthonous boulder collected by Vorwijk in the Guárico flysch near Los Robles de Ortiz, north of the town of Ortiz (sample VK1283B-3, Pl. 22, Fig. 8). The lithology of this allochthonous sample is identical to that in which Assemblage 2a was collected in the Chejendé syncline. The fauna of small bivalves and gastropods is also comparable. The sample also contained a specimen of *Benueites reymenti* Collignon.

Family Phylloceratidae Zittel, 1884

Genus *Phylloceras* Suess, 1865

Subgenus *Hypophylloceras* Salfeld, 1924

Phylloceratidae and Lytoceratidae are extremely rare in the La Luna facies. To date, only a single small-sized specimen of *Hypophylloceras* has been found in the La Luna Formation. It forms part of Assemblage 2a at La Paragua in the Chejendé syncline. Its age is considered to be late early Turonian. It would appear that the euxinic environment offered no favourable living conditions for the genera *Phylloceras* and *Lytoceras*.

Phylloceras (Hypophylloceras) cf. *masiaposensum* (Collignon)
Pl. 22, Fig. 21

1956 *Hyporbulites masiaposensis* Collignon, p. 18, pl. 1, fig. 7, 7a.
1965b *Hyporbulites masiaposensis* Collignon, p. 2, pl. 376, fig. 1634.

The *holotype* comes from the upper Turonian of Masiaposa (Madagascar).
Description: Re6936. Juvenile, wholly septate specimen with opposite side damaged by erosion. Whorl section compressed, oval, thickest below mid-side. Flanks moderately convex, converging towards narrowly rounded venter. Umbilicus relatively wide with 10% of diameter. Ornament consists of densely spaced fine, single ribs, strongest over venter. Ribs begin on umbilical slope and

cross flanks in a flexuous curve. Suture line not preserved.

Family Gaudryceratidae Spath, 1927

Genus *Anagaudryceras* Shimizu, 1934

Anagaudryceras sp. indet.
Pl. 22, Fig. 1–6

These small ammonites are commonly preserved complete with test and living chamber and some even with the aperture. As a group, they exhibit a wide variation in ornamentation; smooth, constricted and slightly ribbed forms all exist. In spite of an intense search, only one poorly defined suture line was found (Pl. 22, Fig. 2c). As it is not known whether the specimens are merely immature stages of *Anagaudryceras* no new names have been introduced.

Location: La Paragua, type section Chejendé Member, Assemblage 2a, late early Turonian.

Description: Re6857 (Pl. 22, Fig. 4a–b). Coiling serpenticone. Body chamber four-fifth volution. Whorl section circular faintly compressed. Umbilicus (50% of diameter) with low, rounded umbilical wall, grading into rounded flank and venter. Sculpture reduced to faint, shallow periodic constrictions not collared adorally, beginning on umbilical seam. They cross the venter in a broad forwardly projected bow. Aperture indicated by a collared constriction. Ornament reduced to growth lines. Suture line preserved at contact between calcite filling of phragmocone and sediment in body chamber, at a whorl height of 2.3 mm. It shows simplified external and lateral lobes.

Re6859 (Pl. 22, Fig. 3a–b). Largest specimen. Slightly compressed. Five shallow constrictions on internal mould of body chamber (last half whorl), the last one being wider and only partly preserved, indicating the aperture. Constrictions are faintly indicated on test.

Re6858 (Pl. 22, Fig. 6a–b). Whorl section depressed, slightly flattened over venter. Ornament consisting of seven broad, deep periodic constrictions on outer volution, beginning at umbilical seam and gradually flattening towards venter. Aperture indicated by last deep and wide collared constriction.

Re6860 (Pl. 22, Fig. 1a–b). Small specimen, distinctly ribbed on body chamber. Fine ribs separated by wide interspaces begin below mid-side and flatten out towards venter.

Re6861 (Pl. 22, Fig. 5a–b). Small, smooth form with collared aperture prolonged into a short rostrum with lirae, preserved on a fragment of test.

Re6898 (Pl. 22, Fig. 2a–c). Large specimen. No other sculpture than strongly forward projected growth striae on tongue-like rostrum of aperture. Last suture lines distinctly approaching towards end of phragmocone, suggesting adult stage (Text fig. 2c).

Measurements:	Dm	Wh	Ww	U
Re6857, Pl. 22, Fig. 4	14 mm	4 (0.29)	3.5 (0.25)	6.8 (0.50)
Re6859, Pl. 22, Fig. 3	16 mm	3.8 (0.24)	4 (0.25)	8 (0.50)
Re6858, Pl. 22, Fig. 6	15 mm	3.8 (0.25)	5.5 (0.33)	7 (0.47)
Re6861, Pl. 22, Fig. 5	12 mm	3 (0.25)	3.8 (0.32)	5 (0.41)
Re6898, Pl. 22, Fig. 2	17 mm	5.5 (0.32)	6 (0.35)	7 (0.41)

Genus *Zelandites* Marshall, 1926

Type species: Zelandites kaiparensis Marshall, 1926.

Occurrence: Europe, North and South Africa, Madagascar, India, Japan, USA, Alaska, Chile, New Zealand, Venezuela.

Zelandites sp. indet.
Text fig. 55b–c

In the rich collection from Assemblage 2 only one poorly preserved juvenile specimen of *Zelandites* has been identified. Its body chamber is fully preserved, but no suture line is exposed. It occurs together with small *Anagaudryceras* and well preserved *Rugoglobigerina.*

Location: Type section of Chejendé Member, Los Mamones, Assemblage 2, mid early Turonian.

Description: Re6945. Internal mould. Whorl section compressed, high-whorled. Before reaching the peristome the umbilicus (21% of diameter) expands feebly. Sculpture consists of seven broad, flat, slightly prorsiradiate constrictions crossing venter in a forward directed bow.

Measurements: Dm 24 mm, Wh 11 (0.46), Ww 8 (0.33), U 5 (0.21).

Family Desmoceratidae Zittel, 1895

Subfamily Puzosiinae Spath, 1922

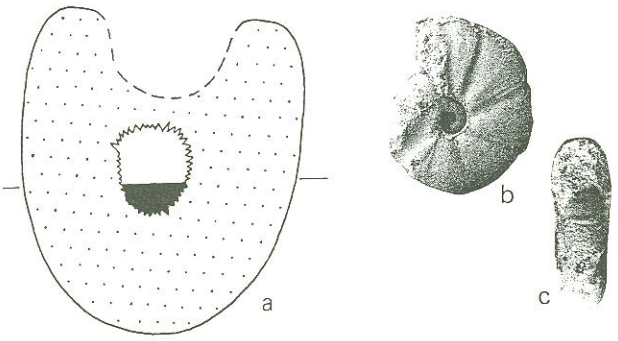
Genus *Puzosia* Bayle, 1878

Type species: Ammonites planulatus J. de C. Sowerby, 1827.

Occurrence: World-wide.

Puzosia aff. *orientalis intermedia* Matsumoto
Pl. 22, Fig. 9a–b; Text fig. 55a

1898 *Puzosia Gaudama* var. *intermedia* Kossmat, p. 116, pl. 17, fig. 3a–c.



Text fig. 55
a. *Puzosia* aff. *orientalis intermedia* Matsumoto, Re6907, Pl. 22, Fig. 9, in a cavity in calcite cement (stippled) oil is present which filled the cavity to a certain level and later became indurated, during the Andean orogeny, 1×.
b–c. *Zelandites*, sp. indet., Re6945 (J30471), Chejendé Member, Los Mamones, Assemblage 2, mid early Turonian, 1×.

1954 *Puzosia orientalis intermedia* Kossmat. Matsumoto, p. 76, pl. 12, fig. 2–3.
1959c *Puzosia orientalis intermedia* Matsumoto, p. 16, pl. 4, fig. 1.
1965b *Puzosia orientalis intermedia* Kossmat, Collignon, p. 4, pl. 377, fig. 1336.
1978 *Puzosia (Austiniceras) orientalis intermedia* Matsumoto, Cooper, p. 75, fig. 13.

Location: La Morita, type section of Chejendé Member, between Assemblages 1 and 2, early Turonian.

Description: Re6907. Single fragment, referable to the group of P. orientalis. Whorl section less compressed than on holotype (whorl width/whorl height 0.78 against 0.90 on present fragment). Otherwise diagnosis by Matsumoto applicable to present form. On test, ribs fine and narrow, fading out between mid-flank and umbilical margin, projected forward over venter. About six constrictions on outer whorl.

Remark: Original depositional position of the specimen can be deduced from the leveled surface of the thermally altered oil present in the cavity (Text fig. 55a.)

Genus *Mesopuzosia* Matsumoto, 1954

Type species: Mesopuzosia pacifica Matsumoto.

Occurrence: Southern India, Japan, Venezuela, Alaska (Jones, 1967).

Mesopuzosia sp. indet.
Pl. 40, Fig. 3a–b

Location: Chejendé syncline, Santa Rosa east of village of Chejendé, Chejendé Member, early Turonian. Coll. Manuel Morales.

Description: Re6928. Fragment showing beginning of body chamber. The specimen differs from *Puzosia orientalis* Matsumoto by ribs starting at the umbilical margin. Most ribs are single, turning adorally on ventral third of flank and crossing venter in a forward directed bow. On body chamber, ribs turn smooth. Partly preserved external suture line as on *Puzosia*.

Family Muniericeratidae Wright, 1952

Genus *Tragodesmoceras* Spath, 1922

Type species: Desmoceras clypealoide Leonhardt, 1897.

Occurrence: Germany (Kaever et al., 1974), France (Kennedy and Wright, 1981), Sweden, Madagascar, Texas (Eagle Ford, Moreman, 1942), Venezuela.

Tragodesmoceras sp. indet.
Text fig. 56

cf. 1971 *Tragodesmoceras carlilense* Cobban, p. 8, pl. 3, fig. 1, 2; pl. 4, fig. 1–16; pl. 5, fig. 1–5.

Location: Chejendé syncline, Santa Rosa east of Chejendé, Chejendé Member, early Turonian. Coll. Manuel Morales.

Description: Re6924. Only an external mould is available, which proves presence of this genus also in Venezuela. Cast prepared of araldite. It just shows the moderately evolute umbilicus with a steep umbilical wall, widely spaced periodic sigmoidally curved ribs, and intermediate ribs faintly indicated by their dorsal ends (arrows on Text fig. 56). The venter is missing. Fragments of desmoceratoid suture preserved on cast.

Text fig. 56
Tragodesmoceras sp. indet., cast of araldite of a specimen (Re6924) from the Chejendé Member, Santa Rosa, east of Chejendé, early Turonian, 3/4×.

Family Vascoceratidae Spath, 1925

Vascoceratidae are abundantly represented within Assemblage 1 (Text fig. 62, 63), by six genera which are: *Fagesia* Pervinquière, 1907; *Vascoceras* Choffat, 1898; *Paramammites* Furon, 1935; *Neoptychites* Kossmat, 1895; *Pseudoneoptychites* Leanza, 1967 and *Nannovascoceras* Renz and Alvarez, 1979. The genera *Gombeoceras* Reyment, 1954a; *Paravascoceras* Furon, 1935; *Pachyvascoceras* Furon, 1935; *Plesiovascoceras* Spath, 1925 and *Thomasites* Pervinquière, 1907, which are widely known from northern and western Africa and from western Europe have not been found to date in Venezuela.

On what regards the phylogeny of the Vascoceratidae, as presented by Cooper (1979, p. 122), we cannot contribute with the material restricted to one narrow interval (Assemblage 1).

Genus *Nannovascoceras* Renz and Alvarez, 1979

Type species: Nannovascoceras intermedium Renz and Alvarez, 1979.

Occurrence: Venezuela.

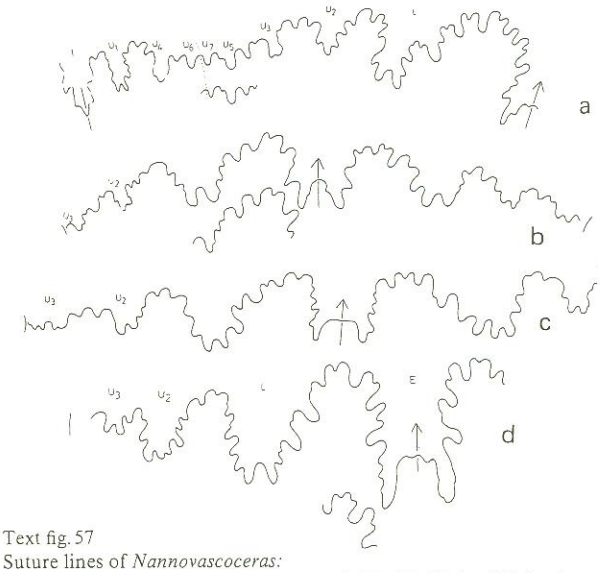
The genus *Nannovascoceras* is most abundant in Assemblages 1 and 2. Its earliest occurrence is found above *Protacanthoceras,* at a level where typical *Vascoceras* have so far not been observed. It attains its maximum development within Assemblages 1 and 2, and then suddenly disappears. Higher in the section, only one small specimen with a wide umbilicus has been observed in association with an abundance of *Hoplitoides* in the interval separating Assemblage 2 from Assemblage 2a (Pl. 22, Fig. 22).

Nannovascoceras constrictum Renz and Alvarez
Pl. 22, Fig. 10a–b, 14a–b, 17a–b, 18a–b; Text fig. 57a, d

1979 *Nannovascoceras constrictum* Renz and Alvarez, p. 978, fig. 2e–h, holotype: fig. 3e–f.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early Turonian.

Description: Re6799-106. Relatively large-sized specimen, with fully preserved body chamber attaining about three quarter volution. Whorl section slightly depressed, with widely arched venter, no distinct shoulder. Umbilicus moderately evolute, 35% of diameter. Ornament on phragmocone restricted to slightly prorsiradiate constrictions curved forward over venter, preceeded by a strong rib and followed by a weaker one. On body chamber ribs strengthen towards peristome. Ribs begin on rounded umbilical margin and cross flank following constrictions. External suture vascoceratid, exceptionally well preserved (Text fig. 57a, d). Dorsal slope of external saddle tends to break up into adventitious elements.



Text fig. 57
Suture lines of *Nannovascoceras:*
a. *N. constrictum* Renz and Alvarez, Re6799-107, Chejendé Member, La Morita, Assemblage 1, 5×.
b. *N. costatum* Renz and Alvarez, Re6799-98, Pl. 22, Fig. 12, 5×.
c. *N. costatum* Renz and Alvarez, Re6799-104, Pl. 22, Fig. 11, 5×.
d. *N.* cf. *constrictum* Renz and Alvarez, Re6799-106, Pl. 22, Fig. 17, 5×.

Re6799-126, Assemblage 2. A compressed variety with flattened flanks and a more shallow umbilicus.

Re6799-127, Assemblage 1. Immature specimen showing constricted stage.

Re6799-128, Assemblage 1. Deep and densely constricted variety with a wider whorl section and a narrower umbilicus.

Measurements:	Dm	Wh	Ww	U
Re6799-106, Pl. 22, Fig. 17	34 mm	12 (0.35)	13 (0.38)	12 (0.35)
Re6799-126, Pl. 22, Fig. 18	24 mm	9 (0.37)	8 (0.33)	8 (0.33)
Re6799-128, Pl. 22, Fig. 10	21 mm	9 (0.43)	10 (0.48)	5 (0.20)
Re6799-127, Pl. 22, Fig. 14	19 mm	7 (0.36)	7 (0.36)	6 (0.32)

Nannovascoceras intermedium Renz and Alvarez
Pl. 22, Fig. 13a–b, 16a–b

1979 *Nannovascoceras intermedium* Renz and Alvarez, p. 978, fig. 2i–q, holotype: fig. i, k.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early Turonian.

Description: Re6799-129. Body chamber preserved. Whorl section slightly higher than wide. Sides flatly convex, grading into broadly rounded venter. Umbilicus 24% of diameter. Costation on interspaces between constrictions is far advanced, but constrictions are still clearly definable.

Re6799-130, Assemblage 1. A less ribbed example intermediate between *N. constrictum* and *N. intermedium.*

Measurements:	Dm	Wh	Ww	U
Re6799-129, Pl. 22, Fig. 16	25 mm	11 (0.44)	10 (0.40)	6 (0.24)
Re6799-130, Pl. 22, Fig. 13	24 mm	10 (0.42)	9 (0.37)	6 (0.25)

Nannovascoceras costatum Renz and Alvarez
Pl. 22, Fig. 11a–b, 12a–b; Text fig. 57b–c

1979 *Nannovascoceras costatum* Renz and Alvarez, p. 979, fig. 2r–v, holotype: fig. 2r, s.
?1979 *Lewesiceras? ulloai* Etayo-Serna, p. 36, pl. 13, fig. 7.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early Turonian.

Description: Re6799-104. Body chamber three quarter volution. Whorl section as wide as high. Costation superimposed on constrictions. Stronger primary ribs elevated into bullae of irregular size on rounded umbilical margin. Shorter intermediate ribs intercalated. Subdued branching occurs on umbilical bullae. Constrictions indistinctly indicated by wider interspaces. Suture line well preserved, typical for genus (Text fig. 57c).

Re6799-98, Assemblage 1. Costation more pronounced, otherwise comparable with previous specimen. Suture identical as on *N. constrictum* (Text fig. 57b).

Measurements:	Dm	Wh	Ww	U
Re6799-104, Pl. 22, Fig. 11	28 mm	11 (0.40)	11 (0.40)	7 (0.26)
Re6799-98, Pl. 22, Fig. 12	24 mm	10 (0.42)	10 (0.42)	6 (0.25)

Nannovascoceras sp. indet.
Pl. 22, Fig. 22a–b

Location: Type section of Chejendé Member, La Paragua. Stratigraphically youngest *Nannovascoceras,* obtained from a concretion containing abundant *Hoplitoides* in the interval between Assemblage 2 and 2a, late early Turonian.

