LEIDSE GEOLOGISCHE MEDEDELINGEN, Deel 31 blz. 165-178, separate published 1-10-1965

CONODONT-BEARING FORMATIONS OF DEVONIAN AND LOWER CARBONIFEROUS AGE IN NORTHERN LEÓN AND PALENCIA (SPAIN)

BY

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SUMMARY

Conodonts have been extracted from calcareous units of the Devonian and Lower Carboniferous sequence from 3 areas in the S. part of the Cantabrian Mountains. There can be distinguished Emsian, Givetian, Frasnian, Famennian and Viséan faunas.

INTRODUCTION

Conodonts are being studied by the present author as part of a stratigraphical and palaeontological investigation of the Devonian and Lower Carboniferous succession in the southern Cantabrian Mountains, carried out under the general supervision of Prof. Dr. A. Brouwer.

Macrofossils and conodont samples were collected in the course of a detailed stratigraphic survey of the Esla autochtone, in order to compare their biostratigraphic results. A publication appeared on the region between the San Isidro pass and the Tarna pass, in which a few conodont faunas are mentioned (van Adrichem Boogaert et al., 1963). Spot samples were investigated to assist mapping in the Cardaño-Vidrieros area (van Veen 1965, in prep.) and the Valdeón. Subsequently selected sections were sampled for conodonts.

It appears to be profitable to give a preliminary account of the the results so far obtained, in view of the interest in these microfossils in the Cantabrian Mountains. A detailed publication on this subject is in preparation.

The Upper Devonian conodont zones quoted in this paper are from Ziegler (1962), unless otherwise stated. The author wishes to express his sincere thanks to Dr. W. Ziegler for the help and advice he received at the Geologisches Landesamt Nordrhein-Westfalen, Krefeld, Germany.

THE ESLA AUTOCHTONE

The reader is referred to Rupke (1965) for the definition and location of the Esla autochtone. Three conodont-bearing stratigraphic units can be recognised.

La Vid Formation

A detrital limestone member in the middle part of the La Vid Formation yields three faunas as represented in table 1.

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TABLE 1

sample (geogr. coord.)	Ib 10 (42°52'25" 01°31'23")	VIII 6114 (42°52'43" 01°35'22")	VIII 6115 (42°52'43" 01°35'22")
Icriodus curvatus Br. & M.		+	
Icriodus latericrescens latericrescens Br. & M.	+	+	+
Icriodus latericrescens bilatericrescens (Ziegler)		+	+
Icriodus latericrescens beckmanni Ziegler		+	
Icriodus nodosus (Huddle)		+	+
Polygnathus linguiformis Hinde	+		+
Spathognathodus steinhornensis Ziegler	+		

The faunas containing *Icriodus latericrescens latericrescens* and *Polygnathus linguiformis* from the samples Ib 10 and VIII 6115 indicate and Emsian age (Ziegler 1956, Walliser 1962). Sample VIII 6114, collected 4.5 m lower in the section than VIII 6115 must have approximately the same age.

Portilla Formation

The basal part of the Portilla Formation, consisting of yellow weathering, detrital limestones, has yielded two faunas: table 2.

TABLE 2

sample (geogr.) coord.)	Id 30 (42°51'10" 01°31'42")	IVc 74 (42°54'25" 01°28'44")
Icriodus curvatus Br. & M.	+	+
Icriodus cymbiformis Br. & M.	+	+
Icriodus expansus Br. & M.	+	+
Icriodus latericrescens latericrescens Br. & M. (Middle Devonian form)	+	+
Icriodus nodosus (Huddle)	+	+
Icriodus cf. *I. obliquimarginatus* Bischoff & Ziegler	+	+
Icriodus postiflexus Br. & M.		+
Polygnathus linguiformis Hinde	+	+
Polygnathus varca Stauffer	+	+
Polygnathus webbi Stauffer		+
Spathognathodus bipennatus Bischoff & Ziegler	+	+

The occurrence together of *Polygnathus varca* and *Icriodus latericrescens latericrescens* (Middle Devonian form) is not mentioned by Bischoff & Ziegler (1957), but their study did not include conodonts from the "Mittlere Stringocephalenstufe" (Middle Givetian). So it is probable that the above-mentioned faunas have to be attributed to the Middle Givetian. This conclusion is supported by the dating of this part of

the Portilla Formation by Dr. Th. F. Krans on the spiririferids (pers. comm.). It follows that the range of the Varca Zone (sensu Ziegler, 1962) has to be extended from the Upper to the Middle Givetian.

