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## Middle and Late Devonian conodonts from Southwestern Sardinia

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KEY WORDS — *Conodonts, Givetian, Frasnian, Famennian, Southwestern Sardinia, Italy, Taxonomy, Biostratigraphy.*

ABSTRACT — *Two nearby sequences represented by stratified limestone beds cropping out at Su Nuargi near Domusnovas (Iglesiente), have been investigated to define their age by means of conodonts. The taxonomic study of a well preserved conodont fauna and the examination of limestone lithologies in thin sections, enabled the present author to prove the presence of Middle as well as Late Devonian pelagic sediments in outcrops previously attributed to Silurian. The Givetian Middle and Upper varcus Subzones, the Frasnian Ancyrognathus triangularis Zone, the Famennian Upper crepida, Lower and Upper rhomboidea, Upper marginifera Subzones were identified from these very condensed sequences. A total of 3255 specimens were collected. Among 79 species and subspecies, referred to 22 genera, Ancyrolepis cixerriensis is described as a new taxon.*

RIASSUNTO — [Conodonti del Devoniano medio e superiore della Sardegna Sud Occidentale] — *Vengono esposti i risultati dello studio di faune a conodonti provenienti da due sequenze di calcari stratificati affioranti a Su Nuargi presso Domusnovas nell'Iglesiente (Sardegna Sud Occidentale).*

*Lo studio tassonomico di tali associazioni ricche e in buono stato di conservazione e l'esame mediante sezioni sottili della litologia dei calcari precedentemente cartografati come siluriani, hanno consentito di provare la loro appartenenza in parte al Devoniano medio e in parte al Devoniano superiore. Sono state infatti identificate le sottozone Middle e Upper varcus del Givetiano (Devoniano medio), la zona Ancyrognathus triangularis del Frasniano (Devoniano superiore) e le sottozone Upper crepida, Lower e Upper rhomboidea, Upper marginifera del Famenniano (Devoniano superiore). Mediante dissoluzione del calcare sono stati estratti complessivamente 3255 esemplari rappresentati da 79 taxa tra specie e sottospecie riferite a 22 generi. Ancyrolepis cixerriensis viene proposto come nuovo taxon.*

### INTRODUCTION

The present paper concerns with the description and illustration of the conodont faunas from two limestone deposits cropping out in the Iglesias area (Southwest Sardinia). The finding of Middle as well as Upper Devonian conodonts in those calcareous sediments, previously mapped as Silurian, opens new perspectives for improving our knowledge on the stratigraphy of Middle and Upper Devonian also from the Iglesias area. The taxonomic and stratigraphic results, here reported, are part of a larger body of informations published during the last years by some researchers of the Institute of Paleontology of the University of Modena.

### PREVIOUS RESEARCHES ON CONODONTS

So far no conodonts have been found in Cambrian and Ordovician sediments from Sardinia.

Silurian conodonts were first reported by Serpagli (1967) from the « calcari ad *Orthoceras* » of the Fluminense area. This Author described and illustrated the whole fauna in 1971.

In recent years, Early Devonian conodonts stimulated the paleontologist's interest, so that several biozones were identified in sediments of that age from Southwestern Sardinia by Serpagli *et al.* (1978), Serpagli & Mastandrea (1980), Olivieri *et al.* (1981), Gnoli *et al.* (1982), Mastandrea (1985a,b). In Southeastern Sardinia Early Devonian conodonts were identified by Walliser and listed in Alberti (1963) and later by Bagnoli (1980) at Mt. Corangiu Melas. Serpagli in 1983, based on Sardinian material, was able to reconstruct the complete apparatus of *Icriodus woschmidti woschmidti*.

The only finding of Middle Devonian conodonts was, until now, a few species of Eifelian age identified by Walliser and listed in Alberti (1963). That material came from Mt. Taccu, East of S. Nicolò Gerrei.

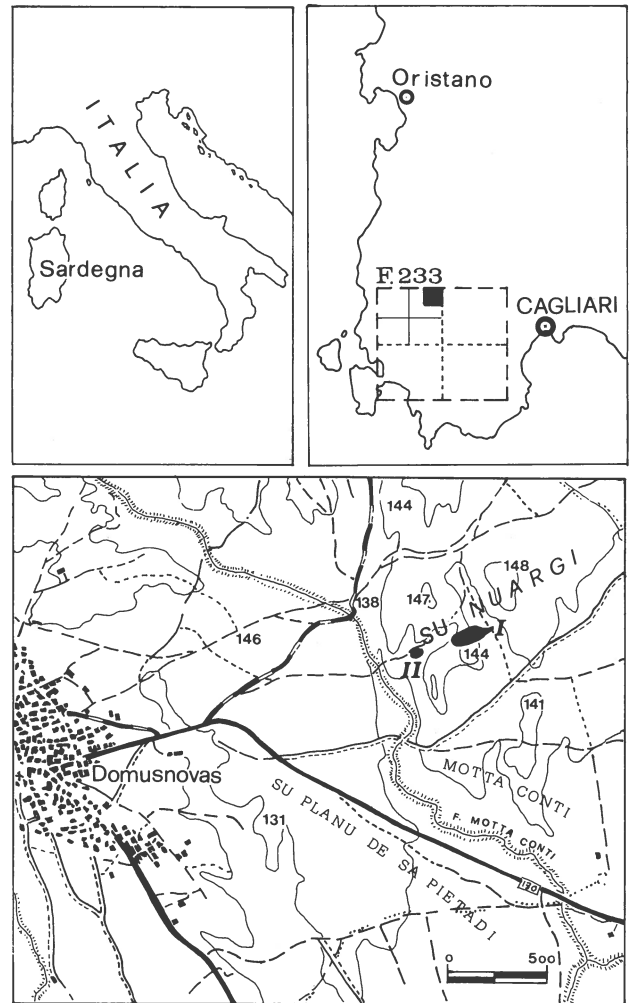
The first report on Upper Devonian is by Pomesano Cherchi (1963) who illustrated some conodonts from the « calcari a *Clymenia* » of the Gerrei area. Olivieri, (1965, 1970) continued the study of the same bedded limestones and in her 1970's paper, by means of abundant conodont assemblages, was able to identify, for the first time, most of the Late Devonian conodont Zones from the Gerrei area, as well as to demonstrate the presence of marine Lower Carboniferous in Sardinia. Fragments of the Late Devonian genus *Palmatolepis* were reported by Leone (1973) at Gutturru Eus in the Iglesiente area. Finally, Devonian conodonts from Mt. Lora and from « Passo Correboi » in Central-Eastern Sardinia have been reported by Murru (1975) and by Pili & Saba (1975), respectively.

No marine sediments of Latest Paleozoic age have been found yet in Sardinia.

Triassic conodonts (Muschelkalk) of the Nurra have been discovered and studied by Pomesano Cherchi (1967). [See also Bagnoli, Perri & Gandin, 1985].

#### GENERAL SETTING OF DEVONIAN DEPOSITS IN SOUTHWESTERN SARDINIA

The Devonian sediments start, in Southwestern Sardinia, with a lithostratigraphic unit for which Gnoli, Leone, Olivieri & Serpagli (work in progress) intend to propose a new formational name. Such a unit can be subdivided into two members. The lower one, about 20 m thick, consisting of dark argillaceous limestones interbedded with encrinite-crinoidal limestones, and the upper one, consisting of nodular argillaceous limestones and shales which alternate more or less regularly. The latter member reaches a greater thickness (up to 300 m ?) in Southern Sulcis area where it includes a stromatolite-bearing carbonate mound (Mt. Padenteddu) as discovered by Gnoli *et al.* (1981) and dated by Olivieri *et al.* (1981). This formation, which belongs entirely to Lower Devonian, is well known stratigraphically because of some conodont studies carried out in the last years at the Institute of Paleontology of the University of Modena. Seven conodont biozones were identified in this part of the Paleozoic sequence in Southwestern Sardinia. Specifically, conodont faunas of the *woschmidti* Zone were found in the Fluminese area by Serpagli & Mastandrea (1980) and in the Sulcis by Olivieri *et al.* (1981). This zone is useful for approximating the Silurian/Devonian boundary, ranging from just below the boundary to within the Lowermost Lochkovian. A slightly younger assemblage with zonally diagnostic species representing the Lochkovian *delta* Zone (= the former *Ozarkodina* n. sp. D Zone of Klapper, 1977), was described by Serpagli *et al.* (1978) and by Ma-