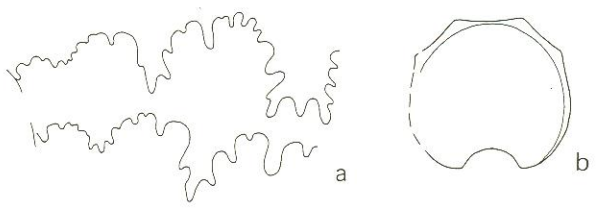
Description: Re6937. Small, wholly complete single specimen. Whorl section faintly wider than high. Umbilicus 39% of diameter, thus larger than on most *Nannovascoceras.* On outer whorl ten ribs, bound adaptically and adorally by equally deep constrictions which approach each other towards aperture. Faint intermediate ribs between constrictions become more pronounced towards end of body chamber. Last suture line indistict.

Measurements: Dm 18 mm, Wh 6 (0.33), Ww 6.8 (0.37), U 7 (0.39).

Remark: For establishing a new species of *Nannovascoceras* additional material from this level would be required.

?*Nannovascoceras* sp. indet.
Pl. 25, Fig. 9a–b; Text fig. 58

Location: La Luna section along road from Egido to Carbonera, 200 m downstream from crossing over the Quebrada Azulita (Estado Mérida). Exact position in the Turonian is not known.



Text fig. 58
Whorl section and suture line of ?*Nannovascoceras* sp. indet., Re6895, Pl. 25, Fig. 9, suture 5×, whorl section 1,5×.

Description: Re6895. Single, small sized ammonite. Body chamber occupies last half of outer volution. Whorl section rounded, slightly depressed. Sides merging evenly into umbilical wall. Umbilicus 31% of diameter, rather wide for *Nannovascoceras.* On outer volution eight constrictions, bound by more or less strong ribs behind and in front. Some of strongest ribs swell into faintly bullate elevations above umbilical wall and into very subdued lower and upper ventrolateral nodes from where ribs project forward over rounded venter. Between constrictions weak ribs with no tuberculations occur. External suture line (Text fig. 58) comparable with that of *Nannovascoceras.*

Measurements: Dm 33.5 mm, Wh 12.5 (0.31), Ww 14 (0.42), U 12 (0.31).

Genus *Fagesia* Pervinquière, 1907

Type species: Olcostephanus superstes Kossmat, 1897.

Occurrence: Europe, North Africa, Israel, Nigeria, Gabon, Madagascar, India, Japan, New Caledonia, Colombia, Mexico, Texas, California, Venezuela.

All specimens here attributed to Fagesia are distinguished by their suture line, characterized by more or less symmetric lobes and saddles as on the type species from India (Kossmat, 1897; p. 133, pl. 17, fig. 1a–c). Eck (1909, p. 181) already considered the suture with its deeply segmented external saddle as diagnostic. This is not, however, valid if the deeply incised saddles are considered, since they occur equally on both *Fagesia* and *Vascoceras.* Barber (1957, p. 13) gives more importance to whorl width and ornament. "The fallibility of the suture-line as a diagnostic character is well illustrated by a series comprising *V. globosum* (Reyment) and its subspecies. All members of this series have deeply incised suture-lines similar to that of the type species of *Fagesia*". Chancellor, Reyment and Tait (1977, p. 91) also prefer this interpretation.
In Venezuela, *Fagesia,* as defined above, has been found together with *Vascoceras* in Assemblage 1. Stronger ribbed forms occur relatively rarely in Assemblage 2. Higher in the section, in Assemblage 2a, the presence of *Fagesia* remains in doubt.

Fagesia levis n. sp.
Pl. 22, Fig. 20a–b, Pl. 23, Fig. 1a–b, 2a–b, 3a–b; Text fig. 53, 59a, c

Holotype: Re6799-109 (Pl. 23, Fig. 2), deposited with Maraven S.A., Caracas.

Location: La Morita, type section Chejendé Member, Assemblage 1.
Age: early early Turonian.

Description of holotype: Adult smooth stage. Conch vat-like, coronate as in *Fagesia superstes*. It differs by the absence of a median ribbed stage. Tuberculation on umbilical edge changes into irregularly shaped bulges at an early growth stage. Growth lines cross venter in a wide forward projected arch. Suture (Text fig. 59a) typical for genus.
Paratype 1. Re6799-17 (Pl. 23, Fig. 1, Text fig. 53). Identical with holotype. Associated with *Pseudoneoptychites andinus* Leanza, on left side, and *Mitonia gracilis*, on right side of figure.
Paratype 2. Re6799-15 (Pl. 22, Fig. 20), a fully septate, very large specimen may belong to this species. Bulges on umbilical edge irregularly obliquely elongated. A juvenile *Vascoceras* penetrated into the conch through a hole in the test.
Paratype 3. Re6799-119 (Pl. 23, Fig. 3), juvenile constricted stage. Ornament reduced to pronounced periodical constrictions.

Measurements:	Dm	Wh	Ww	U
Re6799-109, holotype at	52 mm	21 (0.40)	50 (0.96)	14 (0.27)
Re6799-17, paratype 1	62 mm	20 (0.32)	56 (0.91)	20 (0.32)
Re6799-15, paratype 2	95 mm	36 (0.38)	92 (0.97)	31 (0.32)
Re6799-119, paratype 3	26 mm	11 (0.43)	22 (0.90)	6 (0.23)

Remarks: Vascoceras globosum carteri Barber (1957, p. 25, pl. 8, fig. 2) and *Paravascoceras carteri* (Barber), Chancellor et al. (1977, fig. 15–17) differ from the present species by a wide vascoceratid, asymmetric lateral lobe and the loss of umbilical tuberculation at an early stage.

Fagesia bomba Eck (1909, p. 181, fig. 1–5 and 1914, p. 197, pl. 18, fig. 1, 2) with deeply frilled saddles does not show the faint ribbing characteristic for *Fagesia levis*, but is also devoid of umbilical tuberculation.

Fagesia aff. *superstes* (Kossmat)
Pl. 22, Fig. 19a–b; Pl. 23, Fig. 4a–b; Text fig. 59b

1897 *Olcostephanus superstes* Kossmat, p. 133, pl. 17, fig. 1.
1903 *Pachyceras superstes* Kossmat, Pervinquière, p. 96, 99, 101.
1907 *Fagesia superstes* Kossmat, Pervinquière, p. 322, pl. 20, fig. 1–4.
1940 *Fagesia superstes* (Kossmat), Basse, p. 459.
cf.
1965b *Fagesia superstes* Kossmat var. spheroidalis Pervinquière, Collignon, p. 46, pl. 395, fig. 1677.
1969 *Fagesia* cf. *F. superstes* (Kossmat), Freund and Raab, p. 35, text fig. 7f, suture.

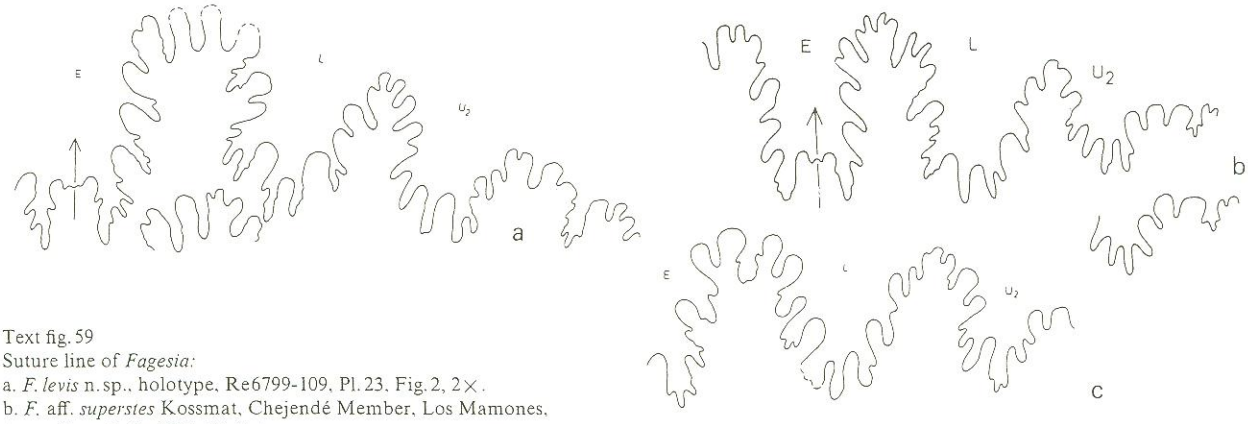
Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Re6799-111 (Pl. 23, Fig. 4). Body chamber not preserved. Transition of ribbed stage into adult stage (with very faint costation) at about 45 mm diameter. Conch vat-like coronate. Whorl section semilunar, slightly wider than diameter. Umbilicus deep, steep-sided. Umbilical edge with 10 to 12 tubercles, variable in distance and size. Ribs more or less distinctly divide in pairs from umbilical tubercles, and cross venter in a slightly forward directed arch. Suture line with symmetrical lateral lobe (Re6799-16, Text fig. 59b) is typical for genus (specimen not figured).

Re6799-1 (Pl. 22, Fig. 19), median ribbed stage. Costation is exposed more clearly than on previous specimen.

Measurements:	Dm	Wh	Ww	U
Re6799-111	64 mm	21 (0.33)	70 (1.09)	20 (0.31)
Re6799-1	47 mm	18 (0.38)	42 (0.90)	16 (0.34)

The Venezuelan specimens only differ from *Fagesia superstes spheroidalis* Pervinquière (1907, p. 133, pl. 17,



Text fig. 59
Suture line of *Fagesia:*
a. *F. levis* n. sp., holotype, Re6799-109, Pl. 23, Fig. 2, 2×.
b. *F.* aff. *superstes* Kossmat, Chejendé Member, Los Mamones, Assemblage 2, Re6799-16, 2×.
c. *F. levis* n. sp., paratype 2, Re6799-15, Pl. 22, Fig. 20, 1×.

fig. 1) described by Collignon (1965b, p. 46, fig. 1677) from Madagascar, in that they possess a narrower umbilicus.

Fagesia cf. *thevestensis* Peron
Pl. 22, Fig. 15a–b

1896 *Mammites? Thevestensis* Peron, p. 23, pl. 7, fig. 2, 3.
1907 *Fagesia Thevestensis* Peron, Pervinquière, p. 325, pl. 20, fig. 5a–b holotype, fig. 6a–b; suture, p. 326, fig. 123–124.

Location: Road from Chejendé to Mitón, Quebrada San Felipe, Chejendé Member, early early Turonian, exact stratigraphic level not known.

Description: JG408. Rather juvenile specimen. Shell cadicone, but less globular than *F. superstes*. Umbilicus 33% of diameter. From 12 blunt umbilical tubercles, slightly changing in strength, two round-topped ribs originate. Some intermediate ribs reach umbilical margin, but remain non-tuberculate. All ribs cross broad venter slightly curving adaptically. No constrictions at that size. Suture line not visible.

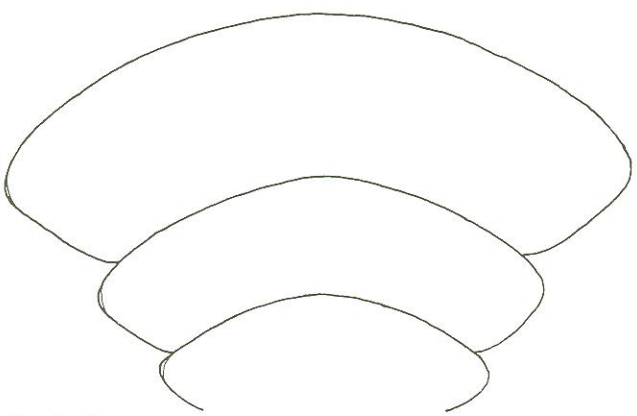
Measurements:	Dm	Wh	Ww	U
JG408	33 mm	12 (0.36)	24 (0.73)	11 (0.33)
Holotype	54 mm	25 (0.46)	36 (0.66)	18 (0.33)

Fagesia aff. *haarmanni* Böse
Text fig. 60

1918 *Fagesia Haarmanni* Böse, p. 211, pl. 14, fig. 1, 2, lectotype; pl. 15, fig. 2.
1954 *Fagesia haarmanni* Böse, Kummel and Decker, p. 313, Text fig. 3.
1963a *Fagesia haarmanni* Böse, Powell, p. 320, pl. 33, fig. 2; pl. 34, fig. 1–5, text fig. 2h–k.

Location: Los Mamones, Chejendé Member, Assemblage 2, mid early Turonian, together with *Watinoceras*.

Description: Re6903. One very large fragment: whorl height 176 mm, whorl width 70 mm, distinguished by a wide umbilicus. It represents an adult stage with living chamber ending in a simple peristome following growth lines. Whorl section very depressed. Sides and umbilical wall slope evenly and steeply from sharp umbilical edge towards umbilical seam, as well as towards widely rounded venter. Besides wide, low bulges on umbilical edge no sculpture at that size. Internal whorls destroyed.



Text fig. 60
Whorl section of *Fagesia* aff. *haarmanni* Böse, Chejendé Member, Los Mamones, Assemblage 2, Re6903, 1/2×.

Distribution: Mexico, Venezuela.

Remarks: The lectotype of *F. haarmanni* possesses considerably larger bulges on umbilical edge than this specimen. It would be premature to establish a new species based on the present material.

?*Fagesia* sp. indet.
Pl. 24, Fig. 11a–b

Location: Type section of Chejendé Member, La Paragua, Assemblage 2a, late early Turonian.

Description: Re6939. Single specimen with test preserved. Whorl section subtrapezoidal with sides rounded and venter slightly flattened. Umbilicus 30% of diameter, moderately deep. Umbilical wall vertical, umbilical margin rounded and ornamented with eleven bullate tubercles from which two ribs part more or less distinctly. Some intercalated ribs attain umbilical margin, others end below mid flank. Ribs round-topped, weakly prorsiradiate, curving faintly forward over venter. Suture line not exposed. End of phragmocone indicated by contact of calcite cement with sediment.

Measurements: Dm 32.5 mm, Wh 13 (0.40), Ww 18.5 (0.57), U 10 (0.30).

Remarks: This doubtful *Fagesia* occurs together with *Benueites* at a level where *Vascoceras* seems to be rare in the sections so far studied in Venezuela.

Genus *Vascoceras* Choffat, 1898

Type species: Vascoceras gamai Choffat, 1898.

Occurrence: Europe, Israel, North Africa, Nigeria, Niger, Sudan, Madagascar, Brazil, Peru, Colombia, Venezuela, Mexico, USA.

The genus is abundantly represented in Assemblage 1, all forms being characterized by wide, asymmetric lateral lobes, which begin to divide into accessory elements, thus introducing a pattern characteristic for the Coilopoceratidae. Owing to inadequate preservation it is not possible to clarify the ontogenetic development of the suture line. By their ornament three different growth stages, comparable to those exhibited by *Fagesia*, can be recognized on Venezuelan *Vascoceras*. The sculpture on the juvenile stage is restricted to periodic constrictions bound adaptically and adorally by more or less coarse ribs. On the succeeding median ribbed stage, the ribs develop be-

tween constrictions to such a degree that the constrictions themselves, being superimposed by ribbing, become indistinct. On the outer volution of the phragmocone and on the body chamber both ribs and constrictions gradually fade. Ornament on different individuals of distinct subspecies shows a high variability, mainly in strength and extension of costation. A conspicuous tuberculation on the umbilical margin lasting to the adult stage is common to all Venezuelan *Vascoceras*. A large fragment (Re6799-121, whorl height 33 mm, whorl width 120 mm) still shows conspicuous large umbilical bulges on living chamber. This serves to distinguish the Venezuelan *Vascoceras* from those of Egypt (Greco, 1915); Nigeria (Reyment, 1954a and Barber, 1957); Tinrhert, Fezzan in Libya (Collignon, 1957); Mexico (Powell, 1963a) and Brazil (Reyment and Tait, 1972).

Vascoceras globosum globosum (Reyment) from Nigeria and Mexico loses its umbilical tuberculation between 28 to 30 mm diameter. These *Vascoceras* may belong to a stratigraphic level which is devoid of ammonites in Venezuela.

Of the numerous species of *Vascoceras* described by Choffat (1898) from Portugal, none can be recognized with certainty in the Venezuelan assemblage. *Vascoceras gamai* Choffat (p. 54, pl. 7) is distinguishable (like most other species from Portugal) by its wide umbilicus.

Berthou and Lauverjat (1974, p. 2605) have shown that in Portugal *Vascoceras gamai* Choffat and *Vascoceras mundae* Choffat (pl. 10, fig. 1) are accompanied by a microfauna which indicates a Cenomanian age. The zone is referred to as "Zone à *Vascoceras gamai-mundae*". The early Turonian of Portugal is characterized by the "*Pachyvascoceras douvillei-durandi* Zone", which corresponds to the *Fagesia superstes* Zone in southeastern France, (Thomel, 1969b). We may thus conclude that Assemblage 1 in Trujillo, which contains *Fagesia,* correlates with intervals H to K (early Turonian) in Portugal. The interval E to G (late Cenomanian–early Turonian in Portugal) may thus be time-equivalent with the zone of black shale, below Assemblage 1 (Text fig. 62) which does not contain any ammonites.

To distinguish the Venezuelan *Vascoceras* a new species called *Vascoceras venezolanum* n. sp. is introduced. The introduction of additional new species seems inappropriate at present. Our knowledge on the ontogenetic evolution of the sculpture from juvenile to adult is incomplete, as only few adult specimens are available. Possible future species are indicated with "forma a to e".

Vascoceras venezolanum n. sp.
Pl. 23, Fig. 5a–b, 6a–b, 7a–b; Text fig. 61i

Holotype: Re6799-20 (Pl. 23, Fig. 5). Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description of holotype: Conch moderately inflated, subelliptical. Body chamber forms last fifth of outer volution. Umbilicus deep and steep-sided, 13% of diameter. Whorl section compressed (body chamber) to slightly depressed, widest on umbilical tubercles which show considerable irregularities in size, and become subdued on body chamber. Flanks converge gently, grading into broadly rounded venter. Ribbed stage ends between 20 and 30 mm diameter. Ribs arise indistinctly from umbilical tubercles, cross sides slightly prorsiradiate, faintly inclined forward from shoulder, over widely rounded venter. Suture (Text fig. 61i) typical for genus.

Paratype 1: Re6799-21 (Pl. 23, Fig. 6). Middle sculptured stage with periodic constrictions separated by intervals bearing two to three ribs, attenuating towards umbilical edge.

Paratype 2: Re6799-19 (Pl. 23, Fig. 7). Constricted juvenile stage lasting to about 20 mm diameter. Intervals between periodic constrictions smooth. Strong ribs, adorally of constrictions, fade towards umbilicus.