The adult specimens of *Icriodus latericrescens latericrescens* (Middle Devonian form) differ noticably from the Lower Devonian specimens. The former are most closely comparable with the description of the type species (Branson & Mehl 1938).

Ermita Formation

The mainly sandy Ermita Formation contains limestone lenses in the upper part. From section IIf, app. 600 m NE, of Valdoré (fig. 1, geogr. coord. app. 42°52'28"–01°28'51") the samples mentioned in table 3 were studied.

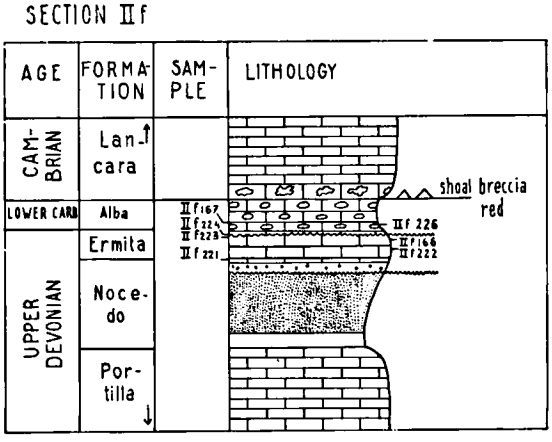

Fig. 1 *

TABLE 3

	W sample	IIf 221	IIf 222	IIf 166	IIf 223
Gnathodus antetexanus Rexroad & Scott					+
Polygnathus communis Br. & M.		+	+	+	+
Polygnathus inornata (E. R. Branson)		+			
Polygnathus longipostica Br. & M.		+			+
Pseudopolygnathus dentilineata E. R. Branson			+	+	+
Spathognathodus aculeatus (E. R. Branson)				+	+
Spathognathodus costatus costatus (E. R. Branson)		+	+	+	
Spathognathodus costatus spinulicostatus (E. R. Branson)			+		+
Spathognathodus stabilis (Br. & M.)					+

* In fig. 1, second colomn, the line between Ermita and Nocedo a has to be lowered 2 mm.

The faunas belong to the Costatus Zone, being of Upper Famennian age (upper to V– to VI). The occurrence of *Gnathodus antetexanus* apparently is the result of a stratigraphic leak from the overlying Alba Formation.

Alba Formation

The Alba Formation consists of red, marly, nodular limestones (griotte). The extension of section IIf (fig. 1) has yielded three faunas: table 4.

TABLE 4

sample	IIf 224	IIf 226	IIf 167
Gnathodus antetexanus Rexroad & Scott		+	+
Gnathodus delicatus Br. & M.	+	+	+
Gnathodus punctatus (Cooper)	+		
Gnathodus semiglaber Bischoff	+	+	+
Gnathodus cf. *G. typicus* Cooper	+		
Polygnathus communis communis Br. & M.	+		
Polygnathus communis carina Hass	+		
Polygnathus inornata E. R. Branson	+		
Pseudopolygnathus dentilineata E. R. Branson	+		
Pseudopolygnathus triangula triangula Voges	+		
Pseudopolygnathus triangula inaequalis Voges	+		
Pseudopolygnathus triangula pinnata Voges	+		
Siphonodella obsoleta Hass	+		
Siphonodella quadruplicata (Br. & M.)	+		
Spathognathodus costatus costatus (E. R. Branson)	+		

The faunas IIf 226 and IIf 167 can be placed in the Anchoralis/Bilineatus Interregnum (upper cu IIβ/γ–lower cu IIδ) and may range into the Anchoralis Zone (cu IIβ/γ) (Voges 1957). Because of the absence of the species *Scaliognathus anchoralis* and polygnathids the latter is less probable. Above-mentioned zones are of Lower Viséan age.