Text-fig. 1 - Sketch-map showing the location of measured sections at Su Nuargi. The two black spots indicate the outcrops I (Eastward) and II (Westward), respectively.

standrea (1985a) from the Fluminese area, whereas Olivieri *et al.* (1981) reported it from the Sulcis. Besides, assemblages of the Pragian *kindley* and *pireneae* Zones were illustrated by Mastandrea (1985b) from the Fluminese area with the latter *pireneae* Zone recorded also at Gruttixedda (Gnoli *et al.*, 1982). Conodonts also enabled us to date the sedimentary sequence of the Sulcis area mentioned above including a mud-mound at Mt. Padenteddu. The age of such sequence is Late Pragian-basal Dalejan because of the presence of the *pireneae*, *dehiscens* and *laticostatus* Zones (Olivieri *et al.*, 1981). Besides conodonts the Lower Devonian sequence of Southwest Sardinia yielded also other fossil groups such as the orthocone cephalopods described and illustrated by Gnoli (1983)

from both the Fluminese and Sulcis areas and the pelagic tentaculitids *Nowakia acuria* (Richter) and *Paranowakia intermedia* (Barrande) reported by Vai in Coccozza *et al.* (1974) from the Sulcis area. *N. acuria* was also reported by Alberti (1963) from Iglesiasiente. Finally, close to the bottom of the formation, foraminifera were also reported (Gnoli & Serpagli, 1985a). Gnoli & Serpagli's (1985b) opinion is that « the sedimentary environment of such formation could be related to submarine swells within subtidal or bathyal shelf ».

The youngest horizon, still belonging to the autochthonous Paleozoic sequence of Southwestern Sardinia, consists of small scattered outcrops of grey, more or less massive limestone. The first information concerning their age is from Leone (1973). This Author reported the occurrence of few conodont platform fragments belonging to the Late Devonian genus *Palmatolepis* from one outcrop of finely stratified arenaceous limestones about 25 m thick, and located near Gutturru Eus in the Iglesiasiente area. A more detailed paleontological documentation is given here. In fact, the occurrence of well preserved conodonts from two nearby sections, represented by condensed calcareous beds cropping out at Su Nuargi near Domusnovas (Iglesiente), enabled the present author to prove the presence of Middle as well as Late Devonian sediments. The Givetian Middle and Upper *varcus* Subzones, the Frasnian *Ancyrognathus triangularis* Zone, the Famennian Upper *crepida*, Lower and Upper *rhomboidea*, Upper *marginifera* Subzones were identified from this very condensed sequence. The contact between the Middle Devonian limestones and the underlying Lower Devonian is not exposed. The sequences here considered are lithologically like another sequence of bedded limestones exposed in Southeastern Sardinia, the conodont fauna of which was described and illustrated by Olivieri (1970).

The above described Devonian sequence is tectonically overlaid by the clastic succession called « Postgotlandiano », which in Southwestern Sardinia was recently reinvestigated by Barca, Coccozza, Del Rio & Pittau (1981). These Authors described the « Postgotlandiano » as « a rather monotonous clastic succession consisting of alternating sandstone, siltite and anchimetamorphic argillite with scattered polygenic conglomerate intercalations ranging from minute to coarsegrained ». For the first time the Authors were able to date these « Postgotlandiano » sediments of the Iglesiasiente-Sulcis on the basis of acritarchs as Early Ordovician in age. Furthermore, on the basis of structural and sedimentological peculiarities, they interpreted these deposits « as turbidites ranging from conoid to basin plane ».

## LITHOLOGICAL REMARKS

The conodont faunas described in the present paper, come from two close sequences represented mainly by calcareous beds cropping out at Su Nuargi (text-fig. 1) about 2 Km Northeast of Domusnovas in the Iglesiasiente area (Southwest Sardinia).

The sequence represented in Section I (text-fig. 2) is composed mainly of very fine grained and more or less massive nodular limestone interbedded with shales. The color of the limestone changes, in ascending order, from hazel-reddish (the beds that yielded samples 0, 1, 1/a) to light-gray (the beds that yielded samples 1/b 1/c, 1/d, 1/e, 1/f, 1/g, 1/h), to gray-hazel (the beds that yielded samples 1/i, 1/l, 1/m).

The short sequence represented by Section II (text-fig. 2) is composed by very condensed gray to dark-gray nodular thin bedded to massive limestone.

In thin sections these lithologies are mainly represented in both sequences, by fossiliferous wackestone to wackestone-packestone.

Samples of sequence I are, above all, rich in ostracods. Rare tentaculites, trilobite fragments and some small thin-shelled gastropods were also observed. Burrowing of geopetal structures due to umbrella effect of small skeletal fragments, sometime are also present.

Samples of sequence II are characterized particularly by a great abundance of tentaculites. Scattered ostracods, fragments of pelmatozoan ossicles, small brachiopods and trilobite fragments were also observed.

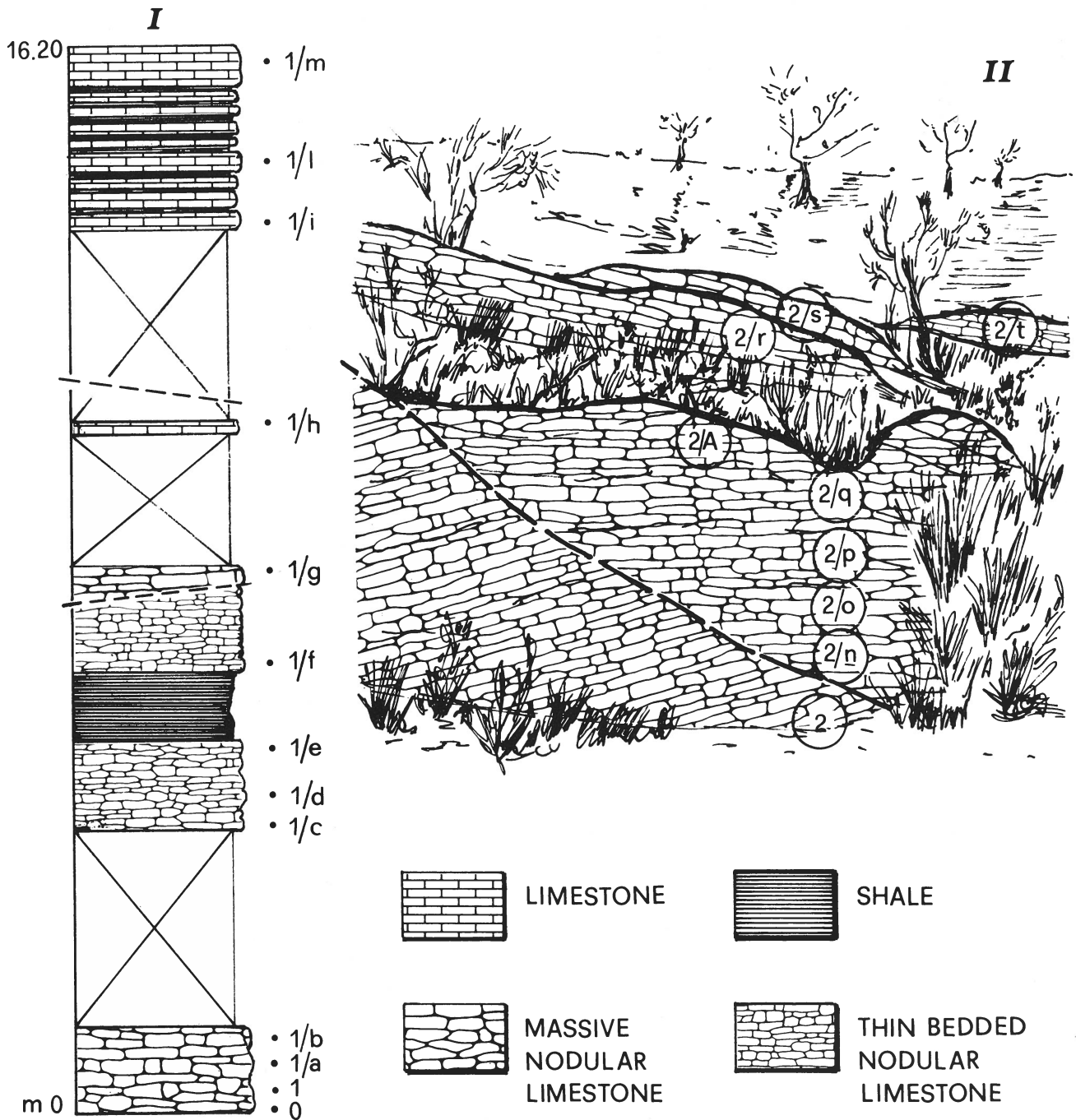
All thin sections show microstilonodular and microbrecciated structures. The cement, mainly represented by drusy calcite, with the exception of little spots in the geopetal structures, is present only in several veins. It has pointed out that reticulate pattern of several fractures are probably due to strong late tectonics and not related to early diagenesis.