Measurements:	Dm	Wh	Ww	U
Re6799-20, holotype	82 mm	43 (0.52)	38 (0.46)	11 (0.13)
Re6799-21, paratype 1	52 mm	24 (0.46)	30.5 (0.58)	8 (0.15)
Re6799-19, paratype 2	36 mm	19 (0.53)	21 (0.60)	5.5 (0.15)

Remarks: Vascoceras durandi Thomas and Peron, figured by Pervinquière from Tunisia (1907, pl. 21, fig. 1) as well as *Vascoceras cauvini* Chaudeau (1909, pl. 1–3) differ from the present species by their pronounced ornamentation. *V. venezolanum* differs from *Pachyvascoceras* Furon, 1935 in that the umbilical tuberculation is maintained until the adult stage.

Vascoceras venezolanum n. sp., forma a
Pl. 23, Fig. 8a–b, 9a–b, 10a–b, 11a–b; Text fig. 61a–b, f, l

Re6799-33 (Pl. 23, Fig. 8), deposited with Maraven S.A., Caracas.

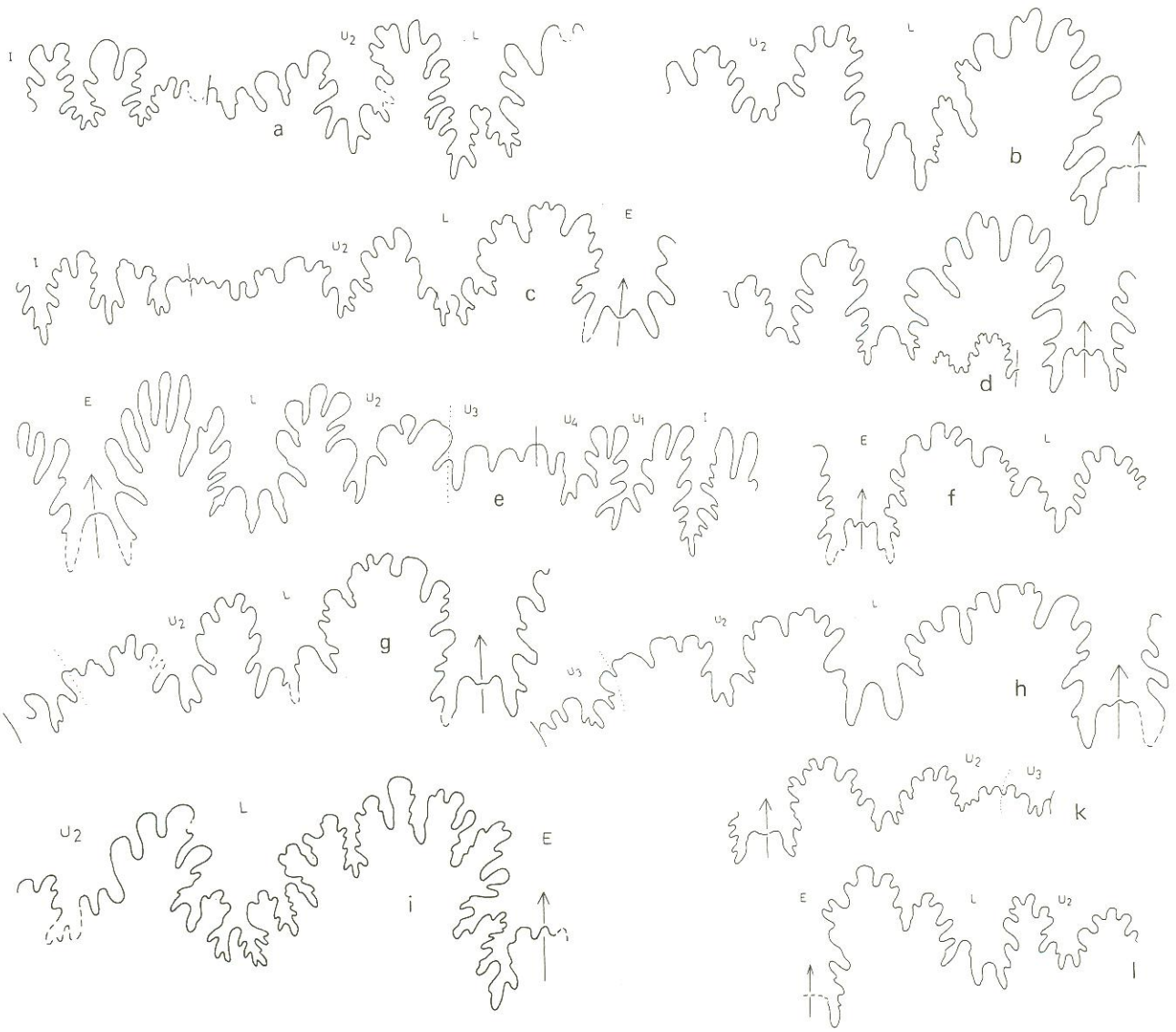
Location: La Morita, type section Chejendé Member, Assemblage 1, early early Turonian.

Description: Body chamber last half volution. It differs from holotype of *V. venezolanum* by its dense, fine costation. Ribs arise from closely spaced, small, bullate tubercles on umbilical edge (13 on last whorl). Numerous shorter ribs, variable in length, are intercalated. Towards body chamber costation flattens gradually. Suture lines (Text fig. 61b, f, l) typical for genus.

Re6799-6 (Pl. 23, Fig. 11). Well preserved median, densely ribbed stage with subdued constrictions.

Re6799-131 (Pl. 23, Fig. 9) and Re6799-28 (Pl. 23, Fig. 10) show the rather constant pattern of ribs of the inner volutions. Suture Text fig. 61l, f.

Measurements:	Dm	Wh	Ww	U
Re6799-33	52 mm	24 (0.46)	29 (0.56)	11 (0.21)
Re6799-6	38 mm	17 (0.45)	22 (0.58)	7 (0.20)



Text fig. 61
Suture lines of *Vascoceras:*
a. *V. venezolanum* n. sp., forma a, Re6799-45, Chejendé syncline, Assemblage 1, 2×.
b. *V. venezolanum* n. sp., forma a, Re6799-33, Pl. 23, Fig. 8, 3×.
c. *V. venezolanum* n. sp., forma e, Re6799-39, Chejendé syncline, Assemblage 1, 3×.
d. *V. venezolanum* n. sp., forma c, Re6799-47, Pl. 24, Fig. 6, 3×.
e. *V. venezolanum* n. sp., forma d, Re6799-133, Assemblage 1, 1.5×.
f. *V. venezolanum* n. sp., forma a, Re6799-28, Pl. 23, Fig. 10, 5×.
g. *V. venezolanum* n. sp., forma c, Re6799-123, Pl. 24, Fig. 7, 4×.
h. *V. venezolanum* n. sp., forma e, Re6799-108, Pl. 25, Fig. 8, 3×.
i. *V. venezolanum* n. sp., holotype, Re6799-20, Pl. 23, Fig. 5, 2×.
k. *V. venezolanum* n. sp., forma b juvenile stage, Re6799-132, Pl. 24, Fig. 2, 3×.
l. *V. venezolanum* n. sp., forma a, Re6799-131, Pl. 23, Fig. 9, 5×.

Re6799-131	31 mm	15 (0.48)	18 (0.58)	6 (0.19)
Re6799-28	33 mm	15 (0.45)	10 (0.48)	6 (0.18)

Vascoceras venezolanum n. sp., forma b
Pl. 24, Fig. 1a–b, 2a–b, 3a–b; Text fig. 61k

Re6799-102 (Pl. 24, Fig. 1). Deposited with Maraven S.A., Caracas.

La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Adult stage. Conch globose, almost spherical. End of last whorl belongs to body chamber. According to traces of umbilical seam preserved on outer whorl, the shell reached about 160 mm diameter. Whorl section semilunar. Umbilicus different in width: right side 16%, left side 18% of diameter, which shows that the width of the umbilicus is no specific feature as long as its variation remains within low limits. Umbilical wall high, steep. Ornament restricted to very faint, broad folds on test, parting from bulges on umbilical margin and superimposed by growth lines crossing venter in a forward

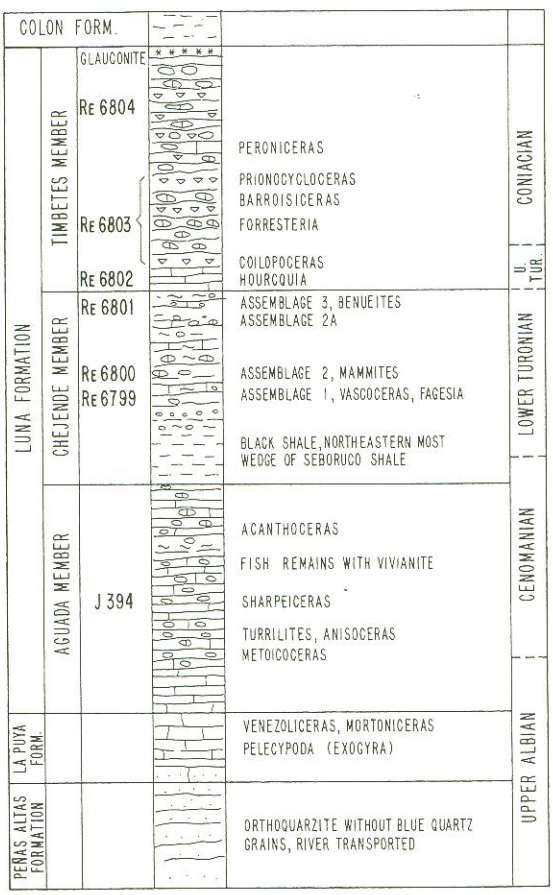
directed curve. Bulges on umbilical margin variable in size and distance. Suture not exposed.

Re6799-4 (Pl. 24, Fig. 3). Median ribbed stage. Sculpture consists of very faint folds between constrictions which vanish at about 25 mm diameter. Folds parting from tubercles vary in height and distance.

Re6799-132 (Pl. 24, Fig. 2). Juvenile constricted stage obtained from larger specimen by preparation. Constrictions bound by ribs adaptically and adorally. Intervals between constrictions smooth. Some intermediate ribbing develops on outer half of the whorl. Suture (Text fig. 61k) typical for *Vascoceras*. Folioles on saddles separated by moderately to very deep incisions.

Measurements:	Dm	Wh	Ww	U
Re6799-102	117 mm	45 (0.40)	79 (0.70)	21 (0.18), 18 (0.16)
Re6799-4	44 mm	20 (0.45)	38 (0.90)	12 (0.27)
Re6799-132	20 mm	9 (0.45)	16 (0.80)	4.5 (0.22)

Remark: The present form appears to be close to *Vascoceras (Pachyvascoceras) crassum* Furon (1935, p. 58, pl. 3, fig. 2) from the Sudan, but juvenile stages of that species are not known.



Text fig. 62
Stratigraphic section of the Upper Cretaceous La Luna Formation between Chejendé and Mitón, showing position of ammonite assemblages 1, 2, 2a and 3, 1:1000.

Vascoceras venezolanum n. sp., forma c
Pl. 24, Fig. 4a–b, 5a–b, 6a–b, 7a–b; Text fig. 61d, g

Re6799-18 (Pl. 24, Fig. 4). Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Phragmocone 68 mm diameter. Test preserved. Conch moderately inflated with flattened sides, slightly converging towards flattened venter, with rounded ventrolateral shoulder. Umbilicus 16% of diameter, moderately deep, with vertical wall. On umbilical edge seven blunt tubercles of variable size and distance, from which ribs between constrictions indistinctly depart, strengthening over venter. Ribbed stage lasts to about 40 mm diameter. Ribs between periodic constrictions irregular, strong and feeble on flank, over venter more even in strength. Suture not exposed.

JG 246 (Pl. 24, Fig. 5). Stronger ribbed variety, from Timbetes Member of Barbacoas.

Re6799-47 (Pl. 24, Fig. 6) represents juvenile constricted stage, lasting to about 18 mm diameter. External suture well preserved (Text fig. 61d).
Re6799-123 (Pl. 24, Fig. 7; Text fig. 61g) shows exceptionally strong costation in median stage and transition to constricted stage.

Measurements:	Dm	Wh	Ww	U
Re6799-18 at	55 mm	27 (0.50)	30 (0.54)	9 (0.16)
Re6799-47	36 mm	17 (0.47)	19 (0.47)	5 (0.14)
Re6799-123	34 mm	14 (0.59)	?19 (0.56)	8 (0.23)

Remark: Vascoceras globosum compressum Barber (1957, p. 25, pl. 28, fig. 10) from Nigeria has a similar flattened venter, but differs by its slender conch and its sculpture.

Vascoceras venezolanum n. sp., forma d
Pl. 24, Fig. 8a–b, 9a–b, 10a–b; Pl. 25, Fig. 1a–b, 2a–b; Text fig. 61e

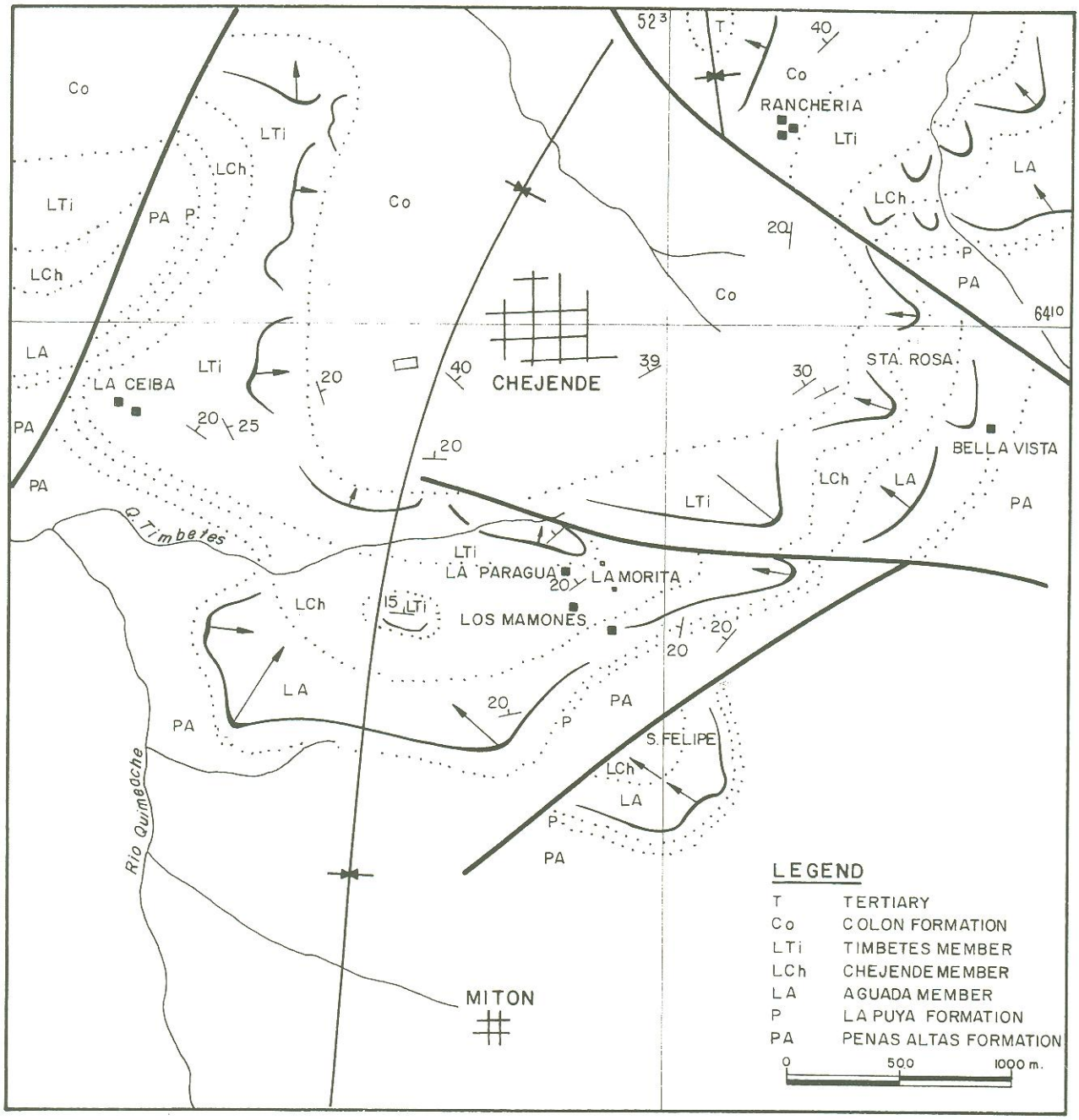
Re6799-113 (Pl. 24, Fig. 8). Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Adult stage. Whorl section subglobose, moderately depressed. Umbilicus narrow and deep, umbilical wall vertical. Sculpture reduced to very faint folds, curved forward, parting from umbilical tubercles or bulges and crossing broad venter in forward directed bows. Suture taken from a not figured fragment (Text fig. 61e) typical for genus.

This form appears to be transitional between *V. venezolanum* n. sp. and *V. venezolanum* forma b.

Re6799-114 (Pl. 25, Fig. 1). Medium sized specimen with equally strong umbilical tuberculation and smooth sides and venter.



Text fig. 63
Geological sketch map of the Chejendé syncline, State of Trujillo, 1:25,000.

Re6799-115 (Pl. 24, Fig. 10). Transition from ribbed to smooth stage. Costation and constrictions flatten at an early stage. Ribs continuing from umbilical tubercles are stronger than intermediate ribs which also reach umbilical margin. All ribs attenuate towards venter.

Re6799-76 (Pl. 25, Fig. 2). Passage from ribbed to juvenile constricted stage. Periodic constrictions dominate, with a stronger rib behind and a weaker one in front.

Re6799-101 (Pl. 24, Fig. 9). Inner constricted stage.