Fauna IIf 224 probably belongs to the Anchoralis Zone. It contains many conodonts from older zones, which can be considered as a stratigraphic admixture, in view of the transgressive character of the Alba Formation (see e.g. Krebs 1964). There is no need to conclude that the ranges of these species deviate from the established values as suggested in Budinger & Kullmann (1964, p. 424, 426).

THE CARDAÑO-VIDRIEROS REGION

Four conodont-bearing formations can be distinguished in this area, the definition and distribution of which is given in van Veen (1965). Cleavage is very common in the northern part of the area. This has often deformed the conodonts. Fig. 3 and 4 represent the sections as shown on the sketch map of fig. 2, which also gives the locations of the spot samples. The spot samples were kindly provided by Mr. J. van Veen.

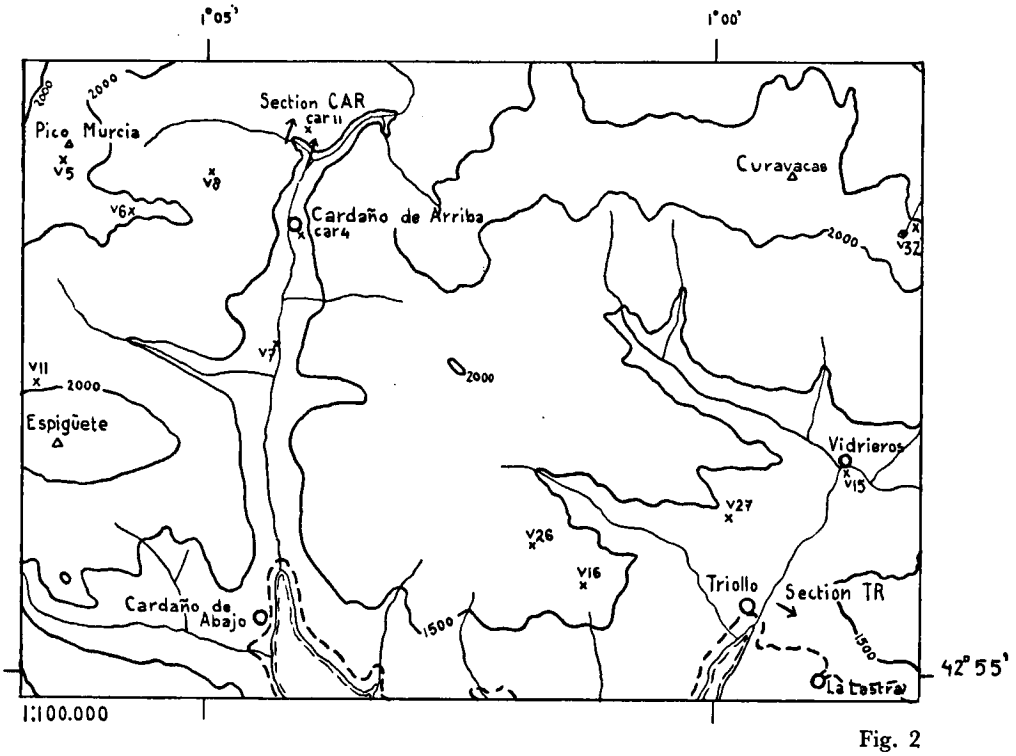

Fig. 2

Gustalapiedra Formation

This formation consists of black limestones alternating with black shales. The results are shown in table 5.

TABLE 5

	W sample	CAR 34	CAR 29	Car 4	V 32
Ancyrodella rotundiloba (Bryant)			+		
Icriodus cymbiformis Br. & M.		+	+	+	
Icriodus nodosus (Huddle)			+		
Icriodus cf. *I. obliquimarginatus* Bischoff & Ziegler		+		+	+
Polygnathus decorosa Stauffer			+		
Polygnathus linguiformis Hinde		+		+	+
Polygnathus pennata Hinde		+	+		
Polygnathus varca Stauffer		+	+	+	+

The faunas CAR 34 and Car 4 (capital letters for samples to be found in the sections, small letters for spot samples) belong to the Varca Zone (Bischoff & Ziegler 1957, Ziegler 1962). Their age is Upper or possibly Middle Givetian (see remarks to Portilla Formation). However, the absence of *Icriodus latericrescens latericrescens* (Middle Devonian form) and *Spathognathodus bipennatus* is in favor of an Upper Givetian age.