## CHARACTERISTICS OF COLLECTED MATERIAL

The material collected from both the studied sequences, consists of 3255 conodont specimens. They are dark-colored and rather well preserved, so that a few of the platform elements show a basal plate intact.

The Middle Devonian (Givetian) species described and illustrated in the present paper, have so far been unknown in Sardinia, as well as the new species *Ancyrolepis cixerriensis*.

Likewise some Upper Devonian (Frasnian) species belonging to the genera *Ancyrodella*, *Ancyrognathus*, and *Palmatolepis*, have been found for the first time in this region. This also the case for some other



Text-fig. 2 - Schematic lithologic sections of the Su Nuargi sequences I and II.

Upper Devonian (Famennian) species belonging to the genera *Polygnathus*, *Nothognathella*, *Palmatolepis*.

In the Middle Devonian conodont association of sequence II, the most abundant genus is *Polygnathus*, which with its combined total number of species and subspecies, makes up almost the 50% of the total fauna. In the Upper Devonian associations of sequence I and at the base of sequence II, the best repre-

sented genus is *Palmatolepis* with 66% of the total faunas, followed by *Polygnathus* with 12%.

The high percentages of conodonts belonging to the above mentioned genera and the previously described lithology (fossiliferous wackestone to wackestone-packestone) of both sequences, support the opinion that the habitat of the studied faunas was pelagic and, particularly, that the most open marine was that

dominated by the genus *Palmatolepis*, in agreement with the the Seddon & Sweet's ecological model for conodonts.

#### CONODONT ZONATION

The zonal subdivisions of the studied sequences are based on the standard Upper Devonian zonation of Ziegler (1962b, 1971), refined by Sandberg & Ziegler (1973) and on the scheme proposed by Ziegler, Klapper & Johnson (1976) for the upper part of the Middle Devonian. The ranges of the index conodonts followed here are those up-dated and plotted in text-figs. 5, 6 by Klapper & Ziegler (1979).

SU NUARGI SEQUENCE I (from bottom to top).

##### — Upper *crepida* Subzone

The Upper *crepida* Subzone was identified at the base of sequence I (sample 0) where *Palmatolepis glabra prima* Ulrich & Bassler, whose appearance marks the beginning of this Subzone, occurs together with several specimens of *Palmatolepis crepida* Sannemann, *P. quadrantinodosalobata* Sannemann, *P. tenuipunctata* Sannemann, *P. cf. regularis* Cooper, *P. subperlobata* Branson & Mehl, *P. termini* Sannemann. Particularly, the joint occurrence of *P. glabra prima* and *P. termini* allows to deduce that the bed which yielded sample 0, belongs to the lower part of the Upper *crepida* Subzone.

##### — Lower *rhomboidea* Subzone

The succeeding sample 1 is characterized by a rich and varied fauna. Particularly significant is the joint occurrence of *Palmatolepis rhomboidea* Sannemann and *P. poolei* Sandberg & Ziegler which, together, define the Lower *rhomboidea* Subzone. In fact, the latter species has a range restricted to the Lower *rhomboidea* Subzone. Also significant is the presence of *Palmatolepis glabra prima* Ulrich & Bassler morphotype 2 *sensu* Sandberg & Ziegler (1973) which first appears within the uppermost part of the Upper *crepida* Subzone and ranges only up to the top of the Lower *rhomboidea* Subzone. Moreover, on the basis of the presence of *P. subperlobata* Branson & Mehl, *P. cf. regularis* Cooper, *P. crepida* Sannemann, *P. quadrantinodosalobata* Sannemann, the examined fauna may represent the lowest part of the Lower *rhomboidea* Subzone.

##### — Upper *rhomboidea* Subzone

In comparison with the conodont fauna of the previous Lower *rhomboidea* Subzone, that present in sample 1/a is characterized by a relatively more abun-

SERIES	STAGE	CONODONT ZONE	
		Conodont	Subzone
UPPER DEVONIAN	FAMENIAN	<i>Palmatolepis marginifera</i>	Upper
			Lower
		<i>Palmatolepis rhomboidea</i>	Upper
			Lower
		<i>Palmatolepis crepida</i>	Upper
			Middle
	Lower		
	FRASNIAN	<i>Palmatolepis triangularis</i>	Upper
			Middle
			Lower
		<i>Palmatolepis gigas</i>	Uppermost
			Upper
			Lower
		<i>Ancyrognathus triangularis</i>	
<i>Polygnathus asymmetricus</i>	Upper		
	Middle		
	Lower		
	Lowermost		
<i>Palmatolepis disparilis</i>			
MIDDLE DEVONIAN	GIVETIAN	<i>Schmidtoognathus hermanni</i> - <i>Polygnathus cristatus</i>	Upper
			Lower
	<i>Polygnathus varcus</i>	Upper	
		Middle	
		Lower	

Text-fig. 3 - Middle and Late Devonian conodont zonation after Ziegler 1962b, 1966b; amended by Ziegler 1971; Sandberg & Ziegler 1973; Ziegler, Klapper & Johnson 1976; Ziegler & Klapper 1982 (Modified from Sandberg 1979).

dant *Palmatolepis rhomboidea* Sannemann and by the disappearance of *P. poolei* Sandberg & Ziegler together with *P. crepida* Sannemann, *P. subperlobata* Branson & Mehl and *P. cf. regularis* Cooper. *P. rhom-*

*boidea* is here associated with *P. glabra pectinata* Ziegler morphotype 1 *sensu* Sandberg & Ziegler (1973) which climaxes and disappears within the Upper *rhomboidea* Subzone. The so called « early form » of *P. glabra lepta* Ziegler & Huddle also occurs in the fauna of sample 1/a. The absence of *P. marginifera marginifera* Helms allows to conclude that we are dealing with the Upper *rhomboidea* Subzone.

— Upper *marginifera* Subzone

In ascending order the sample 1/b is separated from the succeeding sample 1/c by a cover 3m thick nevertheless the faunas, either that from sample 1/b or those from samples 1/c, 1/d, 1/e, 1/f, seem to belong to the same Subzone. All of them are characterized by the occurrence of *Palmatolepis marginifera marginifera* Helms with but any representatives of the *Palmatolepis quadrantinodosa* « group » subspecies and without *Scaphygnathus velifer* Helms. These observations allow to exclude that the considered faunas may belong either to the Lower *marginifera* or to the Lower *velifer* Subzone.

In all the five samples *Palmatolepis marginifera marginifera* occurs jointly with *Polygnathus glaber bilobatus* Ziegler which first appears at the base of the Upper *marginifera* Subzone (Klapper & Ziegler, 1979, text-fig. 6). One sample (1/d) also contains an incomplete specimen of *Palmatolepis perlobata* cf. *grossi* Ziegler that is an additional aid in recognizing the Upper *marginifera* Subzone (Sandberg & Ziegler, 1973, p. 101). Other common conodonts that range up into the Upper *marginifera* Subzone also in Sardinia are *Palmatolepis glabra prima* Ulrich & Bassler, *P. glabra lepta* Ziegler & Huddle (typical form), *P. glabra pectinata* Ziegler, *P. glabra acuta* Helms, *Icriodus cornutus* Sannemann, *Polygnathus glaber glaber* Ulrich & Bassler, *P. germanus germanus* Ulrich & Bassler.

Nevertheless the nominal zonal index is missing, also samples 1/i, 1/l, 1/m from the uppermost part of sequence I in my opinion can be ascribed to the Upper *marginifera* Subzone for the joint occurrence of *Polygnathus glaber bilobatus* (which, as mentioned above, first appears at the base of the Upper *marginifera* Subzone) with *Palmatolepis glabra prima*, *P. glabra acuta*, *Icriodus cornutus*. In fact, the range of *P. glabra prima* ends at the top of the above mentioned Subzone, and that of the last two taxa within the same Subzone.

The assemblages included in the last three mentioned samples contain also a few older reworked conodonts. They are represented by well preserved specimens of *Palmatolepis glabra prima* morphotype 1, *P. quadrantinodosalobata*, *P. crepida*, *P. subperlobata*

coming, probably, from the uppermost part of the Upper *crepida* Subzone, within which *Palmatolepis glabra prima* morphotype 1 first appears.