Measurements:	Dm	Wh	Ww	U
Re6799-113	85 mm	44 (0.52)	52 (0.61)	15 (0.18)
Re6799-114	60 mm	26 (0.43)	42 (0.70)	13 (0.21)
Re6799-115	37 mm	15 (0.40)	31 (0.80)	8 (0.21)
Re6799-76	28 mm	12 (0.43)	21 (0.75)	6 (0.20)
Re6799-101	20 mm	9 (0.45)	16 (0.80)	4 (0.20)

Remarks: Ammonites diartianus d'Orbigny (1850a) refigured by Kennedy and Iuiquet (1977, p. 584, pl. 1, fig. 2) = *Provascoceras diartianum* (Cooper, 1979, p. 123) seems to represent a juvenile specimen resembling the median stage of the present forma d. It originates from

the late Cenomanian of Saint-Calais (France) and, according to Kennedy and Iuiquet, is the oldest *"Vascoceras"* so far known.

Vascoceras augermanni Böse (1918, p. 127, pl. 16, fig. 1–4; pl. 17, fig. 1) appears related to the present form, but has no tubercles: "The surface of the shell is entirely smooth without any tubercles and ribs" (Böse, p. 217).

Vascoceras venezolanum sp., forma e
Pl. 25, Fig. 3a–b, 4a–b, 5a–b, 6a–b, 7a–b, 8a–b; Text fig. 61c, h

1957 *Vascoceras* sp. nov., Bürgl, p. 137, pl. 13, fig. 8a–b.

Re6799-24 (Pl. 25, Fig. 4). Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1. Bürgl (1957, pl. 13, fig. 8) figured this form from El Colegio, near Girardot, in the Magdalena valley, Colombia.

Age: Early early Turonian.

Description: Test fully preserved. Last third of outer volution belongs to body chamber. Conch inflated, moderately involute. Venter broadly arched. Umbilicus 24% of diameter (equal as in Bürgl, 1957, pl. 13, fig. 8). Umbilical wall high, steep-sided. Umbilical rim tuberculated with nodes variable in size and distance. Flat ribs spring from umbilical nodes, the size of which is linked to strength of ribs. Two to three shorter ribs, which vary in length, occur between stronger ones, some being separated by a low constriction. All ribs and constrictions cross venter in a wide, slightly forward directed bow. From 50 mm diameter onward, strength of sculpture declines steadily and ribs flatten into growth lines. Suture not exposed.

Re6799-37 (Pl. 25, Fig. 5). Median ribbed stage. On outer half of exposed volution ornament distinctly stronger, but otherwise identical with holotype. On inner half of outer volution collared constrictions dominate. Up to five weaker ribs intercalated between constrictions.

Re6799-23 (Pl. 25, Fig. 7). Juvenile stage. About nine constrictions with enlarged ribs in front and behind are developed. Adaptically interspaces between constrictions are unsculptured. Adorally additional ribs appear and interspaces gradually approach.

Re6799-25 (Pl. 25, Fig. 6). A fine specimen, showing transition from constricted stage towards ribbed stage.

Re6799-108 (Pl. 25, Fig. 8). A rather poor specimen with subdued ribbed stage. Suture line (Text fig. 61h) typical for genus.

Re6799-30 (Pl. 25, Fig. 3). A typical example of this densely tuberculated form. *Fagesia siskiyouensis* Anderson, 1947, p. 125, pl. 17, fig. 2, 3; 1958, p. 248, pl. 28, fig. 1 from the Pacific coast of California may be related to this form of *Vascoceras*.

Measurements:	Dm	Wh	Ww	U
Re6799-24	70 mm	31 (0.44)	47 (0.67)	17 (0.24)
Re6799-37	49 mm	21 (0.43)	29 (0.59)	10 (0.20)
Re6799-23	28 mm	11 (0.40)	18 (0.64)	6 (0.22)
Re6799-30	45 mm	18 (0.40)	29 (0.64)	12 (0.27)

Distribution: Colombia, Venezuela.

Genus *Paramammites* Furon, 1935

On the basis of their suture lines, Wiedmann (1964, p. 127) includes *Paramammites* and *Neoptychites* in his subfamily Fallotitinae, together with *Plesiovascoceras, Ingridella* and *Spathitoides*, genera which are, so far, not known from Venezuela.

Type species: Vascoceras polymorphum Pervinquière, 1907.

Occurrence: Portugal, Spain, (Wiedmann, 1964), Tunisia, Mexico (Böse, 1918, 1927), Israel (Freund and Raab, 1969), Nigeria.

Paramammites polymorphus pinguis (Pervinquière)
Pl. 25, Fig. 10a–b, 11a–b, 12a–b; Text fig. 64

1907 *Vascoceras polymorphum* var. *pinguis* Pervinquière, p. 336, pl. 21, fig. 6a–b.

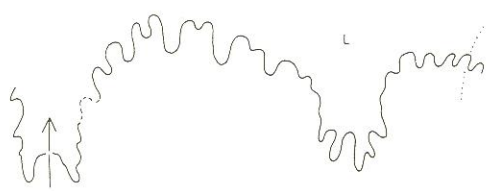
Location: La Morita, type section of Chejendé Member, Assemblage 1, early Turonian.

Description: Re6799-90. Test in parts preserved. Last half of volution belongs to body chamber. Intercostal whorl section depressed, broadly rounded, costal section polygonal. Umbilicus 28% of diameter, deep, steep-sided on costal section. 15 ribs part indistinctly in pairs from seven, high, conical umbilical spines and rise into lower rounded ventrolateral tubercles and into somewhat higher, ventrolateral conical spines. Over concave venter ribs subdued, straight. Suture not exposed.

Re6799-91 is a juvenile specimen from Assemblage 1.

Re6889 is a specimen with well preserved vascoceratid suture line from Assemblage 2 (Text fig. 64).

Measurements:	Dm	Wh	Ww	U
Re6799-90, Pl. 25, Fig. 10	60 mm	26 (0.43)	?42 (0.70)	17 (0.28)
Re6799-91, Pl. 25, Fig. 11	35 mm	15 (0.43)	38 (1.08)	10 (0.28)
Re6889, Pl. 25, Fig. 12	41 mm	?16 (0.40)	29 (0.71)	11 (0.27)



Text fig. 64
Suture line of *Paramammites polymorphus pinguis* (Pervinquière), Re6889, Pl. 25, Fig. 12, 3×.

Distribution: Tunisia, Venezuela.

Remark: Suture lines of Nigerian *Paramammites* drawn by Barber (1957, pl. 31, fig. 6–9) are comparable with the present typically vascoceratid lines (compare suture shown in Pervinquière, 1907, p. 337, fig. 126).

Paramammites polymorphus gracilis (Pervinquière)
Pl. 25, Fig. 13a–b, 14a–b

1907 *Vascoceras polymorphum* var. *gracilis* Pervinquière), p. 336, pl. 21, fig. 4a–b.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2, mid early Turonian.

Description: Re6890 (Pl. 25, Fig. 13). Test partly preserved. Costation closer and tuberculation less pronounced than on *P. polymorphus pinguis.* Intercostal whorl section rounded. Umbilicus 36% of diameter, relatively wide. 20 ribs on outer whorl, from which 12 bear tubercles on umbilical margin and 8 are weaker, feebly or untuberculated, concentrating on end of phragmocone. Branching of ribs from umbilical tubercles occurs, but most ribs remain single. Lower and upper ventrolateral tubercles variable in height, according to strength of ribs. Vascoceratid suture line clearly exposed.

Measurements: Dm 31 mm, Wh 12 (0.31), Ww 18 (0.60), U 11 (0.36).

Distribution: Tunisia, Venezuela.

Of regional interest is a small specimen of *Paramammites polymorphus gracilis* (Pl. 25, Fig. 14) collected by Ch. Beck from the Cerro El Peñón, southeast of Altagracia de Orituco (State of Guárico). It is accompanied by various species which are characteristic of Assemblage 1 in the State of Trujillo.

Genus *Pseudoneoptychites* Leanza, 1967

Type species: Pseudoneoptychites andinus Leanza.

Occurrence: Venezuela.

Pseudoneoptychites represents a diversified group of medium-sized ammonites restricted to and abundant in Assemblage 1 of early early Turonian age. Here they occur abundantly. So far not a single specimen is known from higher in the section (i.e. in Assemblage 2). Intermediate forms tending towards *Neoptychites* which also are found in Assemblage 1 suggest that *Neoptychites* occurring higher up in the section (Assemblage 2 to the top of the Lower Turonian section) may be derived from *Pseudoneoptychites.*

The *Pseudoneoptychites* from the Andes range from stout, highly sculptured to more slender forms with subdued costation. All exhibit a constricted juvenile stage, distinguished by constrictions accompanied adaptically and adorally by ribs (Pl. 26, Fig. 9). With progressing age the whorl width widens rapidly on the broad forms (Pl. 26, Fig. 3), the ornament augments in relief, and the venter becomes round. Kennedy and Wright (1979b, p. 669) interpreted *Pseudoneoptychites,* figured by Leanza, as a juvenile *Neoptychites.*

Pseudoneoptychites venezolanus n. sp.
Pl. 26, Fig. 1a–b, 2a–b, 3a–b; Text fig. 65a, 66c

1967 *Vascoceras* gen. et sp. indet., Leanza, p. 206, pl. 3, fig. 1–2.
1979 *Greenhornoceras* Cobban and Scott, Renz and Alvarez, p. 975.

Holotype: Re6799-9 (Pl. 26, Fig. 1). Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1.

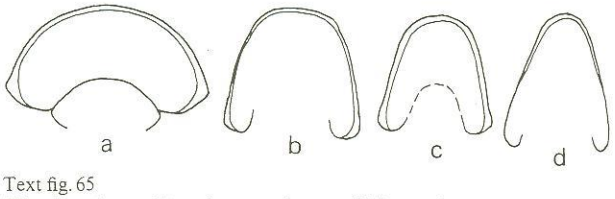
Age: Early early Turonian.

Description of holotype: Adult specimen. Internal mould. Last half of outer volution belongs to body chamber. Conch depressed, coronate (Text fig. 66a). Flanks gently converging towards broadly rounded venter. Umbilicus deep and steep-sided, with 23% of diameter which is wide for the genus. Above umbilical edge about six ribs on outer whorl elevate into higher and lower bullate tubercles irregularly alternating with untuberculated intermediate ribs which flatten within interspaces towards umbilical edge. All ribs cross straight over venter. Last suture line (Text fig. 66c) with U_3 hardly recognizable. Internal sutures not known. The suture clearly differs from that of *Vascoceras* by a less subdivided dorsal slope of the external saddle.

Juvenile stage, paratype 1, Re6799-77 (Pl. 26, Fig. 3) shows a change from constricted juvenile to costated stage taking place within a short interval, simultaneously with a sudden widening of whorl section and with the appearance of high umbilical tubercles. Ribs soon turn coarse and cross straight over venter.

Intermediate stage, paratype 2, Re6799-78 (Pl. 26, Fig. 2). Coronate whorl section begins to develop at an early stage (at about 15 mm diameter).

Measurements:	Dm	Wh	Ww	U
Re6799-78, paratype 2	22 mm	10 (0.45)	15 (0.70)	5 (0.23)
Re6799-77, paratype 1	19 mm	9 (0.42)	10 (0.52)	3 (0.16)
Re6799-9, holotype	34 mm	15 (0.44)	28 (0.82)	7 (0.20)



Text fig. 65
Whorl sections of *Pseudoneoptychites* and *Neoptychites:*
a. *P. venezolanus* n. sp., holotype, Re6799-9, Pl. 26, Fig. 1, 1×.
b. *P. intermedius* n. sp., paratype 2, Re6799-64, Pl. 26, Fig. 6, 1×.
c. *P. intermedius* n. sp., holotype, Re6799-54, Pl. 26, Fig. 5, 1×.
d. *N. transitorius* n. sp., paratype 1, Re6862, Pl. 26, Fig. 15, 1×.

Remark: The holotype closely resembles the specimen figured by Leanza (pl. 3, fig. 1-2) from the Cerro El Peñón southeast of Altagracia de Orituco (State of Guárico).

The inner whorls of *Vascoceras (Greenhornoceras) birchbyi* Cobban and Scott (1972, p. 85, pl. 22-23, fig. 4-6) from the Greenhorn Limestone in Colorado closely resemble *Pseudoneoptychites venezolanum.*

Pseudoneoptychites intermedius n. sp.
Pl. 26, Fig. 4a-b, 5a-b, 6a-b; Text fig. 65b-c

Holotype: Re6799-54 (Pl. 26, Fig. 5a-b; Text fig. 65c) deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1.

Derivation of name: P. intermedium is intermediate between stout, depressed, coronate *P. venezolanum* and slender, flatly ribbed *P. difficilis* Leanza.

Age: Early early Turonian.

Description of holotype: Conch compressed, involute, medium sized. Whorl section widest on umbilical bullate tubercles (Text fig. 65c). Flanks converging towards rounded venter which tends to get square towards body chamber. Umbilicus 14% of diameter. Costation coarse, faintly prorsiradiate. Rib-pattern irregular according to variable strength of umbilical elevations. On outer volution six coarse primary ribs rise bullae-like on umbilical margin. Some untuberculated intermediate ribs reach umbilical margin, others end above or below mid-flank. All ribs evenly cross straight over venter. Suture line not preserved.

Paratypes 1 and 2 (Pl. 26, Fig. 4a-b, 6a-b) display the considerable differences in sculpture and whorl section of this form.

Paratype 2 (Pl. 26, Fig. 6; Text fig. 65b) with its greater whorl width and strongly converging sides could be interpreted as a variety, but so far, only the figured specimen is available.

Measurements:	Dm	Wh	Ww	U
Re6799-54, holotype	37 mm	19 (0.51)	16 (0.43)	5 (0.14)
Re6799-58, paratype 1	26 mm	17 (0.65)	15 (0.57)	5.5 (0.21)
Re6799-64, paratype 2	34 mm	19 (0.56)	19 (0.56)	4 (0.12)

Pseudoneoptychites difficilis Leanza
Pl. 26, Fig. 7a-b, 13a-d

1967 *Pseudoneoptychites difficilis* Leanza, p. 205, pl. 5, fig. 5, 6.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Re6799-57 (Pl. 26, Fig. 7a-b). Medium-sized ammonite. Body chamber forms last three quarters of whorl, aperture partly indicated. Whorl section widest on bullae-like elevated ribs on umbilical margin; from there sides converge towards rounded venter. Umbilicus 14% of diameter. Ornament comparable to that of *P. intermedius.* Radial straight primary ribs are irregularly placed and separated by one to three short intermediate ribs, generally increasing in length adaptically. The species differs from *P. intermedius* mainly by its more slender whorl section of 48%, against more than 50% of diameter on *P. intermedius.* Suture line not available.

Measurements:	Dm	Wh	Ww	U
Re6799-57	39 mm	19 (0.48)	15 (0.38)	5.5 (0.14)
Holotype (Leanza, p. 205)	45 mm	18 (0.70)	?16 (0.35)	4.5 (0.10)

Re6954 (Pl. 26, Fig. 13a-b) shows the transition from the faintly ribbed constricted stage to the strongly ribbed stage with bullate umbilical tubercles.

Re6955 (Pl. 26, Fig. 13c-d) is a more slender specimen, displaying the constricted, smooth stage grading into the ribbed stage.

Pseudoneoptychites andinus Leanza
Pl. 26, Fig. 8a-b, 9a-b, 10a-b, 11a-b, 12a-b; Text fig. 66a-b, d-f

1967 *Pseudoneoptychites andinus* Leanza, p. 203, pl. 5, fig. 3-4 holotype.
1967 *Pseudoneoptychites sohli* Leanza, p. 204, pl. 7, fig. 4-6.
1967 *Pseudoneoptychites transatlanticus* Leanza, p. 201, pl. 3, fig. 7-8.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

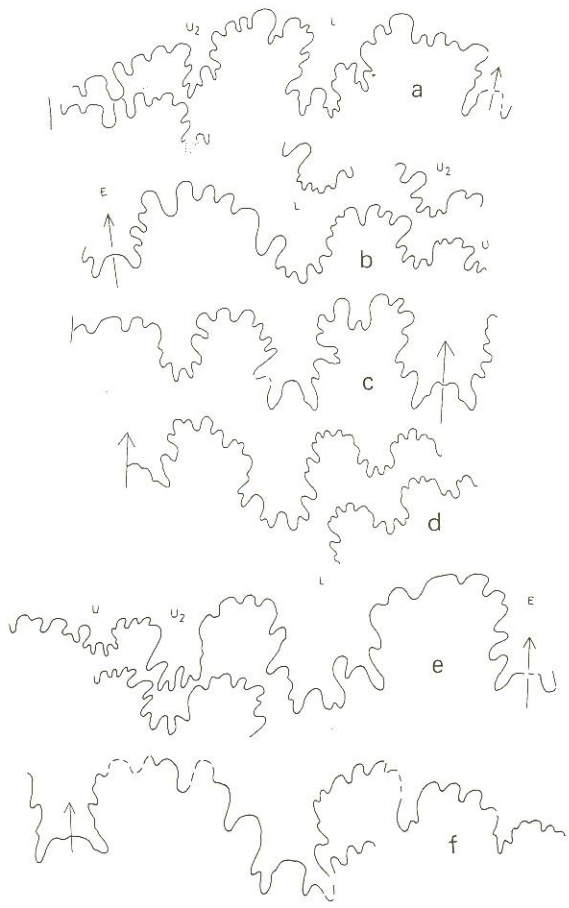
Description: Re6799-136 (Pl. 26, Fig. 10). Conch of moderate size, slender, involute, high-whorled, with test partly preserved on phragmocone. Body chamber attains three-quarter of whorl, ending with simple peristome. Whorl section subrectangular, widest above umbilicus, from there converging towards distinctly flattened venter. Costation on phragmocone close, about 33 slightly prorsiradiate ribs of varying size, faintly beginning from subdued bulges around narrow umbilicus. Ribs strengthen gradually towards ventrolateral shoulder from where they cross straight over venter, to reach their maximum elevation and breadth. On body chamber ribs gradually flatten out whereas interspaces widen. Suture exposed on paratypes 1, 2 and 5 (Text fig. 66a-b, d-f).

Re6799-70 (Pl. 26, Fig. 12). Ribs flattening towards narrow umbilicus without tubercles.

Re6799-74 (Pl. 26, Fig. 8). Stronger ribbed specimen with wider umbilicus and some tubercles around umbilical margin.

Re6799-66 (Pl. 26, Fig. 9). Juvenile constricted stage showing ribs adorally and adaptically of constrictions.

Re6799-59 (Pl. 26, Fig. 11). Fully preserved specimen. On body chamber ornament reduced to flat folds growing stronger over venter. Square venter on phragmocone becoming rounded towards body chamber.