CAR 29 can be placed in the Lower Dubia Zone (Ziegler 1962, see also Ziegler 1958 and Krebs 1959), indicating a Lower Frasnian age (to Iα).

Cardaño Formation

This formation consists of nodular limestones and shales. In small outcrops in the field it is often impossible to distinguish these nodular limestones from those above the Murcia Formation. The conodont contents however permits a clear differentiation. Table 6 shows five conodont faunas from the Cardaño Formation.

TABLE 6

W sample	CAR 28	CAR 25	V 5	V 6	V 7
Ancyrodella curvata (Br. & M.)		+	+	+	+
Ancyrodella lobata Br. & M.	+				
Ancyrognathus asymmetrica (Ulrich & Bassler)		+		+	+
Icriodus alternatus Br. & M.			+	+	
Icriodus curvatus Br. & M.	+				+
Icriodus cymbiformis Br. & M.	+				+
Icriodus expansus Br. & M.					+
Icriodus nodosus (Huddle)					+
Icriodus symmetricus Br. & M.	+				+
Palmatolepis hassi Müller & Müller		+		+	
Palmatolepis rhenana Bischoff		+	+	+	
Palmatolepis subrecta Miller & Youngquist		+	+	+	+
Palmatolepis unicornis Miller & Youngquist				+	
Polygnathus amana Müller & Müller	+	+	+	+	+
Polygnathus decorosa Stauffer			+		+
Polygnathus foliata Bryant	+	+	+	+	+
Polygnathus normalis Miller & Youngquist	+	+	+	+	

The fauna CAR 28 points to a Frasnian age in general.

CAR 25, V 5, V 6 and V 7 belong to the Rhenana Zone. With the exception of V 5 they even are restricted to the upper part of this zone, indicating an Upper Frasnian age (to Iγ/δ–lower to Iδ).

Vidrieros Formation

This formation consists of nodular limestones and shales. The lime contents is variable. Near Triollo and Vidrieros more limestone is found than N. of Cardaño de Arriba. The samples that yielded good faunas are shown in table 7.

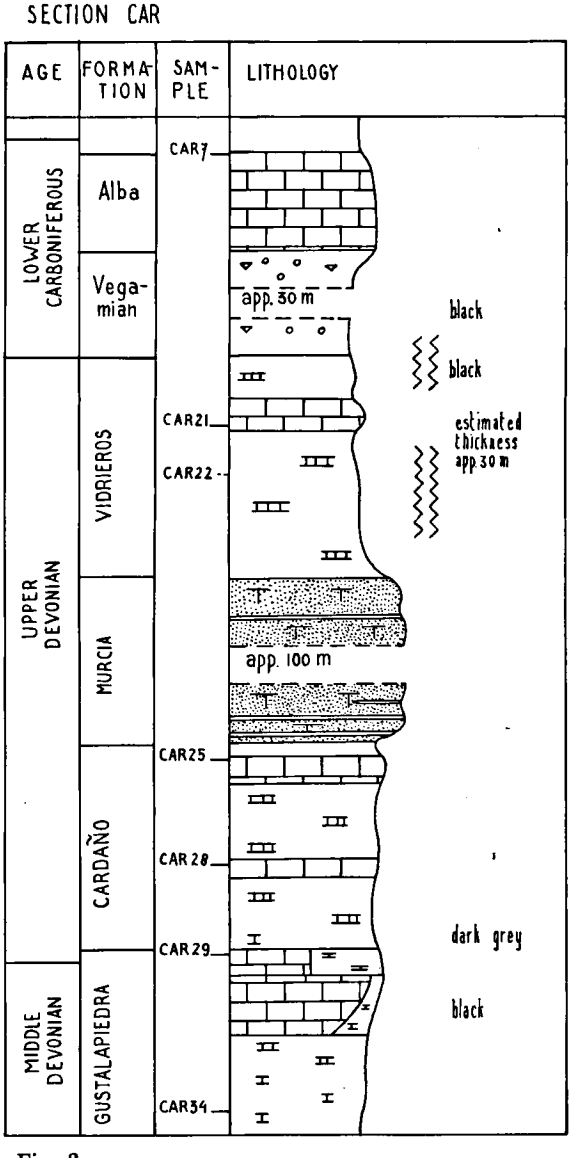
SECTION CAR
AGE
FORMATION
SAMPLE
LITHOLOGY
LOWER CARBONIFEROUS
UPPER DEVONIAN
MIDDLE DEVONIAN
Alba
Vega-mian
VIDRIEROS
MURCIA
CARDAÑO
GUSTALAPIEDRA
CAR7
CAR21
CAR22
CAR25
CAR28
CAR29
CAR34
app. 30 m
app. 100 m
black
black
estimated thickness app. 30 m
dark grey
black