— *Ancyrognathus triangularis* Zone

The *Ancyrognathus triangularis* Zone was distinguished in sample 1/g for the occurrence of the zonal name-bearer species and of *Ancyrodella nodosa* Ulrich & Bassler without *Palmatolepis gigas* Miller & Youngquist, which marks the base of the overlying Zone in the standard Upper Devonian conodont zonation of Ziegler. Some other important conodonts included in that rich assemblage are *Palmatolepis bassi* Müller & Müller, *P. subrecta* Miller & Youngquist, *Ancyrodella curvata* (Branson & Mehl).

— Upper asymmetricus - Middle *P. triangularis* Subzone

It was impossible to assign sample 1/h to a specific Zone because of the impoverished conodont fauna. However, because of the joint occurrence of *Ancyrodella curvata* (Branson & Mehl) and *Palmatolepis subrecta* Miller & Youngquist, the sample may be placed into a stratigraphic interval between the Upper *asymmetricus* and Middle *P. triangularis* Subzone.

The conodont Zones and Subzones recognized in sequence I (Tab. 2) which starts with the Upper *crepida* Subzone, allow to conclude that in the first 8m of the sequence, the *crepida*, *rhomboidea* and *marginifera* Zones occur in regular order. Only the Lower *marginifera* Subzone was not recognized owing to the lack of appropriate diagnostic forms. In the last 8m of the sequence, the presence within the Upper *marginifera* Subzone of two layers belonging respectively to the Frasnian *A. triangularis* Zone and to Upper *asymmetricus* - Middle *P. triangularis* Subzone, indicates that the stratigraphic situation is tectonically much more complex.

SU NUARGI SEQUENCE II (from bottom to top)

Sequence II, cropping out about 15 m west of Sequence I, is represented by stratified nodular thin bedded to massive limestone mostly belonging to the Middle Devonian, Givetian age. These Middle Devonian sediments overly, tectonically, an horizon of Late Devonian, Frasnian age. In ascending order the recorded Zones (Tab. 1) are:

— Uppermost Middle asymmetricus - basal Upper *gigas* Subzone

Sample 2 at the base of sequence II, is characterized by a conodont fauna lacking the nominal index

CONODONTS	ZONATION	top Middle asymmetric - basal Upper gtigas	Middle varcus					Upper varcus			No. of specimens	
			SAMPLE no.	2	2/n	2/o	2/p	2/q	2/A	2/r		2/s
<i>Ancyrodella lobata</i>		1										1
<i>Ancyrolepis cixerriensis</i> n.sp.							12					12
<i>Belodella devonica</i>							56	1	3			60
<i>Belodella resima</i>						3	19					22
<i>Belodella triangularis</i>						2	26					28
<i>Ieriodus alternatus</i>		6										6
<i>Ieriodus brevis</i>			1	1	4			11	11	19		47
<i>Ieriodus</i> cf. <i>difficilis</i>							1		4	4		9
<i>Ozarkodina brevis</i>							9					9
<i>Ozarkodina semialternans</i>							4					4
<i>Ozarkodina plana</i>							2					2
<i>Palmatolepis subrecta</i>		17										17
<i>Polygnathus latifossatus</i>								12	3	1		16
<i>Polygnathus linguiformis linguiformis</i>			3	2	3	13	137		3	5		166
<i>Polygnathus linguiformis linguiformis</i> δ morphotype			2	7	8	8	79					104
<i>Polygnathus linguiformis linguiformis</i> ε morphotype				1			8		2			11
<i>Polygnathus linguiformis mucronatus</i>										4		4
<i>Polygnathus</i> cf. <i>ovatinodosus</i>								4				4
<i>Polygnathus procerus</i>		6										6
<i>Polygnathus varcus</i>			2	4	13	9	23		6	10		67
<i>Polygnathus xilus xilus</i>							33	4				37
<i>Polygnathus xilus ensensis</i>			1	2	1	1	33					38
Acodinan elements							1	1		3		5
Angulodontan elements							11			2		13
Diplododellan elements		3	1					2				6
Falcodontan elements							2					2
Hibbardellan elements					1	4	22	5	1	1		34
Hindeodellan elements			3	2	5	7	38	1	4	4		64
Ligonodinan elements							1			1		2
Lonchodinan elements			1		1	1	11	6				20
Neoprioniodontan elements					3	5	6	2		4		20
Nothognathellan elements		3										3
Ozarkodinan elements						3	29	6	3	2		43
Synprioniodinan elements						3	28	2	1	3		37
Total specimens		36	14	19	39	60	590	57	41	63		919
Specimens per 1 Kg.		8,3	7	9,0	24,3	19,3	49,5	31,6	20,5	21		-
Weight of sample in Kg.		4,3	2	2,1	1,6	3,1	11,9	1,8	2	3		-

Tab. 1 - Distribution of conodonts in the Su Nuargi sequence II.





Tab 2 (continue.)

CONODONTS	ZONATION	Upper <i>marginifera</i>													No. of specimens
		Upper <i>crepida</i>	Lower <i>rhomboidea</i>	Upper <i>rhomboidea</i>							<i>A. triangularis</i>	Upper <i>asymmetricus</i> - Middle <i>P. triangularis</i>	Upper <i>marginifera</i>		
SAMPLE no.		0	1	1/a	1/b	1/c	1/d	1/e	1/f	1/g	1/h	1/i	1/l	1/m	
<i>Palmatolepis rhomboidea</i>			27	36											63
<i>Polygnathus nodocostatus</i> s.l.			5	2	2	2						18	2	8	39
<i>Polygnathus glaber glaber</i>			33	25	1							24	8	10	101
<i>Polygnathus glaber bilobatus</i>					27		6	13	9			9	5	6	75
<i>Polygnathus glaber medius</i>						11		2							13
<i>Palmatolepis glabra lepta</i> ( early form )				4											4
<i>Palmatolepis gracilis gracilis</i>				4	14	9	7	11	30						75
<i>Apathognathus varians</i>										5					5
<i>Bispathodus stabilis</i>					4	6		4	5						19
<i>Ozarkodina lacera</i>						2									2
<i>Palmatolepis glabra distorta</i>								5	24	1					72
<i>Palmatolepis marginifera marginifera</i>					42	9	8	10	10	2					39
<i>Palmatolepis glabra lepta</i> ( typical form )					16	9	1	54				3		5	88
<i>Palmatolepis</i> cf. <i>perlobata grossi</i>								1							1
<i>Polygnathus diversus</i>						1	1	3	2						7
<i>Polygnathus</i> sp. A												5			5
<i>Polygnathus</i> sp. B													3		3
<i>Polygnathus</i> sp. C												2	1		3
<i>Polylophodonta</i> cf. <i>confluens</i>				2											2
<i>Tripodellus robustus</i>					1	1	2		3						7
Acodinan elements			2										1	1	4
Diplododellan elements		5	2		1	1	4	5	2		5	2	3	2	32
Neoprioniodontan elements		1			1	3	1	1				1			8
Ozarkodinan elements		2	4	2				1	1	4		1	2	1	18
Synprioniodinan elements				2					3	1		2			8
Total specimens		506	347	143	184	125	69	186	108	213	37	177	87	154	2336
Specimens per 1 Kg.		133,1	115,6	62,1	61,3	41,6	27,6	66,4	54	85,2	11,9	88,5	48,3	64,1	—
Weight of sample in Kg.		3,8	3	2,3	3	3	2,5	2,8	2	2,5	3,1	2	1,8	2,4	—

Tab. 2 - Distribution of conodonts in the Su Nuargi sequence I. The asterisks indicate reworked conodonts.

species, but because of the joint occurrence of *Ancyrodella lobata* Branson & Mehl and *Palmatolepis subrecta* Miller & Youngquist, the sample may be placed into a stratigraphic interval between uppermost Middle *asymmetricus* - basal Upper *gigas* Subzone of the Late Devonian, Frasnian age.

#### — Middle varcus Subzone

The assemblages contained in the next samples 2/n, 2/o, 2/p, 2/q, 2/A show an unsuspected faunistic change. Polygnathids of the *linguiformis* and *varcus* groups are the dominant taxa. Among the most significant, from a biostratigraphic standpoint is *Poly-*

*gnathus linguiformis linguiformis*  $\delta$  morphotype *sensu* Ziegler & Klapper (1976) whose total range is comprised within the middle *varcus* Subzone. *Polygnathus xilus ensensis* Ziegler & Klapper, which also occurs in all the above cited samples, disappears within the same subzone. Sample 2/A is the richest of the five and also contains the new species *Ancyrolepis cixerriensis*.