Text fig. 66
Suture lines of *Pseudoneoptychites:*
a. *P. andinus* Leanza, Re6799-74, Pl. 26, Fig. 8, 3×.
b. *P. andinus* Leanza, Re6799-55, Assemblage 1, 3×.
c. *P. venezolanus* n. sp., Re6799-9, Pl. 26, Fig. 1, 3×.
d. *P. andinus* Leanza, Re6799-69, Assemblage 1, 3×.
e. *P. andinus* Leanza, Re6799-73, Assemblage 1, 3×.
f. *P. andinus* Leanza, Re6799-70, Pl. 26, fig. 12, 3×.

Measurements:	Dm	Wh	Ww	U
Re6799-136	53 mm	27 (0.51)	21 (0.40)	3.5 (0.06)
Re6799-70	36 mm	19.5 (0.51)	12.5 (0.35)	2 (0.05)
Re6799-74	35 mm	19 (0.54)	12.5 (0.36)	2 (0.06)
Re6799-66	20 mm	9 (0.45)	6.5 (0.32)	1.5 (0.07)
Re6799-59	62 mm	34 (0.55)	22.5 (0.36)	2.5 (0.04)

Remark: The material available to Leanza originated from Cerro El Peñón, southeast of Altagracia de Orituco (State of Guárico).

Pseudoneoptychites sp. indet.
Pl. 26, Fig. 14a–b

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Re6799-71. Largest specimen of *Pseudoneoptychites* available. Internal mould. Whorl section compressed, ovally inflated, thickest slightly below mid-flank. Umbilicus moderately wide for genus, 10% of diameter. Venter flattened on phragmocone, becoming round towards body chamber. Irregular alternation of strong, long ribs, which begin below umbilical margin, with shorter ribs varying in length. Ribs, straight to slightly flexuous, cross straight over venter. Suture line not visible.

Measurements: Dm 69 mm, Wh 36 (0.52), Ww 29 (0.42), U 7 (0.10).

Genus *Neoptychites* Kossmat

Type species: Ammonites telinga Stoliczka, 1865.

Occurrence: France, Tunisia, Cameroon, Madagascar, India, Texas, Mexico, Venezuela, Trinidad, Spain, Israel, Japan.

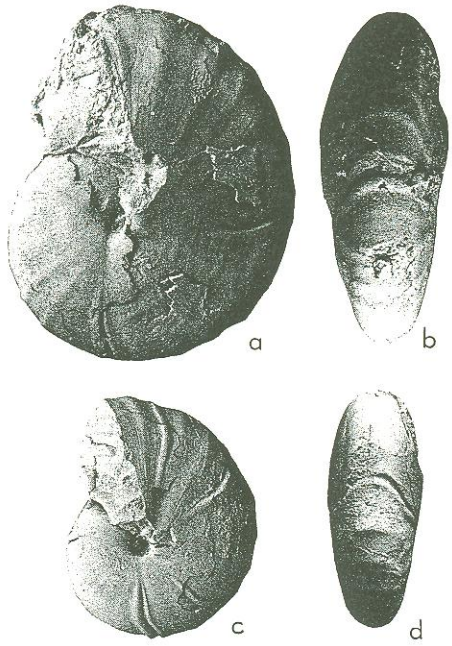
Remark: For a discussion on the homeomorphy of *Neoptychites* with the Triassic genus *Ptychites* Mojsisovics refer to Reyment 1955b, p. 574.

Neoptychites transitorius n. sp.
Pl. 26, Fig. 15a–b, 18a–b; Text fig. 66A, a–d; 65d

Holotype: Re6952 (Text fig. 66A, a–b) deposited with Maraven S.A., Caracas.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2.

Derivation of name: Transitional species, combining features of *Pseudoneoptychites* as well as of *Neoptychites.*



Text fig. 66A
Neoptychites transitorius n. sp.:
a–b. Holotype, Re6952 (J30469), Los Mamones, Assemblage 2, 1×.
c–d. Paratype 2, Re6953 (J30470), Los Mamones, Assemblage 2, 1×.

Age: Mid early Turonian.

Description of holotype: Shell of moderate size, compressed, involute, with test largely retained. On phragmocone whorl section widest on mid-flank; on body chamber widest on umbilical margin. Ventral half of simple peristome preserved. Umbilicus narrow, closing further on body chamber, taking an elongate shape. Venter slightly squared, with rounded ventrolateral shoulder. Sculpture on phragmocone dominated by constrictions which are bound by a stronger rib adaptically and by a weaker rib adorally. On phragmocone constrictions become indistinct and flat folds appear. Faint constrictions and folds begin above narrow umbilicus and strengthen progressively, bending forward from ventrolateral shoulder, reaching their greatest intensity over venter. Suture covered by test.

Measurements: Dm 49 mm, Wh 28 (0.47), Ww 18 (0.31), U 2 (0.03).

Paratype 1: Re6862 (Pl. 26, Fig. 15a–b; Text fig. 65d), Assemblage 2, showing last constrictions and flat folds.

Paratype 2: Re6953 (Text fig. 66A, c–d), Assemblage 2, exposing constricted stage and beginning of folds.

Paratype 3: JG532 (Pl. 26, Fig. 18a–b), juvenile constricted stage. Exact position in section not known.

Measurements:	Dm	Wh	Ww	U
Re6862, paratype 1	42 mm	25 (0.59)	15 (0.35)	2 (0.05)
Re6953, paratype 2	33 mm	20 (0.60)	13 (0.42)	2 (0.07)
JG532, paratype 3	23 mm	13 (0.56)	19.5 (0.41)	1.5 (0.06)

Neoptychites xetriformis Pervinquière
Pl. 26, Fig. 19a–b; Text fig. 67

1907 *Neoptychites Xetriformis* Pervinquière, p. 398, pl. 27, fig. 5a–b.
1918 *Neoptychites* aff. *N. xetriformis* Pervinquière, Böse, p. 223, pl. 18, fig. 9, 11.
1920 *Neoptychites xetriformis* Pervinquière, Taubenhaus, p. 45, pl. 5, fig. 1.
1931 *Neoptychites xetriformis* Pervinquière, Basse, p. 35, pl. 12, fig. 1, suture line.
1963b *Neoptychites xetriformis* Pervinquière, Powell, p. 1229, pl. 171, fig. 2–4.
1967 ?*Neoptychites transatlanticus* Leanza, p. 201, pl. 1, fig. 7–8.
1969 *Neoptychites xetriformis* Pervinquière, Freund and Raab, p. 48.
1972 *Neoptychites xetriformis* Pervinquière, Cobban and Scott, p. 89, pl. 30, fig. 2–6; Text fig. 48.
1979b *Neoptychites xetriformis* Pervinquière, Kennedy and Wright, p. 679, pl. 84, fig. 1–2, pl. 86, fig. 1–3.

Location: La Paragua, Chejendé syncline, transition from the Chejendé to the Timbetes Member, latest early Turonian.

Description: Re6799-79. A single, medium-sized specimen which closely resembles the holotype from Tunisia. Initial part of living chamber just exposed. Conch broadly disk-shaped with minute umbilicus. Whorl-section subtriangular, widest at rounded umbilical margin. Inflated convex sides converging towards narrowly rounded venter. Ornament consists of about 18 broad, rectiradiate low folds which flatten out towards venter. External suture (Text fig. 67) well preserved, confirming drawing of Pervinquière (1907, text fig. 154). Remarkably short external lobe.

Measurements: Dm 65 mm, Wh 35 (0.54), Ww 34 (0.52), U 3.5 (0.05).

Distribution: Tunisia, France, Spain, Israel, Madagascar, Mexico (Powell, 1963b), Texas, Colorado, Venezuela, ?Colombia (Leanza, 1967).

Neoptychites aff. *crassus* Solger
Pl. 26, Fig. 16a–b

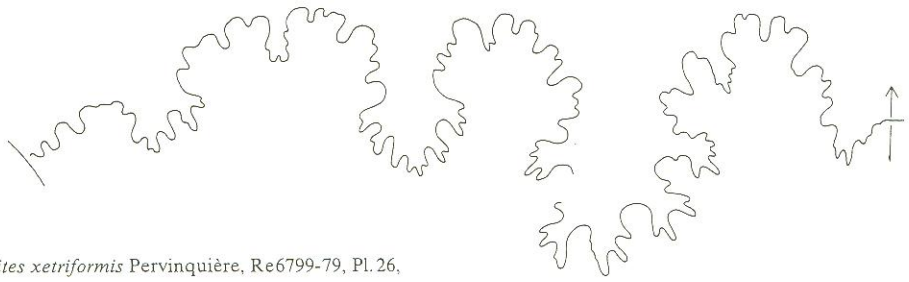
1904 *Neoptychites crassus* Solger, p. 119, pl. 3, fig. 5a–b.
1955a *Neoptychites crassus* Solger, Reyment, p. 67.
1969 *Neoptychites crassus* Sloger, Freund and Raab, p. 49.
1972 *Neoptychites crassus* Sloger, Reyment, p. 366, fig. 7 (2–3).

Location: Road Chejendé to Alto de Bolivia, southeast of Santa Rosa, Chejendé Member; early Turonian.

Description: JG457-1. A single, imperfectly preserved specimen. Whorl section broadly inflated, thickest at umbilical rim, from which flanks converge towards narrowly rounded venter. The specimen, which is thought to be a juvenile stage, has a sculpture reduced to widely spaced constrictions over venter, bound by equally strong ribs adorally and adaptically. They flatten out near mid-flank.

Neoptychites aff. *telingaeformis discrepans* Solger
Pl. 26, Fig. 17a–b

1904 *Neoptychites telingaeformis* var. *discrepans* Solger, p. 117, pl. 3, fig. 4.
1932 *Neoptychites telingaeformis* var. *discrepans* Solger, Riedel, p. 123, pl. 26, fig. 5, 5a.



Text fig. 67
Suture line of *Neoptychites xetriformis* Pervinquière, Re6799-79, Pl. 26, Fig. 19, 3×.

Location: Chejendé syncline, Santa Rosa, Chejendé Member, early Turonian, exact stratigraphical level not known.

Description: JG458. Juvenile constricted specimen. Shell compressed, involute. Whorl section widest above umbilical rim. Flanks convex, merging into rounded venter. On outer volution ornament restricted to four prorsiradiate constrictions with strong ribs adorally.

Family Acanthoceratidae de Grossouvre, 1894

Subfamily Mammitinae Hyatt, 1900

Genus *Mammites* Laube and Bruder, 1887

Type species: Ammonites nodosoides Schlotheim in von Buch, 1829.

Occurrence: Almost world-wide (Cobban and Scott, 1972, p. 79), Japan (Matsumoto et al., 1978).

Mammites nodosoides (Schlotheim)
Pl. 27, Fig. 1a–b, 3a–b, 4a–b, 7a–b, 10a–b

1871 *Ammonites nodosoides* Schlotheim, Schlüter, p. 19, pl. 8, fig. 1–4.
1887 *Mammites nodosides* Schlotheim, Laube and Bruder, p. 229, pl. 25, fig. 1a–b.
1907 *Mammites nodosoides* Schlotheim, Pervinquière, p. 309, pl. 18, fig. 1a–b.
1916 *Mammites nodosoides chivensis* Arkhangelskii, p. 51, pl. 8, fig. 1, 4–7.
1929 *Mammites nodosoides* var. *Afra* Pervinquière, Steinmann, p. 147, Text fig. 181.
1935 *Mammites nodosoides* Schotheim var. *armata*, Karrenberg, p. 136, pl. 30, fig. 8, 8a; pl. 33, fig. 7.
1940 *Mammites nodosoides* Schlotheim, Fabre, p. 285, pl. 9, fig. 1; pl. 10, fig. 1.
1956 *Mammites nodosoides afer* Pervinquière, Benavides-Cáceres, p. 468, pl. 55, fig. 5–8.
1963a *Mammites nodosoides* (Schlotheim), Powell, p. 316, pl. 33, fig. 1, 3, 4, 6, 10, 11.
1972 *Mammites* sp., Reyment, p. 305, fig. 8 (2a–b, 3, 4a–b).
1972 *Mammites nodosoides* (Schlotheim), Cobban and Scott, p. 78, with synonymy.
1979 *Mammites nodosoides appelatus* Etayo-Serna, p. 85, pl. 13, fig. 1.
1979 *Mammites nodosoides* (Schlotheim), Cobban and Hook, pl. 15, pl. 8, fig. 6–7.

An accumulation consisting of well preserved *Mammites nodosoides*, showing a considerable individual variability, has been obtained from the Chejendé Member near La Morita. It forms part of Assemblage 2. In this assemblage *M. nodosoides*, together with *Nannovascoceras*, exceed all remaining genera in abundance.
Within Assemblage 1, *M. nodosoides* is rather scarce. It seems to be distinguished by low umbilical bullae instead of the spines found higher in the section (Assemblage 2). The two small specimens Re6841 (Pl. 27, Fig. 4) and Re6799-84 (Pl. 27, Fig. 3) originate from Assemblage 1.

A specimen from Barbacoas (MBJ28504, Pl. 27, Fig. 1) most closely resembles the holotype.

Location: Highest point on the road between Barbacoas and San Pedro, above the basal shale zone of Chejendé Member, early early Turonian.

Description: MBJ28504. Test not separable from matrix consisting of coarse grained calcite cement. Whorl section rectangular, as wide as high. Sides slightly convex, parallel. Venter becoming widely concave towards body chamber, where high horns develop. Umbilicus moderately evolute, 21% of diameter, steep-sided. Sparse folds, variable in strength and distance arise from long umbilical bullae. Above mid-flank ribs nearly effaced before rising into lower ventrolateral clavate tubercles and upper ventrolateral clavi. At about 50 mm diameter both merge into high horns. Suture line destroyed.

Measurements: Dm 77mm, Wh 34 (0.44), Ww 33 (0.43), U 16 (0.21).

Remarks: Re6799.84 and Re6841 (Pl. 27, Fig. 3, 4) are juvenile stages displaying the ontogeny of the ornament. Upper ventrolateral clavi, separated by variable intervals, appear first at 12 mm diameter. Between 13 and 15 mm lower ventrolateral tubercles follow. Umbilical tuberculation develops last. Middle growth stages are represented by the specimens Re6838 (Pl. 27, Fig. 7) and Re6844 (Pl. 27, Fig. 10).

Mammites nodosoides Schlotheim var.
Pl. 27, Fig. 5a–b

Location: Los Mamones, Assemblage 2, mid early Turonian.

Description: Re6837. The variety differs from others by seven high bullate umbilical tubercles which are turned backwards. Ribs are mostly effaced over mid-flank.

Measurements: Dm 58 mm, Wh 27 (0.46), Ww 41 (0.70), U 21 (0.36).

Mammites nodosoides Schlotheim var.
Pl. 27, Fig. 2a–b

Location: Los Mamones, Assemblage 2, mid early Turonian.

Description: Re6836. It differs from other specimens of the accumulation by its irregular arrangement and size of the umbilical bullae which lengthen on inner whorls.

Measurements: Dm 75 mm, Wh 35 (0.46), Ww 32 (0.42), U 17 (0.22).

Mammites nodosoides Schlotheim from Assemblage 2a
Pl. 27, Fig. 6a–b, 9a–b

Abundant small-sized *Mammites nodosoides* have been collected near La Paragua (Assemblage 2a), late early Turonian. Several specimens displaying the range of

variability are present, two are figured. All maintain the features which are typical for the species from an early growth stage onwards.

Measurements:	Dm	Wh	Ww	U
Re6869, Pl. 27, Fig. 9	23 mm	11 (0.47)	12 (0.50)	5 (0.21)
Re6867, Pl. 27, Fig. 6	31 mm	15 (0.48)	15 (0.48)	6 (0.20)

Mammites nodosoides (Schlotheim), transition towards *Benueites*
Pl. 27, Fig. 8a–b

Location: Los Mamones, type section of Chejendé Member, Assemblage 2, mid early Turonian.

Re6960 (Pl. 27, Fig. 8) represents the only specimen available from this level showing affinities towards *Benueites*.

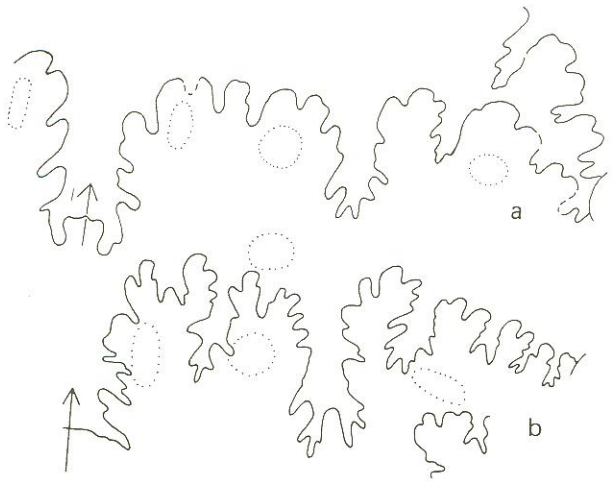
Mammites aff. *nodosoides wingi* Morrow
Pl. 28, Fig. 6a–b; Text fig. 68a, 69b

1935 *Mammites wingi* Morrow, p. 467, pl. 51, fig. 2; pl. 52, fig. 2a–c.
1972 *Mammites nodosoides wingi* Morrow, Cobban and Scott, p. 79, pl. 26, fig. 1–4, 9–10; pl. 31, fig. 1–2, holotype; pl. 32.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Re6779-87. Immature fragment with body chamber preserved. It resembles the juvenile stage figured by Cobban and Scott (pl. 26, fig. 1–3), but differs considerably from the much larger holotype. Whorl stout, as wide as high (Text fig. 69b). Venter widely arched on intercostal section and flatly concave between low clavi. Tuberculation subdued and ribs very flat. Suture typical for genus (Text fig. 68a).

Measurements: Dm 56 mm, Wh 28 (0.50), Ww 28 (0.50), U 25 (0.18).



Text fig. 68
Suture lines of *Mammites:*
a. *M. nodosoides* aff. *wingi* Morrow, Re6799-87, Pl. 28, Fig. 6, 2×.
b. *M. spinosus* Basse, MBJ28505, Pl. 28, Fig. 1, 2×.