Fig. 3

TABLE 7

sample	CAR 22	CAR 21	CAR 19	TR 13	TR 1	V 11	V 15	V 16	V 26	V 27
Icriodus cf. *I. cornutus* Sannemann						+	+	+		
Palmatolepis gracilis gracilis Br. & M.				+		+	+	+		+
Palmatolepis gracilis sigmoidalis Ziegler										+
Palmatolepis distorta Br. & M.						+				
Palmatolepis glabra glabra Ulrich & Bassler						+	+	+		
Palmatolepis glabra elongata Holmes						+				
Palmatolepis glabra pectinata Ziegler						+	+			
Palmatolepis minuta minuta Br. & M.							+			
Palmatolepis perlobata schindewolfi Müller						+	+	+		
Palmatolepis quadrantinodosa marginifera Ziegler						+	+			
Polygnathus communis Br. & M.			+	+	+				+	+
Polygnathus glabra glabra Ulrich & Bassler							+			
Polygnathus inornata E. R. Branson					+					
Polygnathus longipostica Br. & M.					+				+	
Polygnathus nodocostata Br. & M. s.l.							+	+		
Polygnathus sp. A					+					
Pseudopolygnathus cf. *P. dentilineata* Br. & M.				+					+	
Scaphignathus velifera Ziegler	+									
Spathognathodus aculeatus (Br. & M.)			+	+						
Spathognathodus amplus (Br. & M.)							+	+		
Spathognathodus costatus costatus (E. R. Branson)		+		+						+
Spathognathodus costatus spinulicostatus (E. R. Branson)		+	+							
Spathognathodus costatus (E. R. Branson) subsp. indet.									+	
Spathognathodus inornatus (Br. & M.)			+	+					+	
Spathognathodus stabilis (Br. & M.)		+	+	+	+					+
Spathognathodus strigosus (Br. & M.)						+	+			

The oldest faunas are V 11, V 15 and V 16. They can be placed in the Quadrantinodosa Zone, which has a range from the upper part of the Lower Famennian to the lower part of the Middle Famennian (upper to IIβ–lower to IIIα), although V 15 may range somewhat into the Rhomboidea Zone (lower to IIβ).

CAR 22 belongs to the Middle Famennian Velifera Zone (upper to IIIα–lower to IV).

CAR 21, CAR 19, TR 13, V 26 and V 27 belong to the Costatus Zone, indicating an Upper Famennian age (upper to V– to VI).

TR 1 shows a fauna which, though rich in quantity, lacks charactaristic guide forms. Its location is just below the shales of the Vegamián Formation *. A few

* The author uses the concepts Vegamián Formation and Alba Formation as redefined by van Ginkel (1965, p. 182–185).

metres lower in the section the Costatus Zone is present in sample TR 13. The question arises whether the fauna TR 1 may be an uppermost Devonian association belonging to the post-*Spathognathodus costatus*/pre-*Gnathodus kockeli* interval as is incorporated in the Hangenberg Schiefer in Germany (Ziegler 1962, p. 42).

Alba Formation

The Alba Formation consists here of grey, spotted, often nodular limestones. This unit lenses and pinches out towards the north west of the area, whereas near Triollo a good consistent development exists. Table 8 shows the faunas obtained from this formation.