— *Upper varcus Subzone*

Samples 2/r, 2/s, 2/t, are characterized by the occurrence of *Polygnathus latifossatus* Wirth, which according to Ziegler & Klapper marks the lower boundary of Upper *varcus* Subzone, while the upper boundary of the Subzone is defined by the first occurrence of *Schmidtnathus hermanni* Ziegler. In the various samples *Polygnathus latifossatus* occurs together with *P.* cf. *ovatinodosus* Ziegler & Klapper in sample 2/r, with *P. linguiformis linguiformis*  $\epsilon$  morphotype *sensu* Ziegler & Klapper in sample 2/s, and with *P. linguiformis mucronatus* Wittekindt in sample 2/t. The last three mentioned polygnathids disappear within the Upper *varcus* Subzone.

Conodont data (Tab. 1) indicate that the basal part of sequence II is Frasnian and that only in the following part of the sequence, the Middle and Upper *varcus* Subzones of Givetian age, are in regular order. The tectonic contact, between Frasnian and Givetian, indicates that also in this sequence the stratigraphic situation is much complex.

#### SYSTEMATIC PALEONTOLOGY

All species encountered have been tabulated, the majority of the blade, bar and ramiform elements are

only illustrated, whereas the majority of the available platform species are discussed or also described herein. Descriptions are given only in the cases in which one species was not known from Sardinia and for the new species.

No attempt was made to examine the fauna for multielement species.

Genera and species are arranged in alphabetic order.

#### Genus ANCYRODELLA Ulrich & Bassler, 1926

1926 *Ancyrodella* ULRICH & BASSLER, p. 48.

1957 *Ancyropenta* MÜLLER & MÜLLER, pp. 1092-1099.

*Type species* — *Ancyrodella nodosa* Ulrich & Bassler, 1926.

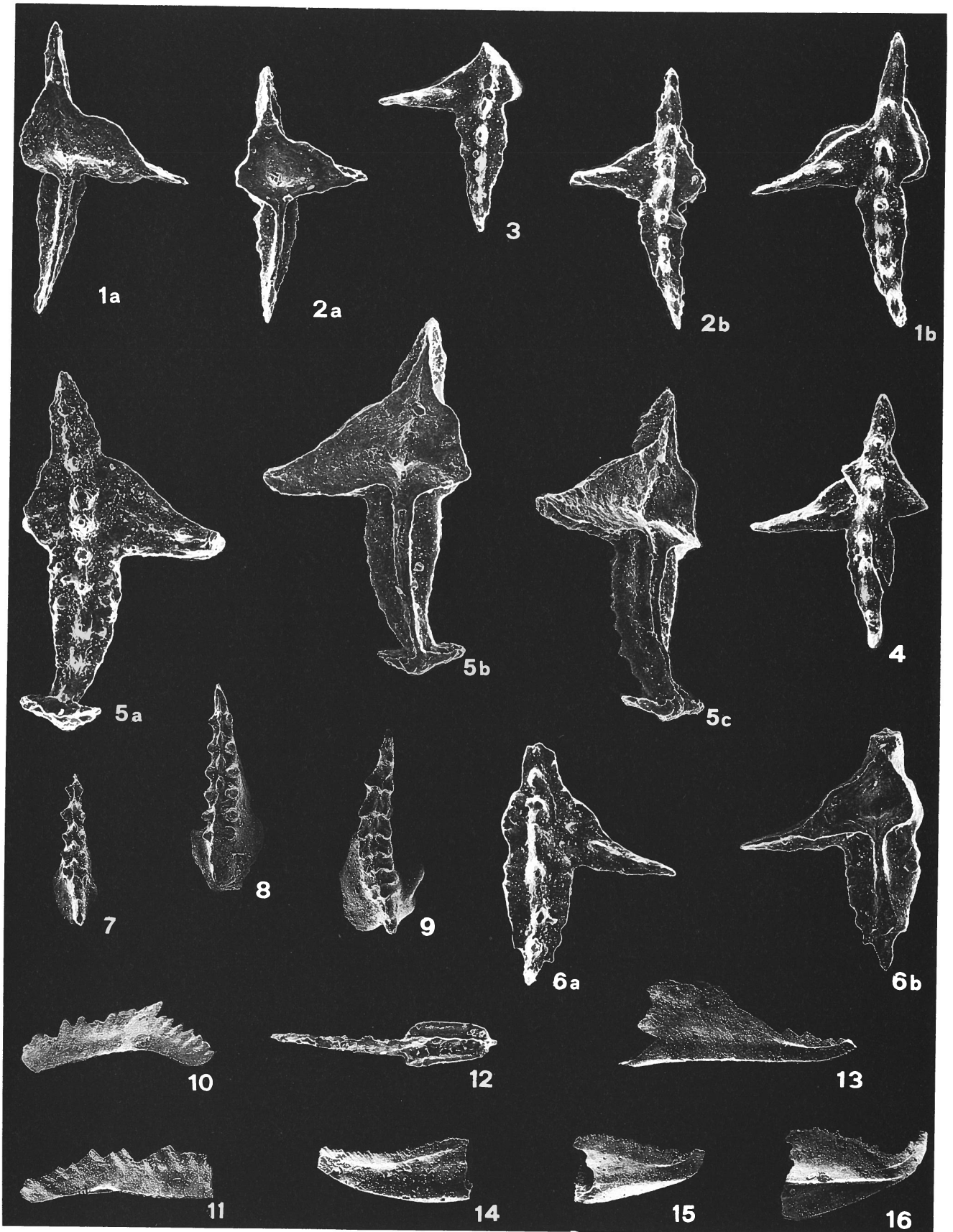
*Description* — Genus with anchor-like general shape of the platform. Three major lobes always present, having different shapes and sizes. Two lobes are located anteriorly on the sides of the proximal portion of the free blade; the third lobe posteriorly. Some species develop a postero-lateral additional lobe. Blade extending over the platform as main nodular carina which reaches the end of posterior lobe. Anterior lobes crossed by two secondary carinas converging medially posteriorwards. Ornamentation consisting of randomly placed or aligned coarse nodes. The lower surface shows a basal pit of different sizes where the main and secondary keels meet.

*Remarks* — Most Authors do not consider the exact number of keels and carinas a sufficiently discriminative generic character; thus, the genus *Ancyropenta* Müller & Müller is considered a junior synonym of *Ancyrodella* Ulrich & Bassler.

#### EXPLANATION OF PLATE 1

All the specimens are from Su Nuargi sequence II.

- Figs. 1a-6b - *Ancyrolepis cixerriensis* n. sp. 1a-b) Holotype n. 20235, lower and upper views; 2a-b) Paratype n. 20236, lower and upper views; 3) Paratype n. 20237, upper view, anterior lobe partially broken; 4) Paratype n. 20238, upper view, showing, exceptionally, an inner angular lobe; 5a-c, Paratype n. 20239, upper, lower and oblique-lower views; (6a-b) Paratype n. 20240, upper and lower views. All from sample 2/A, Middle *varcus* Subzone, all figs. x 70.
- Figs. 7-8 - *Icriodus brevis* Staffer. 7) Hypotype n. 20288, x 40, upper view, sample 2/n; 8) Hypotype n. 20289, x 40, upper view, sample 2/t, Upper *varcus* Subzone.
- Fig. 9 - *Icriodus* cf. *difficilis* Ziegler & Klapper. Hypotype n. 20290, x 40, upper view, sample 2/t, Upper *varcus* Subzone.
- Fig. 10 - *Ozarkodina regularis* Branson & Mehl. Hypotype n. 20291, x 40, outer-lateral view, sample 2/r, Upper *varcus* Subzone.
- Fig. 11 - *Ozarkodina plana* (Bischoff & Ziegler). Hypotype n. 20292, x 40, outer-lateral view, sample 2/A, Middle *varcus* Subzone.
- Fig. 12 - *Polygnathus varcus* Stauffer. Hypotype n. 20293 x 50, upper view, sample 2/A, Middle *varcus* Subzone.
- Fig. 13 - *Belodella resima* (Philip). Hypotype n. 20464, x 40, lateral view, sample 2/q, Middle *varcus* Subzone.
- Fig. 14 - *Belodella devonica* (Stauffer). Hypotype n. 20465, x 60, lateral view, sample 2/A, Middle *varcus* Subzone.
- Figs. 15-16 - *Belodella triangularis* (Stauffer). Hypotypes n. 20466 - 20467, x 40, opposed lateral sides, sample 2/A, Middle *varcus* Subzone.