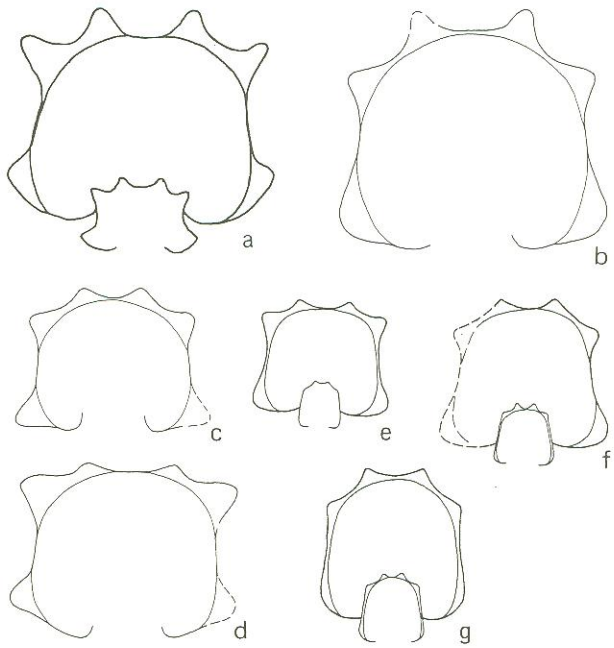
Mammites spinosus Basse var.
Pl. 27, Fig. 11a–b; Pl. 28, Fig. 1a–b, 2a–b, 3a–b, 4a–b, 5a–b, 26a–b; Text fig. 68b, 69a, c–d

?1902 *Mammites binicostatus* Petrascheck, p. 145, pl. 7, fig. 6a–b.
1940 *Mammites nodosoides* var. *spinosa* Basse, p. 458, pl. 7, fig. 2; pl. 9, fig. 2, holotype.
1966 *Mammites nodosoides* var. *spinosa* Collignon, p. 40, pl. 20, fig. 12.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2 and La Paragua, Assemblage 2a, mid to late early Turonian.

Descriptions: Re6959 (Pl. 27, Fig. 11), a good specimen showing adult stage with body chamber preserved.

Two specimens of *Mammites spinosus* are figured from the Barbacoas syncline: MBJ28505 (Pl. 28, Fig. 1) and MBJ28506 (Pl. 28, Fig. 2). Both have high, narrowly spaced, lower ventrolateral, conical tubercles and upper clavi (Text fig. 69a). MBJ28506 is a pathologic specimen with its upper ventrolateral clavi on its left side (right side on figure) missing (compare also *Benueites reymenti* Collignon, Re6887, Pl. 28, Fig. 15 which shows the same deficiency).



Text fig. 69
Whorl sections showing transition from *Mammites* towards *Benueites:*
a. *Mammites spinosus* Basse, MBJ28505, Pl. 28, Fig. 1, 1×.
b. *Mammites nodosoides* aff. *wingi* Morrow, Re6799-87, Pl. 28, Fig. 6, 1.5×.
c. *Mammites spinosus* Basse, Re6868, Pl. 28, Fig. 4, 1.5×.
d. *Mammites spinosus* Basse, Re6866, Pl. 28, Fig. 5, 1.5×.
e. *Benueites trinidadensis* n. sp., paratype 1 from Trinidad, MBJ28451, Pl. 29, Fig. 1, 1.5×.
f. *Benueites trinidadensis* n. sp., paratype 4, Re6908, Pl. 28, Fig. 10, 1.5×.
g. *Benueites trinidadensis* n. sp., transition towards *Benueites reymenti* Collignon, paratype 7, Re6885, Pl. 28, Fig. 13, 1.5×.

Three smaller specimens of *Mammites spinosus* collected from Assemblages 2 and 2a are illustrated: Re6835 (Pl. 28, Fig. 3), Assemblage 2; Re6868 (Pl. 28, Fig. 4; Text fig. 69c), Assemblage 2a; Re6866 (Pl. 28, Fig. 5; Text fig. 69d), Assemblage 2a. It is not known whether these specimens, of which the body chamber is preserved, are juvenile stages or whether they lived in a less favourable environment which was insufficiently supplied with oxygen. The great number of immature ammonites in the sediment of this assemblage might support the latter assumption.

Re6921 (Pl. 28, Fig. 26) shows the beginning of umbilical spines at a diameter of 16 mm.

Measurements:	Dm	Wh	Ww	U
Re6959, Pl. 27, Fig. 11	122 mm	51 (0.42)	63 (0.51)	29 (0.23)
Re6866, Pl. 28, Fig. 5	31 mm	14 (0.45)	19 (0.61)	8.5 (0.19)
Re6868, Pl. 28, Fig. 4	27 mm	13 (0.48)	18 (0.48)	5 (0.18)
MBJ28505, Pl. 28, Fig. 1	70 mm	35 (0.35)	42 (0.60)	16 (0.23)
Re6835, Pl. 28, Fig. 3	45 mm	20 (0.44)	26 (0.67)	9 (0.20)

Remarks: In Venezuela *Mammites* with high umbilical spines are concentrated in Assemblages 2 and 2a. They appear to have developed from the ground form (MBJ28504, Pl. 27, Fig. 1) which in the Chejendé syncline occurs in Assemblage 1. It is therefore suggested that species status should be admitted for forms with high umbilical tubercles.
Intermediate forms between *Mammites* and *Benueites* which will be discussed hereafter, are associated with this accumulation.

Genus *Benueites* Reyment, 1954

Type species: Ammonites Mosquerae Karsten, 1886.

Occurrence: Colombia, Venezuela, Trinidad, Morocco, Nigeria, Cameroon.

Benueites is widely distributed throughout western Venezuela. Specimens have been collected in the Perijá Range (Re2358, Text fig. 70a), in the Chejendé Member of Humocaro Bajo (JG261), in the Chejendé syncline (Assemblage 2a and 3) and in the autochthonous La Luna near Carora. Moreover, the genus has been observed in allochthonous masses of Turonian age in the Guárico flysch north of Ortiz (VK1283B-4, Text fig. 70e). It also exhibits a considerable vertical range.
The marked variation shown by the genus *Benueites* has been discussed and illustrated by Reyment (1971, pl. 1 to 10). Reyment suggests that the variations may be the result of sexual dimorphism (Forms A and B).
At the type section of the Chejendé Member, stronger ribbed *Benueites* occur at a lower stratigraphic level (Assemblage 2a) than the finer ribbed forms restricted to Assemblage 3, whereas in Trinidad fine and coarse ribbed species overlap. This suggest an intermediate stratigraphic position for the *Benueites* from the boulders in the Trinidadian Plaisance Conglomerate.
The close association of *Mammites* and *Benueites* observed in the Chejendé syncline suggests an evolution of *Mammites* towards *Benueites* within the Andean geosyncline. It may be assumed that during early Turonian time, *Benueites* migrated from Trinidad eastwards to the present-day Tarfaya Basin in Morocco and from there southwards to Nigeria. The genus is not ascertained in Brazil (oral communication by P. Bengtson).

Benueites trinidadensis n. sp. from Trinidad
Pl. 29, Fig. 1a–b; Text fig. 69e, 71b–c

In order to obtain a more complete picture of *Benueites* a discussion on the nature and occurrence of that genus in Trinidad is necessary. Samples were obtained from a collection made in 1936 by H. Kugler from a boulder of the Plaisance Conglomerate intercalated in the San Fernando Formation of the Central Range of the island (compare Rutsch, 1939, p. 521). The ammonites contained in these samples were extracted from the matrix and prepared for study by O. Renz.

Holotype: MBJ28452 (Text fig. 71b–c), deposited in the Museum of Natural History, Basel.

Location: Boulder from Plaisance Conglomerate, San Fernando Formation, Central Range, Trinidad.

Age: Early Turonian, together with small *Hoplitoides*.

Description of holotype: Adult specimen, *Mammites* stage. Test partly preserved. Phragmocone 21 mm diameter. Intercostal whorl section on outer volution depressed, subquadrate, flat-sided, rounding into umbilical wall and venter. Costal section low trapezoidal over venter. Ornament closely resembles the juvenile *Mammites spinosus*. Umbilicus 24% of diameter. Whorl width on last volution increases rapidly from 6 to 18 mm. Height of umbilical wall increases in accordance. Flat broad folds branch indistinctly from high conical spines on umbilical margin and rise into 18 prominent lower ventrolateral clavi from which ribs turn forward, strengthening and ending in much smaller upper ventrolateral clavi, separated by a narrow median groove. On some weaker ribs, tuberculation is subdued.

Measurements: Dm 35 mm, Wh 18 (0.51), Ww 21 (0.60), U 9 (0.26).

Paratype 1: MBJ28451 (Pl. 29, Fig. 1, Text fig. 69e). Specimen combines features of *Benueites* (inner volutions) and *Mammites* (outer volution). Transition occurs within a short interval. Whorl section at 14 mm compressed oval. Venter narrowly grooved. Ribs closely spaced with feebly indicated ventrolateral tubercles. At 17 mm diameter sudden change in whorl width. Whorl section becomes compressed and sculpture assumes features of *Mammites* (Text fig. 69e).

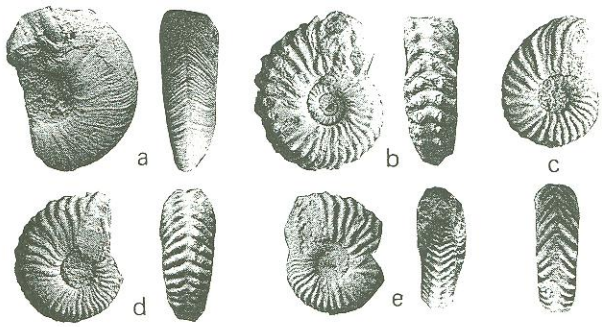
Measurements: Dm 28 mm, Wh 11 (0.40), Ww 17 (0.30), U 7 (0.25).

Benueites trinidadensis n. sp. from Assemblage 2a
Pl. 28, Fig. 7a–b, 8a–b, 9a–b, 10a–b, 11a–b, 12a–b; 13a–b, 14a–b, Text fig. 69f–g

In Venezuela transitional forms between *Benueites* and *Mammites* are so far restricted to Assemblage 2a (late early Turonian) from near La Paragua, where they occur together with *Benueites reymenti* and small sized *Mammites nodosoides.*
In accordance with the great variability of *Mammites* and *Benueites,* transitional stages such as represented by *B. trinidadensis,* follow this pattern.
Re6874 (Pl. 28, Fig. 14), paratype 8. Juvenile stage, which might best be compared with *Benueites reymenti.* Costation high in relief. Ribs begin on rounded umbilical margin where some are slightly elevated and bullae-like. Lower ventrolateral nodes and upper ventrolateral clavi well developed and connected by strong ribs.

Re6872 (Pl. 28, Fig. 12), paratype 6 compares well with paratype 1 of *B. trinidadensis* (MBJ28451, Pl. 29, Fig. 1). Transition from the *Benueites* to the *Mammites* stage occurs at about 20 mm diameter where strong umbilical bullae, very variable in strength, begin. Ribs over flank, between umbilical and pronounced lower ventrolateral tubercles, become nearly effaced, as on *Mammites.*

Re6871 (Pl. 28, Fig. 7), paratype 9, Re6849 (Pl. 28, Fig. 8) paratype 2, Re6908 (Pl. 28, Fig. 10) paratype 4 (Text fig. 69f) clearly display transitions from the *Benueites* stage to the *Mammites* stage. On the other hand, Re6873 (pl. 28, Fig. 9) paratype 3, Re6870 (Pl. 28, Fig. 11) paratype 5, and Re6885 (Pl. 28, Fig. 13) paratype 7 (Text fig. 69g) suggest transitions towards *Benueites reymenti.* Costation remains well defined as far as the mouth border and the ventral groove is distinctly more narrow.



Text fig. 70
Benueites from different localities in Venezuela, all 1×.
a. *B. benueensis* Reyment, Re2358, Río Apón, Perijá foothills, State of Zulia.
b. *B. reymenti* Collignon, Re6943 (J30434), Chejendé syncline, La Paragua, Assemblage 2a, State of Trujillo.
c. *Benueites* sp. indet., Re6946 (J30432), Pié de Cuesta, west of Humocaro Bajo, State of Lara.
d. *B. reymenti* Collignon, Re6942 (J30427), Chejendé syncline, La Paragua, Assemblage 2a, State of Trujillo.
e. *B. reymenti* Collignon, VK1283B-4 (J30424) from boulder in Guárico flysch with *Hoplitoides* aff. *wohltmanni* von Koenen (see Pl. 31, Fig. 2), State of Guárico.

Re6877 (Pl. 28, Fig. 17). Typical for species.

Re6876 and Re6896 (Pl. 28, Fig. 18, 19). Sample with faintly elevated bullae on umbilical margin. Compares well with specimen figured by Collignon (1966) from Tarfaya (pl. 20, fig. 9).

Samples Re6886 (Pl. 28, Fig. 20) and Re6875 (Pl. 28, Fig. 21) found in a concretion in the marl interval of Assemblage 2a.

Re6887 (Pl. 28, Fig. 15) represents a pathologic specimen from Assemblage 2a comparable with *Mammites spinosus* from Barbacoas (MBJ28506, Pl. 28, Fig. 2) which shows a similar deficiency.

Measurements:	Dm	Wh	Ww	U
Re6878, Pl. 28, Fig. 16	30 mm	13 (0.43)	12 (0.40)	6.5 (0.21)
Re6877, Pl. 28, Fig. 17	31 mm	13 (0.42)	13 (0.42)	9 (0.30)
Re6876, Pl. 28, Fig. 18	26 mm	11 (0.42)	10 (0.40)	7 (0.27)
Re6875, Pl. 28, Fig. 21	18 mm	7.5 (0.42)	7 (0.39)	6 (0.33)
Re6886, Pl. 28, Fig. 20	20 mm	8.2 (0.40)	8 (0.40)	6 (0.30)

Benueites reymenti Collignon
Pl. 28, Fig. 15a–b, 16a–b, 17a–b, 18a–b, 19a–b, 20a–b, 21a–b; Text fig. 70b, d–e

1966 *Benueites reymenti* Collignon, p. 38, pl. 20, fig. 8–9.
1971 *Benueites reymenti* Collignon, Reyment, p. 10, pl. 3, fig. 1–4.

Holotype: Benueites reymenti Collignon, 1966, pl. 20, fig. 8, 8a–b.

Location: La Paragua, type section of Chejendé Member, all figured specimens form part of Assemblage 2a; late early Turonian.

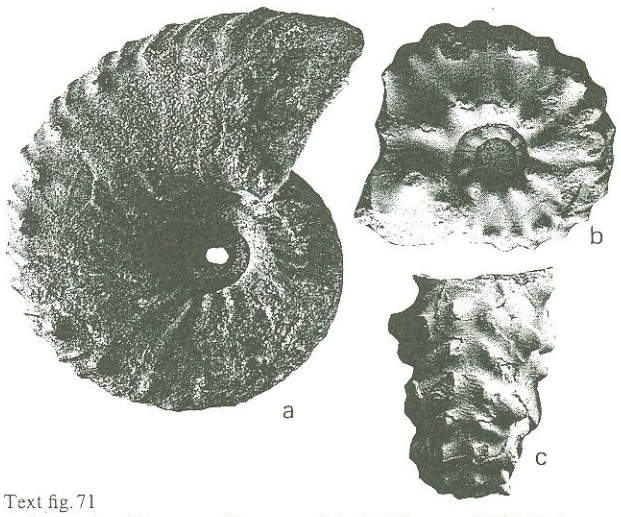
Description: Re6878 (Pl. 28, Fig. 16a–b). Moderate size. Test generally preserved. Whorl section with parallel sides and low trapezoidal venter on costal section, rounded intercostally. Umbilicus relatively narrow, 21% of diameter, against 30% on other specimens. Ribs begin on distinct umbilical bullae of irregular strength, where some bifurcations occur. They cross the flank in flexuous curves, rising into lower ventrolateral nodes, from where they strengthen, turning adorally, ending at high ventrolateral clavi which weaken and become bullate on body chamber. Narrow median groove slightly widening on body chamber, where some feeble ribs meet in a chevron-like manner, as on *Watinoceras.*

Benueites mosquerae (Karsten)
Pl. 28, Fig. 22a–b, 23a–b, 24a–b; Text fig. 71a

1886 *Ammonites Mosquerae* Karsten, p. 62, pl. 4, fig. 4a–c.
1954b *Benueites spinosus* Reyment, p. 156, pl. 3, fig. 2, 4.
1955a *Benueites spinosus* Reyment, p. 58, pl. 13, fig. 3, 4a–b.
1957 *Mammitidae*? n. gen., n. sp. 2, Bürgl, p. 137, pl. 13, fig. 4a–b.
1966 *Benueites spinosus* Reyment, Collignon, p. 38, pl. 20, fig. 4, 4a.
1971 *Benueites spinosus* Reyment, p. 8, pl. 2, fig. 2; pl. 3, fig. 1–4; pl. 4, fig. 1–3.

Location: Quebrada San Pedro near Humocaro Bajo, State of Lara, Chejendé Member, late Turonian.

Description: JG267 (Pl. 28, Fig. 22), closely resembles the holotype (refigured in Text fig. 71a). Test partly preserved. Body chamber covers last two thirds of outer



Text fig. 71
a. *Ammonites Mosquerae* Karsten, original of Karsten (1886, Pl. 4, Fig. 4a) = *Benueites mosquerae* (Karsten), 1×.
Phot. Humboldt University, East Berlin.
b–c. *Benueites trinidadensis* n. sp., holotype, MBJ28452, Plaisance Conglomerate, Trinidad, Coll. H. Kugler, 1×.

volution. Whorl section slightly compressed, subrectangular, widest below mid-flank. Sides parallel. Venter broadly trapezoidal with narrow siphonal groove, interrupting costation, and widening towards body chamber. Umbilicus 27% of diameter, steep-sided, narrowly merging into flank. Rib pattern on inner whorls dense, widening towards body chamber, where spacing and strength of ribs become irregular. Coarser ribs begin on umbilical slope, cross sides in prorsiradiate, flexuous curves. Some elevated into lower ventrolateral, partly spinous tubercles, varying in height, from which they lean forward, ending at upper ventrolateral clavi on strong ribs, and bullae on finer ones. Suture poorly indicated.