TABLE 8

sample	CAR 17	CAR 11	TR 3	TR 4'	TR 11
Gnathodus bilineatus (Roundy)	+	+	+	+	+
Gnathodus delicatus Br. & M.		+	+	+	
Gnathodus commutatus commutatus (Br. & M.)		+	+	+	+
Gnathodus commutatus multinodosus Higgins		+			
Gnathodus commutatus nodosus Bischoff		+			+
Gnathodus cf. *G. girtyi* Hass			+		
Spathognathodus campbelli Rexroad		+		+	

The faunas Car 11, TR 3 and TR 4' indicate an Upper Viséan age (cu III). The occurrence together of *Gnathodus bilineatus* and *Gnathodus delicatus* agrees with the observations in Budinger & Kullmann (1964, p. 427).

Faunas CAR 17 and TR 11 point to an Upper Viséan to Lower Namurian age (Bischoff 1957, Collinson et al. 1962).

THE VALDEÓN REGION

The Devonian of this area compares well with that of the Cardaño-Vidrieros region, both belonging to the Palentian facies. This succession differs fundamentally from the Devonian of the Esla region, the latter being of the Asturo-Leonesian facies type (Brouwer 1964).

The first, rich conodont fauna was discovered in the Valdeón region near Pico Gildar in a sample collected by Mr. I. B. H. M. Rubbens in 1959. A section W. of this peak was sampled later on (fig. 5). The location of this section and of several spot samples are shown on fig. 6. Since this area is still being studied, among others by Mr. J. A. Kutterink, who is mapping the area, no formal rock unit names will be given. Three conodont-bearing units can be distinguished.

Thin bedded limestones, nodular limestones and shales lying below the quartzite

The results are given in table 9.