The most significant specific feature is the platform outline followed, secondarily, by the way how the secondary keels and carinas develop, whereas the number of the secondary keels and carinas may, at times, vary even within the same species.

ANCYRODELLA CURVATA (Branson & Mehl, 1934)

Pl. 3, fig. 6

- 1934 *Ancyrognathus curvata* BRANSON & MEHL, p. 241, pl. 19, figs. 6, 11.  
 1971 *Ancyrodella curvata* (Branson & Mehl) - SZULCZEWSKI, p. 11, pl. 3, fig. 5, pl. 4, figs. 4, 5.  
 1976 *Ancyrodella curvata* (Branson & Mehl) - DRUCE, p. 55, pl. 1, fig. 3, (*cum syn.*).  
 1978 *Ancyrodella curvata* (Branson & Mehl) - ORCHARD, p. 926, pl. 114, figs. 2, 8 - 10, 20.  
 1979 *Ancyrodella curvata* (Branson & Mehl) - BALINSKI, p. 73, pl. 19, fig. 3 (only).  
 1980 *Ancyrodella curvata* (Branson & Mehl) - PERRI & SPALLETTA, p. 292, pl. 1, fig. 3.  
 1982 *Ancyrodella curvata* (Branson & Mehl) - MORZADec & WEYANT, p. 30, pl. 4, figs. 17, 18.

*Description* — Specimens with thick and highly asymmetric platform because of a strong inward curvature of the posterior lobe and of the presence of a well developed outer-lateral lobe posteriorly directed. Large free blade located between the anterior lobes, but incomplete in the studied specimens due to fractures. The blade continues on the platform as main nodular carina, decreasing in height towards the end of the posterior lobe. Two secondary carinas from the end of the lobes converge towards the main carina, but do not reach it. Instead, the two secondary

outer-lateral carinas meet at an angle of about 90°. Ornamentation consists of irregular nodes. In lower view, within the main keel, opens the basal pit towards which the secondary keels also converge.

*Remarks* — *Ancyrodella curvata* differs from *A. lobata* Branson & Mehl in having a much more developed outer-lateral lobe, which always possesses a secondary carina in addition to the keel.

*Occurrence* — Sequence I, samples 1/g, 1/h.

*Range* — Upper *asymmetricus* Subzone - Lower *P. triangularis* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 7 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20318 (figured hypotype), 20319-20320 (hypotypes not figured).

ANCYRODELLA LOBATA Branson & Mehl, 1934

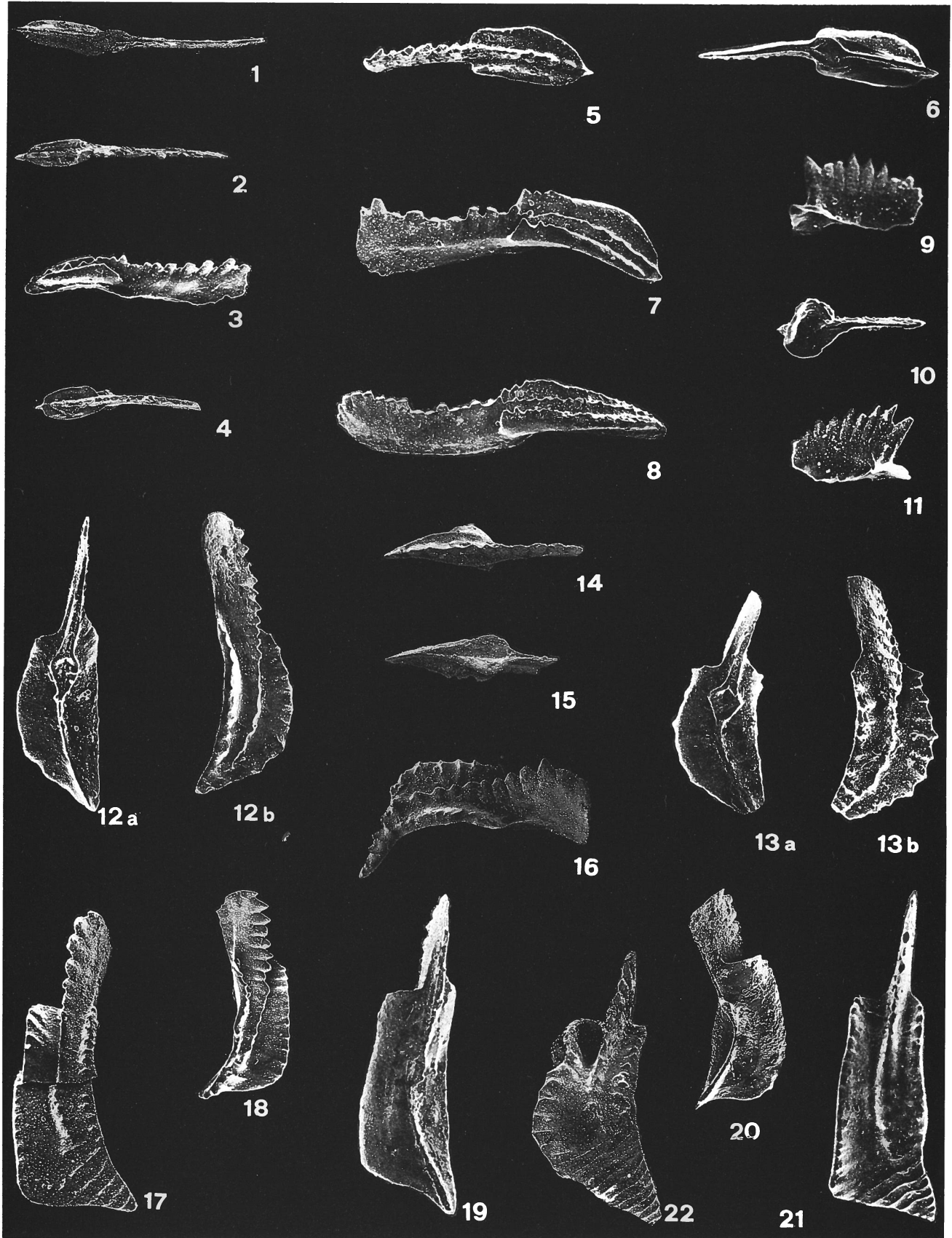
Pl. 3, figs. 5a-b

- 1934 *Ancyrodella lobata* BRANSON & MEHL, p. 239, pl. 19, fig. 11; pl. 21, figs. 22, 23.  
 1970 *Ancyrodella lobata* Branson & Mehl - SZULCZEWSKI, p. 13, pl. 3, figs. 1-4; pl. 4, fig. 3 (only).  
 1975 *Ancyrodella lobata* Branson & Mehl - DRUCE, p. 59, pl. 5, figs. 1-2; pl. 6, figs. 1-3 (*cum syn.*).  
 1979 *Ancyrodella lobata* Branson & Mehl - BALINSKI, p. 74, pl. 19, fig. 7.  
 1980 *Ancyrodella lobata* Branson & Mehl - PERRI & SPALLETTA, p. 293, pl. 1, figs. 5, 6.  
 1983 *Ancyrodella lobata* Branson & Mehl - WANG & ZIEGLER, p. 84, pl. 1, fig. 3.

EXPLANATION OF PLATE 2

All the specimens are from Su Nuargi, sequence II.