Variety Re6845 (Pl. 28, Fig. 23) from the Chejendé syncline, forms part of Assemblage 3, La Paragua. It is a slender variety, resembling the holotype. It best compares to a smaller example figured by Reyment (1971, pl. 2, fig. 3) from Colombia.

Variety JG259 (Pl. 28, Fig. 24) from Quebrada San Pedro near Humocaro Bajo shows fine-ribbed inner whorl with a narrow ventral groove. Towards body chamber costation becomes coarser and ventrolateral tuberculation sets in.

Measurements:	Dm	Wh	Ww	U
JG267	45 mm	20 (0.44)	19 (0.42)	12 (0.27)
Re6845	36 mm	16 (0.44)	12 (0.32)	9 (0.25)

Distribution: Colombia, Venezuela, Nigeria.

Benueites benueensis Reyment
Pl. 28, Fig. 25a–b; Pl. 29, Fig. 2a–b, Text fig. 70a

1954b *Benueites benueensis* Reyment, p. 155, pl. 3, fig. 1, 1a.
1955a *Benueites benueensis* Reyment, p. 58, pl. 13, fig. 1–2.
1966 *Benueites benueensis* Reyment, Collignon, p. 38, pl. 20, fig. 5–7.
1971 *Benueites benueensis* Reyment, p. 6, pl. 1, fig. 1–4; pl. 2, fig. 1, 3–5; pl. 4, fig. 4, pl. 10, fig. 4.
1978 *Benueites benueensis* Reyment, Matsumoto et al., p. 5.

Location: Quebrada San Pedro near Humocaro Bajo, State of Lara, Chejendé Member, late Turonian.

Description: JG 261-2 (Pl. 29, Fig. 2). Small, compressed ammonites. Whorl section high-oval. Sides flat-convex, grading into rounded, narrowly grooved venter and towards gently sloping umbilical wall. Umbilicus low, 32% of diameter. Costation fasciculate. Ribs very close, fine, thin striae-like, prorsiradiate, sigmoidally curved, projecting forward on ventrolateral shoulder and ending at narrow siphonal groove. Bundles of three to five ribs begin from bullae-like, low elevations on umbilical margin. Suture line not preserved.

Sample Re6847 (Pl. 28, Fig. 25) from Assemblage 3 (late early Turonian) near La Paragua is a very slender immature specimen with its body chamber preserved.

Re2358 (Text fig. 70a) shows a *B. benueensis* from the Río Apón section (Perijá foothills).

Measurements:	Dm	Wh	Ww	U
JG261-2, Pl. 29, Fig. 2	22 mm	9 (0.41)	8 (0.36)	7 (0.32)
Re6847, Pl. 28, Fig. 25	17.5 mm	7.5 (0.43)	4 (0.23)	5 (0.30)

Distribution: Nigeria, Morocco, Trinidad, Venezuela, Colombia.
Remarks: B. benueensis is restricted to Assemblage 3 from the upper Chejendé Member, where it occurs abundantly. Lower in the section within Assemblage 2a, mostly coarser ribbed *Benueites* were observed.

Genus *Watinoceras* Warren, 1930

Type species: Watinoceras reesidei Warren, 1930

Occurrence: England, Spain, Morocco, Nigeria, Cameroon, Madagascar, Turkestan, Canada, USA, Venezuela, Japan.

Indications for sexual dimorphism, as proposed by Cooper (1978, p. 123) were not observed in the material obtained from Venezuela. The precondition that microconchs *(W. reesidei)* and macroconchs *(W. coloradoense)* lived together (i.e. that they occur in the same layer or concretion) is not met. Until additional material comes to light which could provide more convincing evidence it is recommended that *W. reesidei* and *W. coloradoense* be considered as distinct species.

Watinoceras reesidei Warren
Pl. 29, Fig. 7a–b, 8a–b

In the Chejendé region *Watinoceras* is present in Assemblage 2, and thus occurs below *Benueites* which forms part of Assemblages 2a and 3. *Watinoceras* is a rare ammonite found in association with abundant *Mammites spinosus.*

1930 *Watinoceras reesidei* Warren, p. 67, pl. 3, fig. 2; pl. 4, fig. 9–12.
1947 *Watinoceras reesidei* Warren, p. 122, pl. 30, fig. 6.
1954b *Watinoceras* aff. *reesidei* Warren, Reyment, p. 55, text fig. 25b, c.
1961 *Watinoceras reesidei* Warren, Cobban and Gryc, p. 186, pl. 38, fig. 44–49.
1965 *Watinoceras reesidei* Warren, Hattin, text fig. 3.
1966 *Watinoceras* aff. *reesidei* Warren, Collignon, p. 37, pl. 19, fig. 14, 15.
1972 *Watinoceras reesidei* Warren?, Cobban and Scott, p. 75, pl. 27, fig. 7–10; pl. 28, fig. 4.
1978 *Watinoceras reesidei* Warren, Cooper, p. 120.

Location: Los Mamones, Chejendé Member, Assemblage 2, mid early Turonian.

Description: Re6825-1 (Pl. 29, Fig. 7). Small-sized ammonites with body chamber preserved, test mostly retained. Whorl section about as wide as high. Sides convex, flattened, subparallel. Venter subtrapezoidal, slightly concave between ventrolateral tubercles. Umbilicus moderately evolute, 37% of diameter. Umbilical wall gently sloping, without distinct umbilical margin. Costation dense, 45 sigmoidally curved, slightly prorsiradiate ribs remain single or bifurcate, more or less distinct from low umbilical bullae. On body chamber ribs predominantly single. All ribs lean forward from lower ventrolateral bullate tubercles and rise on shoulder into oblique clavi, then cross venter, showing weak forward projection. Feebly, partly untuberculated ribs are intercalated, especially towards body chamber. Suture not visible.

Re6825-2 (Pl. 29, Fig. 8). Costation more regular on inner volution.

Measurements:	Dm	Wh	Ww	U
Re6825-1	27 mm	10 (0.37)	9.5 (0.36)	10 (0.37)
Re6825-2	20 mm	8 (0.40)	6.5 (0.32)	6 (0.30)

Distribution: Colorado, Morocco, Cameroon, Venezuela.

Watinoceras aff. *reesidei* Warren
Pl. 29, Fig. 9a–b

Location: Syncline of Barbacoas, La Aguada, Chejendé Member, early Turonian.

Description: Re6826. Conch comparable with *Watinoceras reesidei*. Crossing of ribs over venter remains rather subdued, but becomes more distinct towards end of body chamber. Lower ventrolateral tubercles are faintly indicated on turning point of ribs, adorally. Upper ventrolateral tubercles clearly developed. Branching of ribs from umbilical bullae is common.

For a better appreciation of this specimen additional material would be needed.

Measurements: Re6826, Dm 26 mm, Wh 9 (0.35), Ww 8.5 (0.33), U 10 (0.40).

? *Watinoceras* aff. *coloradoense* (Henderson)
Pl. 29, Fig. 4a–b

1908 *Acanthoceras coloradoense* Henderson, p. 259, pl. 13, fig. 10, 11.
1972 *Watinoceras* aff. *coloradoense* (Henderson), Cobban and Scott, p. 76, pl. 27, fig. 11–19; pl. 28, fig. 1–3, 5–9.
1978 *Watinoceras (W.) coloradoense* (Henderson), Cooper, p. 123, fig. 18c–d, 19e–f, 31–34.

Location: From an allochthonous boulder in the Paleocene-Eocene Guárico flysch north of Ortiz, near Los Robles de Ortiz, Hacienda Barranca Amarilla (State of Guárico). It occurs together with *Hoplitoides* and *Pseudaspidoceras*.

Description: VK1283B-2. Medium sized ammonite. Test preserved. Living chamber three-quarter whorl. Peristome partly preserved; over venter simple, feebly collared. Whorl section quadrate, widest on umbilical bullae located above rounded umbilical margin. Venter on costal section flatly trapezoidal. Umbilicus 21% of diameter, umbilical wall steep-sided. Ornament consists of three rows of tubercles characterized by variable size, mainly on living chamber. They are bullate above umbilicus, conical to spinous above mid-flank and clavate ventrolaterally. Ribs subdued over flank between umbilical bullae and lower ventrolateral tubercles, as well as over venter. Suture line covered by test.

Measurements: Dm 63 mm, Wh 30 (0.47), Ww 29 (0.46), U 13 (0.21).

Distribution: Colorado (USA), Venezuela.

Remark: Watinoceras aff. *coloradoense* figured by Collignon (1966, p. 37, pl. 20, fig. 1–3) from the Tarfaya Basin in Morocco are small ammonites.

? *Watinoceras* aff. *coloradoense* (Henderson)
Pl. 29, Fig. 3a–b

Location: Type section of Chejendé Member, La Paragua, Assemblage 2a, late early Turonian.

Description: Re6888. Single, apparently still juvenile, small-sized *Watinoceras*, if compared with the holotype and the adult specimen figured by Cooper from Colorado. Costation is normally strong.

Watinoceras venezolanum n. sp.
Pl. 29, Fig. 5a–b, 6a–b

Holotype: Re6958 (Pl. 29, Fig. 5), deposited with Maraven S.A., Caracas.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2.

Age: Mid early Turonian.

Description of holotype: Test partly preserved. Body chamber three-quarter whorl, with simple aperture. Whorl section rectangular, flanks flat, parallel, grading narrowly into flat arched venter, resulting in a distinct ventrolateral shoulder. Umbilical margin rounding towards steeply sloping umbilicus which reaches 27% of diameter. Costation rather dense, slightly prorsiradiate. On outer volution ribs irregular in strength. Some weaker ribs do not reach umbilical margin, stronger ones

indistinctly branch from low bullae on umbilical margin. Most ribs bear lower ventrolateral tubercles becoming bullate towards phragmocone. From here all ribs turn adorally, rising into upper ventrolateral more or less clavate tubercles, also of variable size. Over venter of body chamber, ribs continue and meet chevron-like on median line. On phragmocone ribs flatten over venter without touching, as on *Benueites*.

Paratype, Re6879 (Pl. 29, Fig. 6), Assemblage 2. An example of a small specimen with a somewhat closer costation, also on phragmocone. On body chamber lower bullate and upper clavate ventrolateral tubercles inconsistent in strength. Over venter ribs project chevron-like forward on body chamber, as on holotype.

Measurements:	Dm	Wh	Ww	U
Holotype	56 mm	23 (0.41)	24 (0.43)	15 (0.27)
Paratype	41 mm	16 (0.40)	?15 (0.37)	8.5 (0.20)

Remarks: None of the numerous *Watinoceras* figured by Collignon (1966) from Morocco resembles these specimens.

Genus *Mitonia* Renz and Alvarez, 1979

Type species: Mitonia venezolana Renz and Alvarez

Occurrence: Venezuela.

The genus *Mitonia* forms part of Assemblage 1 (abundant) and Assemblage 2a (rare). It probably is also present in Assemblage 2. Thus its stratigraphic range is considerable.

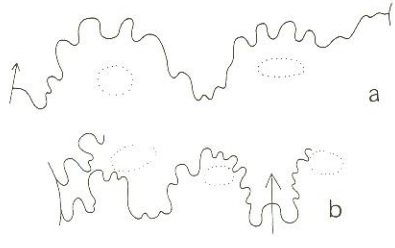
Mitonia venezolana Renz and Alvarez

Pl. 29, Fig. 11a–b, 12a–b, 13a–b, 15a–b, 22a–b, 23; Text fig. 72, 73a–b

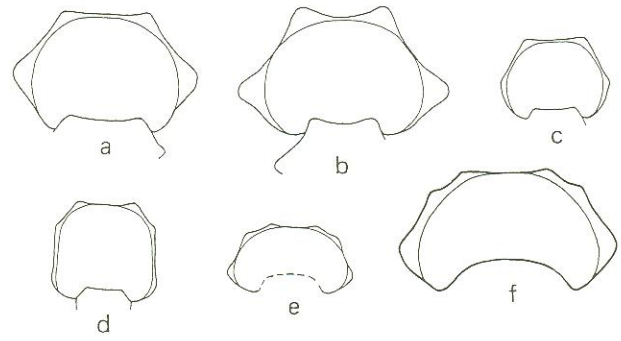
1967 *Paramammites polymorphus* Pervinquière, Leanza, p. 200, pl. 1, fig. 1–4.
1979 *Mitonia venezolana* Renz and Alvarez, p. 975, fig. 2a–b, w.

Location: La Morita, type section of Chejendé Member, Assemblage 1, early early Turonian.

M. venezolana is a common small ammonite in Assemblage 1.



Text fig. 72
Mitonia venezolana Renz and Alvarez.
a. Suture line, Re6799-135 (J30439), assemblage 1, 6×.
b. Suture line of holotype, Re6799-81, 5×.



Text fig. 73
Whorl sections of *Mitonia:*
a. *M. venezolana* Renz and Alvarez, Re6799-61, Pl. 29, Fig. 11, 2×.
b. *M. venezolana* Renz and Alvarez, Re6799-125, Pl. 29, Fig. 15, 2×.
c. *M. gracilis* Renz and Alvarez Re6799-85, Pl. 29, Fig. 16, 2×.
d. *M. evoluta* Renz, Re6865, Pl. 29, Fig. 10, 2×.
e. *M.* sp. indet., Re6892, Pl. 29, Fig. 14, 2×.
f. *M. constricta* n. sp., Re6799-105, Pl. 29, Fig. 18, 3×.

Description: Re6799-61 (Pl. 29, Fig. 11a–b). Identical in all features with holotype. Costal whorl section depressed, trapezoidal, greatest breadth on dorsal bullae. Intercostal section roughly circular (Text fig. 73a). Venter moderately concave between ventrolateral bullae. Sides rounded sloping evenly towards umbilical seam, without forming pronounced edge. Umbilicus 40% of diameter. Ornament appears early in ontogeny. Ribs broad and flat, becoming indistinct and irregular on body chamber. 16 ribs on outer whorl rise above umbilical seam, and elevate in outstanding radially elongated bullae slightly below midflank. From 7 bullae very indistinct branching occurs such that 20 ribs reach venter, where all rise into bullate tubercles. Over venter ribs join straight ventrolateral bullae, following growth lines. Along siphonal line ribs distinctly subdued.

Re6799-125 (Pl. 29, Fig. 15, Text fig. 73b). Variety with somewhat wider spaced ribs provided with higher umbilical spines resulting in a much greater whorl width. Ventrolateral spines alternating over venter might be interpreted as an abnormal feature, which is not found on any other specimen.

Re6799-124 (Pl. 29, Fig. 12). Variety with low ventrolateral bullae resulting in a circular whorl section. Venter narrow with ribs between ventrolateral bullae nearly effaced.

Re6799-60 (Pl. 29, Fig. 13). On body chamber ribbing widens irregularly, resulting in smooth intervals. This might be considered as pathologic.

Re6918 (Pl. 29, Fig. 22). Variety with a less pronounced ornamentation.

Re6920 (Pl. 29, Fig. 23) shows surface of last septum. The lobe formula E L U_2/U_1 J is suggested (Text fig. 72).

Measurements:	Dm	Wh	Ww	U
Re6799-61	26 mm	8 (0.31)	12 (0.46)	10.5 (0.40)
Re6799-125	24 mm	8 (0.33)	15 (0.62)	10 (0.42)

Re6799-124	24 mm	7.8 (0.33)	11.5 (0.48)	10 (0.42)
Re6799-60	21 mm	7.5 (0.35)	9 (0.43)	9 (0.43)

Remarks: M. venezolana has recently also been found by C. Beck in the State of Guárico, in the Cerro El Peñon to the south of Altagracia de Orituco, some 350 km to the northeast of the La Morita (Trujillo) occurence.

Mitonia gracilis Renz and Alvarez
Pl. 29, Fig. 16a–b, 17a–b, 21a–b; Text fig. 73c

1979 *Mitonia gracilis* Renz and Alvarez, p. 976, fig. 2c–d.

Location: La Morita type section of Chejendé Member, Assemblage 1, early early Turonian.

Description: Re6799-85 (Pl. 29, Fig. 16). Conch with preserved body chamber. Aperture simple, following sigmoidally curved growth lines. Whorl section slightly depressed on costal section, sub-trapezoidal with rounded edges, widest on dorsal bullae (Text fig. 73c). Venter tabulate on phragmocone, rounded towards body chamber. Flanks rounding into steep sloping umbilical wall. Ribs predominantly single, especially on body chamber. Tuberculation strong on phragmocone, weakening towards body chamber. From elongate bullae on dorsal half of flank some subdued branching occurs. All ribs rise into ventrolateral clavi on phragmocone which become bullate towards body chamber. Over venter costation faintly inclines forward, following growth lines. Ribs flattening over mid-venter, especially on phragmocone. Suture line not exposed.

Measurements: Re6799-85, Dm 20 mm, Wh 7 (0.35), Ww 9 (0.45), U 8 (0.40).

Re6799-82 (Pl. 29, Fig. 17) and Re6917 (Pl. 29, Fig. 21) are adult examples of *M. gracilis* with parts of their living chambers preserved.

Mitonia constricta n. sp.
Pl. 29, Fig. 18a–b; Text fig. 73f

Holotype: Re6799-105. Deposited with Maraven S.A., Caracas.

Location: La Morita, type section of Chejendé Member, Assemblage 1.

Age: Early early Turonian.

Description of holotype: Single specimen. Last two-thirds of outer volution occupied by body chamber. Whorl section (Text fig. 73f) depressed, venter flattened, sides convex; umbilical wall steep with rounded margin. Umbilicus moderately deep, 40% of diameter. Deep constrictions, preceeded by a stronger rib which rises into a more or less pronounced umbilical bulla are conspicuous sculptural features. Costation between constrictions is typical for *Mitonia*. Ribs bear lower and upper ventrolateral tubercles and cross venter, attenuated along median line.

Measurements: Dm 17.5 mm, Wh 6 (0.34), Ww 8.8 (0.50), U 7 (0.40).

Remarks: M. constricta has been isolated from the concretion which furnished the long-spined *Pseudaspidoceras* (Pl. 30, fig. 5). The species differs from *M. venezolana* as well as from *M. gracilis* by the presence of an additional small, lower, ventrolateral elevation as developed on *Mitonia* sp. (Pl. 29, Fig. 14). Whether it would be justifiable to interpret these bituberculated forms as a subgenus of *Mitonia* or as a new genus, cannot be decided from the scanty material available.