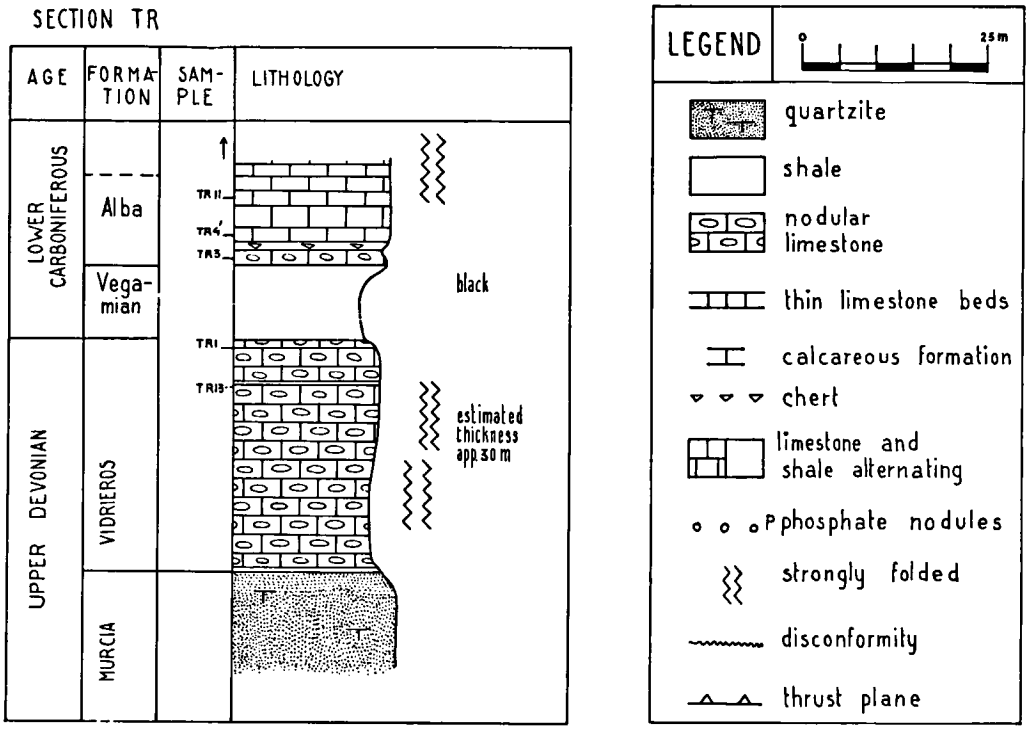

Fig. 4

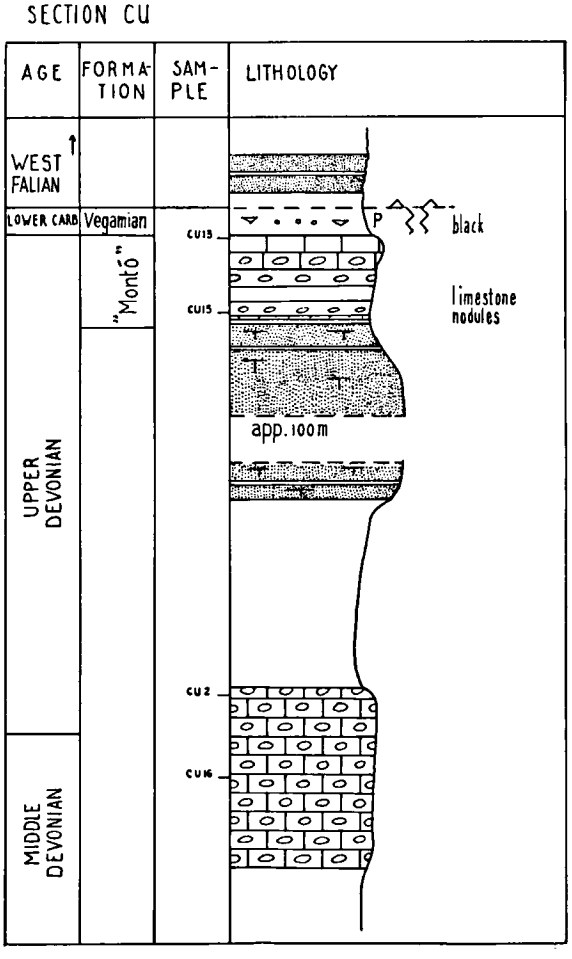

Fig. 5

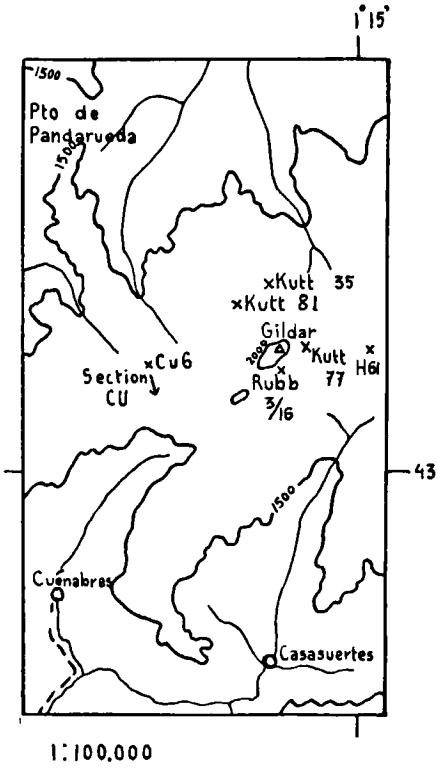

Fig. 6

TABLE 9

sample	CU 16	CU 2	CU 6	Rubb 3/16	Kutt 81	Kutt 35
Ancyrodella curvata (Br. & M.)				+		+
Ancyrodella lobata Br. & M.		+		+		
Ancyrognathus asymmetrica (Ulrich & Bassler)				+		
Ancyrognathus triangularis Youngquist				+		
Icriodus alternatus Br. & M.				+		
Icriodus curvatus Br. & M.		+		+		
Icriodus cymbiformis Br. & M.	+	+		+		
Icriodus expansus Br. & M.				+		
Icriodus nodosus (Huddle)		+		+		
Icriodus cf. *I. obliquimarginatus* Bischoff & Ziegler	+				+	
Icriodus symmetricus Br. & M.		+		+		
Palmatolepis subrecta Miller & Youngquist		+		+		+
Palmatolepis transitans Müller			+			
Polygnathus amana Müller & Müller				+		+
Polygnathus cristata Hinde			+			
Polygnathus decorosa Stauffer			+	+		+
Polygnathus dubia asymmetrica Bischoff & Ziegler			+			
Polygnathus foliata Bryant		+		+		+
Polygnathus linguiformis Hinde	+				+	
Polygnathus normalis Miller & Youngquist				+		
Polygnathus ordinata Bryant			+			
Polygnathus pennata Hinde			+			
Polygnathus varca Stauffer	+				+	

The faunas CU 16 and Kutt 81 belong to the Varca Zone, indicating an Upper Givetian to possible Middle Givetian age. The remark about the association of CAR 34 and Car 4 applies here as well.