- Figs. 1-4 - *Polygnathus varcus* Stauffer. Hypotypes n. 20294-20297, x 50, 1) lower view, sample 2/p; 2,4) two upper views, samples 2/q, 2/n; 3) oblique-lateral view, sample 2/A, Middle *varcus* Subzone.  
 Figs. 5-6 - *Polygnathus xilus xilus* Stauffer. Hypotypes n. 20304-20305, x 50, upper and lower views, sample 2/A, Middle *varcus* Subzone.  
 Figs. 7-8 - *Polygnathus xilus ensensis* Ziegler & Klapper. Hypotypes n. 20308-20309, x 45, two oblique upper views, sample 2/A, Middle *varcus* Subzone.  
 Figs. 9-11 - *Ozarkodina brevis* (Bischoff & Ziegler). Hypotypes n. 20550-20552, x 70; 9, 11) lateral views; 10) lower view, sample 2/A, Middle *varcus* Subzone.  
 Figs. 12a-13b - *Polygnathus linguiformis linguiformis* Hinde ♂ morphotype *sensu* Ziegler & Klapper (1973). 12a-b) Hypotype, n. 20271, x 45, lower and oblique-upper views, sample 2/A; 13a-b) Hypotype n. 20272, x 45, lower and upper views, sample 2/A, Middle *varcus* Subzone.  
 Figs. 14-15 - *Polygnathus latifossatus* Wirth. Hypotypes n. 20254-20255, x 50, lower and upper views, sample 2/t, Upper *varcus* Subzone.  
 Fig. 16 - *Polygnathus linguiformis mucronatus* Wittekindt. Hypotype n. 20277, x 40, sample 2/t, Upper *varcus* Subzone.  
 Figs. 17-21 - *Polygnathus linguiformis linguiformis* Hinde. 17, 21) Hypotypes, n. 20259-20260, x 45, two upper views of typical specimens; 19) Hypotype, n. 20261, x 45, lower view; 18, 20) Hypotypes 20262-20263, x 60, oblique-upper and lower views of two juvenile specimens. All from sample 2/A, Middle *varcus* Subzone.  
 Figs. 22 - *Polygnathus linguiformis linguiformis* Hinde ε morphotype *sensu* Ziegler & Klapper (1973). Hypotype 20279, x 45, upper view, sample 2/A, Middle *varcus* Subzone.



*Remarks* — A single specimen with part of the posterior lobe missing, but certainly belonging to *A. lobata* of which it shows all the main diagnostic characters. In fact, it can be observed the outer-lateral lobe without secondary carina, but with a markedly pronounced secondary keel which extends from the distal extremity of the lobe to the square basal pit; also the other keels radiate out from its vertices.

The most variable feature in *A. lobata* is in the way of development of the secondary keel on the outer-lateral lobe. It can either extend from a vertex of the basal pit to the end of the lobe, terminate without reaching the end, or start from the end of the lobe, continuing towards the basal pit, but not reach it. Generally the outer-lateral lobe lacks a true secondary carina; at most, some specimens may show a certain alignment of nodes along the axis of the lobe.

*Occurrence* — Sequence II, sample 2.

*Range* — Middle *asymmetricus* Subzone - basal Upper *gigas* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 1 specimen.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20321 (figured hypotype).

#### ANCYRODELLA NODOSA Ulrich & Bassler, 1926

Pl. 3, figs. 3-4

1926 *Ancyrodella nodosa* ULRICH & BASSLER, p. 48, pl. 1, figs. 10-13.

1971 *Ancyrodella nodosa* Ulrich & Bassler - SZULCZEWSKI, p. 14, pl. 2, fig. 4; pl. 5, figs. 2-5.

1976 *Ancyrodella nodosa* Ulrich & Bassler - ORCHARD, p. 928, pl. 114, fig. 3.

1979 *Ancyrodella nodosa* Ulrich & Bassler - BALINSKI, p. 74, pl. 19, fig. 6.

*Description* — Tripartite specimens having an anchor-like shape. The slender anterior lobes are characterized by secondary carinas and keels on the upper and lower sides, respectively. The secondary carinas border, distally, the inner margins of the lobes. The posterior lobe shows a more or less marked constriction of the lateral margins. A long free blade extends beyond the anterior lobes and continues posteriorly on the platform as main carina. The rather limited platform ornament is represented by marginally located nodes.

*Remarks* — *Ancyrodella nodosa* is considered by Ziegler (1962a) an intermediate form between *A. buckeyensis* and *A. ioides*. A clear distinction between *A. nodosa* and *A. buckeyensis* is not easy because the stratigraphic level where the two species coexist also contains many specimens with intermediate features. However, typical forms of *A. buckeyensis* present, with respect to *A. nodosa*, a heavier triangular platform with straight or slightly convex postero-lateral margins. *A. nodosa* is easily distinguished from *A. ioides* which presents a very reduced and cruciform platform.

*Occurrence* — Sequence I, sample 1/g.

*Range* — *A. triangularis* Zone - basal Upper *gigas* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

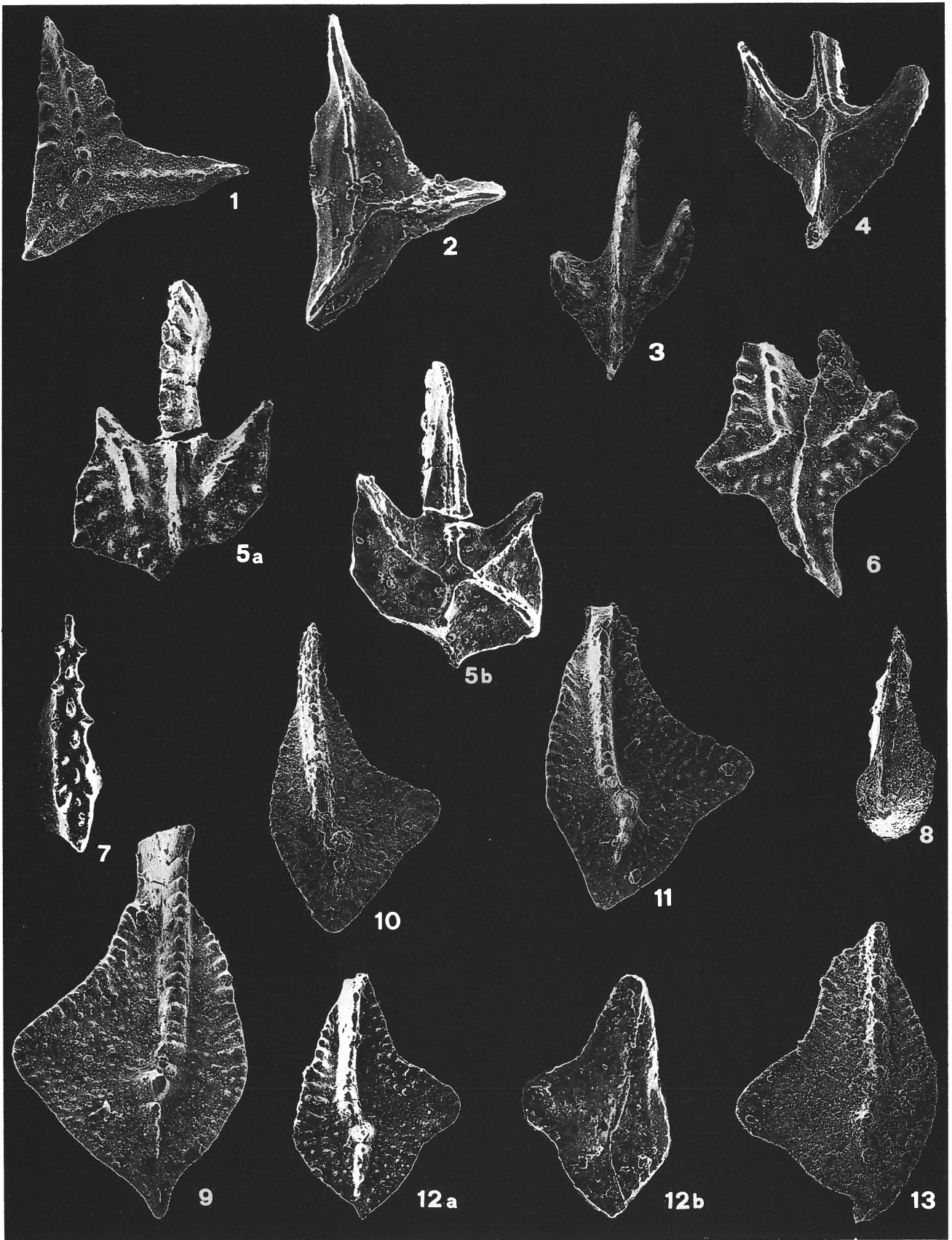
*Material* — 48 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20322-20323 (figured hypotypes), 20324 (hypotypes not figured).

#### EXPLANATION OF PLATE 3

All the specimens are from Su Nuargi, sequence I, unless specified.