Mitonia evoluta n. sp.
Pl. 29, Fig. 10a–b; Text fig. 73d

Holotype: Re6865. Deposited with Maraven S.A., Caracas.

Location: La Paragua, type section of Chejendé Member, Assemblage 2a.

Age: Late early Turonian.

Description of holotype: Small ammonite. Coiling serpenticone. Body chamber covers last two-thirds of outer volution. Test almost fully preserved. Whorl section slightly depressed, rectangular (Text fig. 73d). Flanks parallel, flattened. Venter flat, distinctly concave. Umbilicus low, evolute, 44% of diameter. Costation even, dense. 45 slightly prorsiradiate ribs begin on rounded umbilical margin and rise into low ventrolateral bullae from which ribs turn forward, ending at upper ventrolateral bullate clavi. Except for the growth striae on test, venter between ventrolateral bullae remains smooth. Suture not preserved.

Measurements: Dm 21.5 mm, Wh 6.5 (0.30), Ww 8 (0.37), U 9.5 (0.45).

Remark: M. evoluta occurs together with small *Mammites nodosoides,* coarse ribbed *Benueites* and transitional forms connecting *Mammites* with *Benueites.*

Mitonia sp. indet.
Pl. 29, Fig. 14a–b; Text fig. 73e

Assemblage 2a furthermore contains a single, imperfectly preserved *Mitonia* which is not suitable as a holotype. It is associated with *Benueites* and *Hoplitoides* and is considered to be late early Turonian in age.

Description: Re6892. Small sized ammonite. Phragmocone diameter 14 mm. Whorl section strongly depressed, twice as high as wide (Text fig. 73e). Umbilicus 38% of diameter. Wall steep-sided on costal section, rounded intercostally. High bullae on umbilical edge commence at umbilical seam and continue in flat, low, rectiradiate ribs bearing feeble lower and upper ventrolateral nodes as on *M. constricta.* Over the broad, flat rounded venter, ribs flatten out towards siphonal region, as typical for genus.

Measurements approximative: Dm 16 mm, Wh 4.5 (0.28), Ww 9 (0.56), U 7 (0.44).

Remarks: Present information on the stratigraphic range of species of *Mitonia* is not sufficiently conclusive to allow a subdivision of the genus into subgenera. Forms without lower ventrolateral tubercles can be distinguished: *M. venezolana* and *M. gracilis* and others with lower ventrolateral tubercles: *M. constricta, M. evoluta* and *M.* sp. indet.

Subfamily Euomphaloceratinae Cooper, 1978

Genus *Euomphaloceras* Spath, 1923

Type species: Ammonites euomphalus Sharpe, 1855.

Occurrence: Europe, Africa, Madagascar, Syria, India, Japan, Texas, Mexico, Venezuela.

Subgenus *Kanabiceras* Reeside and Weymouth, 1931

Type species: Scaphites ?septem-seriatus Cragin, 1893.

Euomphaloceras (?Kanabiceras) septemseriatum (Cragin)
Pl. 21, Fig. 8a-b

1893 *Scaphites ?septem-seriatus* Cragin, p. 240.
1927 *Acanthoceras ?kanabense* Stanton, Moreman, p. 95, pl. 13, fig. 5.
1931 *Prionotropis echinatus* Douvillé H., p. 34, pl. 3, fig. 1-5; pl. 4, fig. 1-3.
1942 *Neocardioceras septemseriatum* (Cragin), Moreman, p. 213, pl. 33, fig. 11, 12.
1951 *Neocardioceras septemseriatum* (Cragin), Adkins and Lozo, pl. 6, fig. 7, 8.
1958 *Lyelliceras stanislausense* Anderson, p. 247, pl. 8, fig. 5.
1959c *Kanabiceras septemseriatum* (Cragin), Matsumoto, p. 99, pl. 24, fig. 1a-c.
1963a *Kanabiceras septemseriatum* (Cragin), Powell, p. 316, pl. 31, fig. 9-10.
1969 *Kanabiceras septemseriatum* (Cragin), Matsumoto, in Matsumoto, Muramoto and Takahashi, p. 279, pl. 37, fig. 1-3.
1972 *Kanabiceras septemseriatum* (Cragin), Cobban and Scott, p. 72, pl. 12, fig. 5-27, with synonymy.
1978 *Euomphaloceras (Kanabiceras) septemseriatum* (Cragin), Cooper, p. 106, fig. 4N-O, 10A-E, 12E-H, 18G-H, 19G-L, 26A-B, 28.

Holotype: Kanabiceras septemseriatum (Cragin), Cobban and Scott, 1972, p. 72, pl. 12, fig. 24, 25, Eagle Ford Shale, Texas.

Location: Type section Chejendé Member, Assemblage 2a, near La Paragua, late early Turonian.

Description: Re6827. Single fragment of body chamber, showing main features of *E. (K.) septemseriatum.* Whorl section broad rectangular with flat sides, feebly converging towards rounded venter on intercostal section, thickest on umbilical bullae (one preserved). Ribs and tubercles irregular in strength. Ribs part from umbilical bullae, cross flank in a slightly convex forward curved bow, to lower ventrolateral nodes, from where they further incline slightly adorally towards upper ventrolateral clavi. Ribs cross venter in a feebly forward projected arch. Siphonal tubercles clavate.

Distribution: France, England, USA, Mexico, Venezuela, Angola, Nigeria, Japan.

Remarks: A relation of this fragment to *Kamerunoceras,* suggested by its occurence within the upper part of the Turonian section, cannot be excluded. Additional material, also of phragmocones, is indispensable to define its taxonimic position.

Genus *Pseudaspidoceras* Hyatt, 1903

Type species: Ammonites footeanus Stoliczka, 1865.

Occurrence: Europe, Tunisia, Egypt, Nigeria, Madagascar, India, USA, Venezuela, Brazil.

Pseudaspidoceras armatum (Pervinquière)
Pl. 30, Fig. 1a-b, 2a-b, 3a-b, 4a-c, 5, 9a-b

1907 *Mammites (Pseudaspidoceras) armatus* Pervinquière, p. 317, pl. 19, fig. 2-3.
1959 *Pseudaspidoceras* cf. *P. armatum* (Pervinquière), Wiedmann, p. 715.
1969 *Protexanites armatus* (Pervinquière), Freund and Raab, p. 70.
1979b *Kamerunoceras turoniense* (d'Orbigny), Kennedy and Wright, p. 1170, 1175.

P. armatum forms part of Assemblages 1, 2 and 2a. It occurs together with *Benueites* and *Kamerunoceras ("Schindewolfites")* in Assemblage 2a. Its stratigraphic range is thus considerable.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2, mid early Turonian.

Description: Re6951 (Pl. 30, Fig. 1). Large ammonites. Still juvenile specimen. Outer volution with body chamber, without exaggerated development of upper ventrolateral spines. Intercostal whorl section subquadrate. Flanks rounding towards umbilical seam without umbilical margin. Venter tabulate, with slightly elevated sipho. No keel or siphonal clavi. Ribs begin above umbilical seam, rise into elongated bullae above umbilical margin which flatten around mid-flank. Ribs rise again into lower ventrolateral clavate tubercles and upper ventrolateral round-topped nodes. Holotype from Tunisia shows basis of a spine, sitting on node, preserved on body chamber.

On sample Re6850 (Pl. 30, Fig. 4a-c) four spines, sitting on upper ventrolateral nodes, two on each side, are preserved. Their tops are missing. Spines are hollow, thin-shelled and delicate. They are filled with calcite cement. The surface of the nodes is covered by test representing its inner layer which isolates the body chamber from the hollow spines. This is distinctly exposed on sample Re6850 (Pl. 30, Fig. 4c). Preserved part of longest spine attains a length of 30 mm.

Re6938 (Pl. 30, Fig. 9). Fragment, forming part of Assemblage 2a (late early Turonian), is distinguished by closer ribbing and might represent a variety of *P. armatum.*

Another specimen of *Pseudaspidoceras armatum* has been collected by G. H. Voorwijk from an allochthonous boulder in the Guárico flysch, north of Ortiz (location VK1283-B).

Juvenile stage Re6891 (Pl. 30, Fig. 2). Outer ventrolateral nodes begin to develop at about 9 mm diameter and are followed by lower ventrolateral clavate tubercles. At about 20 mm diameter bullae appear above the umbilicus. There is no trace of siphonal elevation.

JG457-2 (Pl. 30, Fig. 3) originates from the Santa Rosa region (1.5 km east of Chejendé) and was collected by de Jong.

Re6853 (Pl. 30, Fig. 5) from Assemblage 1, shows longest spine observed, reaching 80 mm (after reconstruction about 100 mm). In cross section spines are oval with their long axis parallel to median line. Longest spines near end of phragmocone; length diminishes adaptically. Spines converge inside, thus ends must nearly have touched each other.

Measurements:	Dm	Wh	Ww	U
Re6951	73 mm	27 (0.37)	31 (0.42)	27 (0.37)
Re6891, juvenile	25 mm	9 (0.36)	11 (0.44)	9.5 (0.38)

Distribution: France, Tunisia, Israel, Venezuela.

Remarks: Kennedy and Wright (1979b) incorporate the holotype of *Pseudaspidoceras armatum* (Pervinquière) in the genus *Kamerunoceras* Reyment (1954a, b). This genus is characterized by siphonal clavi. Kennedy and Wright (p. 1166) state that "the presence of siphonal clavi clearly excludes the genus from the Mammitinae".

Kamerunoceras with siphonal clavi (*Ammonites turoniensis* d'Orbigny, 1850a, and *K. seitzi* (Riedel) 1932 (pl. 30, fig. 7) from the Mungo River in Cameroon (Kennedy and Wright, 1979a, p. 1169, text fig. 1) are not known so far from the Turonian in Venezuela. Here all specimens available possess a venter without median tuberculations. Therefore, they should not be grouped with *Kamerunoceras* but with *Pseudaspidoceras armatum* Pervinquière which they closely resemble. According to Pervinquière (1907, p. 315) no siphonal clavi are present on this form: "... et aux milieu une légère carène rarement un peu onduleuse, formée par la saillie du siphon. Pas de rang de tubercules au milieu du dos, même dans le plus jeune âge". This coincides precisely with the present specimens.

Genus *Kamerunoceras* Reyment, 1954

Type species: Acanthoceras Eschii Solger, 1904 (refigured: Kennedy and Wright, 1979, text fig. 1, p. 1169).

Occurrence: Spain, France, England, Morocco, Tunisia, Middle East, Madagascar, Venezuela.

Kamerunoceras ("Schindewolfites") ganuzai (Wiedmann)
Pl. 29, Fig. 19a–b; Text fig. 74a

1959 *Schindewolfites ganuzai* Wiedmann, p. 738, pl. 5, fig. 1–2.
1964 *Schindewolfites ganuzai* Wiedmann, p. 125, fig. 8a–b, 9.
1979a *Kamerunoceras ganuzai* (Wiemann), Kennedy and Wright, p. 1165–1178.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2, mid early Turonian. Found in association with *Mammites nodosoides.*

Description: Re6830. Single, small specimen. Phragmocone consists of coarse calcite crystals. Body chamber begins with outer fragmental volution. Intercostal section slightly compressed, subquadrate with rounded corners (Text fig. 74a). Umbilicus moderately evolute, 36% of diameter. Ribs single, rectiradiate, projected slightly forward, over venter. Stronger ribs begin in pairs from umbilical bullae and are separated by one or two weaker ribs which are not or only faintly tuberculated. Strong ribs bear lower ventrolateral spinous tubercles and upper spines which have a pronounced adaptical turn. Along siphonal line all ribs rise into low bullae, nearly touching each other, suggesting a faint keel. Last suture line badly damaged.

Measurements: Dm 33, Wh 20 (0.60), Ww 14 (0.42), U 12 (0.36).

Distribution: Spain, Venezuela.

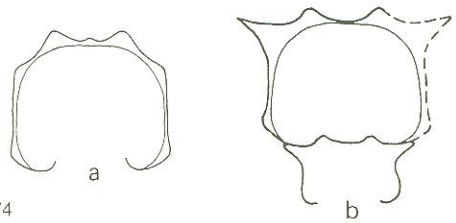
Kamerunoceras ("Schindewolfites") andinum n. sp.
Pl. 29, Fig. 20a–b; Text fig. 74b

Holotype: Re6904, deposited with Maraven S.A., Caracas.

Location: Los Mamones, type section of Chejendé Member, Assemblage 2.

Age: Mid early Turonian.

Description of holotype: Adult specimen with body chamber reaching three-quarter volution. Test mostly broken off during preparation. Horns filled with calcite, about one third longer on test than on cast. Whorl section subquadrate (Text fig. 74b). Intercostal section slightly depressed. Sides flattened, roughly parallel, rounding evenly towards umbilical seam and venter.



Text fig. 74
Whorl sections of *Kamerunoceras:*
a. *Kamerunoceras ("Schindewolfites") ganuzai* (Wiedmann), Re6830, Pl. 29, Fig. 19, 2×.
b. *Kamerunoceras ("Schindewolfites") andinum* n. sp., Re6904, Pl. 29, Fig. 20, 1×.

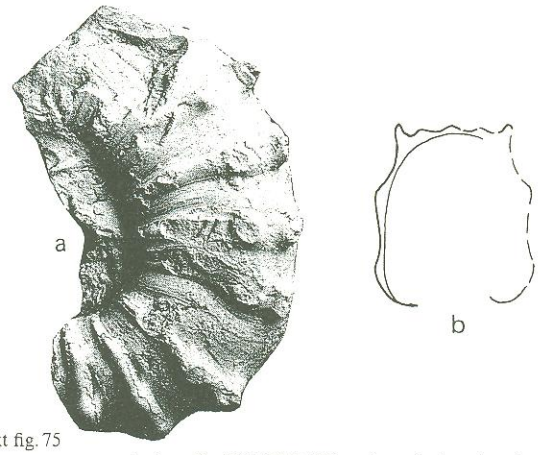
Sipho very slightly elevated. Umbilicus 59% of diameter, relatively wide. Costation on phragmocone, as far as visible, close, widening and gaining in strength towards body chamber. Ribs cross flank about rectiradiate and faintly bend forward in a wide angle over venter. On body chamber few weak, not tuberculated ribs are irregularly interspersed. Towards end of body chamber ornament weakens, ribs become closer and tuberculation lowers. On rounded umbilical margin ribs rise into low bullate tubercles. Lower ventrolateral spines developed on phragmocone and change on body chamber into high, sharply pointed horns projected adaptically, as typical for *Schindewolfites* Wiedmann (1964). Those horns diminish in height towards aperture. Upper ventrolateral tubercles round-topped and low. No tuberculation along mid-line of venter, as far as visible. Suture not preserved.

Measurements (excluding height of lower ventrolateral horns):
Dm 61 mm, Wh 22 (0.36), Ww 24 (0.39), U 23.5 (0.39).

Kamerunoceras sp. indet.
Text fig. 75

Location: La Paragua, type section Chejendé Member, Assemblage 2a from upper part of member together with *Benueites*, late early Turonian.

Description: Re6831. A single, poorly preserved specifically undeterminable fragment. Intercostal whorl section rounded. Ribs radial, widely spaced, single. Nine rows of tubercles: umbilical bullae feeble, lower ventrolateral tubercles rounded, upper ones paired into dorsal high spines and ventral low clavi; on mid-venter a row of poorly preserved clavi is present.



Text fig. 75
Kamerunoceras sp. indet., Re6831 (J30481), a. lateral view, b. whorl section, 1×.

Family Coilopoceratidae Hyatt, 1903

Genus *Hoplitoides* von Koenen, 1898

Type species: Hoplitoides latesellatus von Koenen, 1897.

Occurrence: Tunisia, Syria, Israel, Egypt, Nigeria, Cameroon, Trinidad, Venezuela, Colombia, Peru, Brazil (Oliveira and Brito, 1969).

In Venezuela the genus *Hoplitoides* occurs more or less abundantly throughout most sections of early Turonian age. Thus, it has comparatively a wide stratigraphical range. Nevertheless only three species have so far been recognized. Forms belonging to the group of *H. ingens*, described by von Koenen (1898), Solger (1904) and Reyment (1955) from Nigeria have not been encountered in Venezuela to date.

The majority of *Hoplitoides* in Venezuela possess a truncated venter showing a rather distinct concavity.

Hoplitoides mirabilis Pervinquière
Pl. 30, Fig. 6a–b, 7a–b; Pl. 31, Fig. 10a–b

1907 *Hoplitoides mirabilis* Pervinquière, p. 218, pl. 10, fig. 3.
1918 *Hoplitoides mirabilis* Pervinquière, Böse, p. 225, pl. 19, fig. 1–3.
1928 *Hoplitoides ingens costatus* Solger, Douvillé, H., p. 29, text fig. 19.
1954 *"Hoplitoides" mirabilis* Pervinquière, Kummel and Decker, p. 317.
1969 *Hoplitoides* cf. *H. mirabilis* Pervinquière, Freund and Raab, p. 65, pl. 10, fig. 1–2.

Location: Los Mamones, Chejendé Member, Assemblage 2, associated with *Nannovascoceras*, mid early Turonian.

Description: Re6854 (Pl. 30, Fig. 6). Largest specimen available, showing beginning of body chamber. Conch compressed, discoidal, very involute. Whorl section high, widest between umbilical border and mid-side. Flanks slightly convex, converging towards narrow, truncated, distinctly grooved venter. Ornament reduced to biconcave growth lines on test. Suture line poorly preserved, characterized by a wide external lobe subdivided into various adventitious lobes.

Re6950 (Pl. 30, Fig. 7). Juvenile stage remains smooth. Occasionally faint folds can be recognized. Grooved venter starts at an early stage of growth (around 5 mm diameter).

Re6923 (Pl. 31, Fig. 10). Aperture fully preserved. Variety distinguished by its narrow and more deeply grooved venter.

Measurements:	Dm	Wh	Ww	U
Re6854	96 mm	58 (0.60)	25 (0.26)	4 (0.04)
Re6950	50 mm	22 (0.55)	10 (0.20)	2 (0.02)

Distribution: Tunisia, Israel, Venezuela.

Hoplitoides aff. *mirabilis* Pervinquière, ribbed variety
Pl. 31, Fig. 7a–b, 8a–b, 9a–b

Location: La Paragua, type section Chejendé Member, Assemblage 2a, late early Turonian.