Cu 6 can be placed in the Lower Dubia Zone, being of Lower Frasnian age (to Iα).

CU 2 and Kutt 35 can range from the Dubia Zone to the lower part of the Triangularis Zone, all of Frasnian age (to I(β)/γ–to Iδ).

Rubb 3/16 belongs to the Upper Rhenana Zone, pointing to an Upper Frasnian age (to Iγ/δ–lower to Iδ).

The oldest formation to be found in the Valdeón area consists of upto to 20 m of well bedded, often slightly dolomitized, dark limestones, weathering to a light color, which do not yield an adequate conodont fauna. Their place in the sequence below the Frasnian/Givetian limestones, and their lithological properties are comparable with the Polentinos limestone (van Veen 1965) in the eastern part of the Cantabrian Mountains.

This allows them to be considered as provisionally of Couvinian age.

Nodular limestones grading into light grey limestones above the quartzite

This formation, though reduced in thickness, is the equivalent of the Montó Schichten of Kullmann (1960). Budinger & Kullmann (1964) mention five conodont faunas

from this formation, ranging from to IIβ to to VI, which confirms the dating on ammonites by Kullmann.

Three faunas from this part of the section are shown in table 10.

TABLE 10

sample	CU 15	CU 13	Kutt 77
Icriodus cf. *I. cornutus* Sannemann	+		
Palmatolepis gracilis gracilis Br. & M.	+	+	+
Palmatolepis gracilis sigmoidalis Ziegler		+	+
Palmatolepis distorta Br. & M.	+		
Palmatolepis glabra glabra Ulrich & Bassler	+		
Palmatolepis glabra elongata Holmes	+		
Palmatolepis glabra pectinata Ziegler	+		
Palmatolepis perlobata schindewolfi Müller	+		
Palmatolepis quadrantinodosa marginifera Ziegler	+		
Polygnathus communis Br. & M.		+	
Polygnathus glabra glabra Ulrich & Bassler	+		
Polygnathus nodocostata Br. & M. s.l.	+		
Polygnathus cf. *P. nodomarginata* E. R. Branson		+	
Spathognathodus aculeatus (Br. & M.)		+	+
Spathognathodus costatus costatus (E. R. Branson)		+	
Spathognathodus costatus spinulicostatus (E. R. Branson)		+	
Spathognathodus costatus ultimus Bischoff		+	
Spathognathodus inornatus (Br. & M.)		+	+
Spathognathodus jugosus (Br. & M.)			+
Spathognathodus stabilis (Br. & M.)		+	+

The fauna CU 15 belongs to the Quadrantinodosa Zone, being of upper Lower to lower Middle Famennian age (upper to IIβ– lower to IIIα).

Kutt 77 belongs to the Lower and Middle Costatus Zone, which has an Upper Famennian age (upper to V – lowermost to VI).

CU 13 can be placed in the Middle and Upper Costatus Zone, pointing to a slightly younger Upper Famennian age (uppermost to V – to VI).

Alba Formation

The Alba Formation consists of grey and locally reddish nodular limestones. Sample H 61 received from Mr. H. Teer, contains:

Gnathodus bilineatus (Roundy)
Gnathodus commutatus commutatus (Br. & M.)
Gnathodus commutatus nodosus Bischoff
Polygnathus sp.
Spathognathodus campbelli Rexroad

This fauna points to an Upper Viséan to Lower Namurian age (Bischoff 1957, Collinson et al. 1962).

CONCLUSION

The formations of the Devonian and Carboniferous investigated have yielded conodont faunas that, even when the rocks are cleaved, can be utilized for stratigraphic and systematic studies. Correlations with the standard biostratigraphic sequences compare closely with the results obtained by other workers with macro- and microfossils from these formations in the Cantabrian Mountains.

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