- Figs. 1-2 - *Ancyrognathus triangularis* Youngquist. 1) Hypotype n. 20325, x 60, upper view, sample 1/g; 2) Hypotype n. 20326, x 70, lower view, sample 1/g, *Ancyrognathus triangularis* Zone.
- Figs. 3-4 - *Ancyrodella nodosa* Youngquist. 3) Hypotype n. 20322, x 70, upper view, sample 1/g; 4) Hypotype n. 20323, x 60, lower view, free blade partially broken, sample 1/g, *Ancyrognathus triangularis* Zone.
- Figs. 5a-b - *Ancyrodella lobata* Branson & Mehl. Hypotype n. 20321, x 45, upper and lower views, posterior lobe almost completely missing, sequence II, sample 2, Middle *asymmetricus* - basal Upper *gigas* Subzone.
- Fig. 6 - *Ancyrodella curvata* (Branson & Mehl). Hypotype n. 20318, x 60, upper view, sample 1/h, Upper *asymmetricus* - Middle *P. triangularis* Subzone.
- Figs. 7-8 - *Icriodus alternatus* Branson & Mehl. Hypotypes n. 20468-20469, x 40, upper and lower views, sequence II, sample 2, Middle *asymmetricus* - basal Upper *gigas* Subzone.
- Fig. 9 - *Palmatolepis hassi* Müller & Müller. Hypotype n. 20392, x 60, upper view, sample 1/g, *Ancyrognathus triangularis* Zone.
- Figs. 10-13 - *Palmatolepis subrecta* Miller & Youngquist. 10, 11, 13) Hypotypes n. 20453-20455, x 60, three upper views, sample 1/g, *Ancyrognathus triangularis* Zone, 12a-b) Hypotype n. 20456, x 45, upper and lower views, sequence II, sample 2, Middle *asymmetricus* - basal Upper *gigas* Subzone.



## Genus ANCYROGNATHUS Branson &amp; Mehl, 1934

1934 *Ancyrognathus* BRANSON & MEHL, p. 240.  
1947 *Ancyroides* MILLER & YOUNGQUIST, p. 504.

*Type species* — *Ancyrognathus symmetricus* Branson & Mehl, 1934.

*Description* — Conodonts with wide trilobate platform, triangular in general shape. Anterior, posterior and outer-lateral lobes are present. In upper side a nodular main carina extends across the platform between the distal ends of the anterior and posterior lobes. It reaches its greatest height anteriorly as a fixed blade. In some species the fixed blade can extend anteriorly as a short sturdy free blade. A secondary carina generally extends along the lateral lobe. Ornamentation of upper surface consists, generally, of more or less randomly arranged nodes. In some species short ridges are also present. In lower side the main and secondary keels converge on a small, triangular basal pit.

*Remarks* — The only character used by Miller & Youngquist to distinguish their genus *Ancyroides* from *Ancyrognathus* Branson & Mehl is the abrupt posterior termination of the blade. However, since discrimination among various genera of platform conodonts places greater importance on lower surface features than on details of the upper surface, Ziegler (1958) judged *Ancyrognathus* and *Ancyroides* as sy-

nonyms because of the identity of their lower surfaces.

## ANCYROGNATHUS TRIANGULARIS Youngquist, 1945

Pl. 3, figs. 1-2

- 1945 *Ancyrognathus triangularis* YOUNGQUIST, p. 356, pl. 54, fig. 7.  
1980 *Ancyrognathus triangularis* Youngquist - PERRI & SPALLETTA, p. 296, pl. 3, figs 2-3.  
1981 *Ancyrognathus triangularis* Youngquist - Ziegler in ZIEGLER (ed.), p. 23-24, *Ancyrognathus* - pl. 5, figs. 1-10, (*cum syn.*).

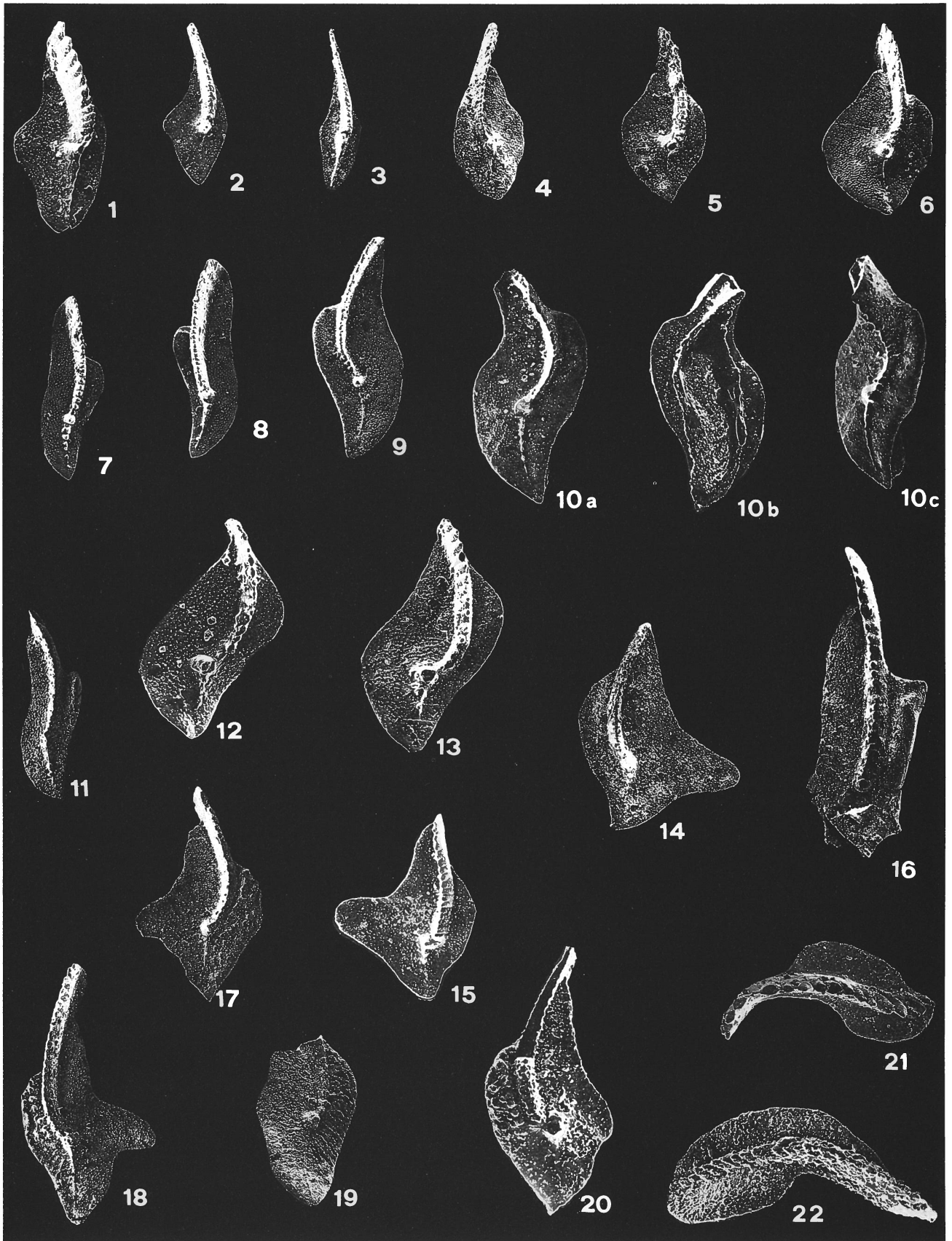
*Description* — Specimens variable in size with a trilobate platform, whose anterior, posterior and outer-lateral lobes are distally tapered. The anterior and posterior lobes form the main body of the platform, whose inner margin varies from a near straight line to widely concave. The external margin presents two wide concavities extending from the tip of the lateral lobe to the ends of the anterior and posterior lobes, respectively. A main carina extends from the distal tip of the posterior lobe to the anterior lobe, where in some specimens it rises to form a relatively low and short blade. A secondary carina runs along the lateral lobe and forms, in the studied specimens, an angle of about 90° with the anterior part of the main carina, whereas the angle formed with its posterior part is always obtuse because of the inward curvature of this part

## EXPLANATION OF PLATE 4

All the specimens are from Su Nuargi, sequence I.

- Figs. 1-3 - *Palmatolepis minuta minuta* Branson & Mehl. 1) Hypotype n. 20401, x 60, upper view, sample 1; 2, 3) Hypotypes n. 20402-20403, x 40, two upper views, sample 1, Lower *rhomboidea* Subzone.  
Figs. 4-6 - *Palmatolepis rhomboidea* Sannemann. 4, 5) Hypotypes n. 20441-20442, x 40, two upper views, sample 1, Lower *rhomboidea* Subzone; 6) Hypotype n. 20443, x 40, upper view, sample 1/a, Upper *rhomboidea* Subzone.  
Figs. 7-8 - *Palmatolepis glabra prima* Ziegler & Huddle. Hypotypes n. 20333-20334, x 40, two upper views, sample 1, Lower *rhomboidea* Subzone.  
Fig. 9 - *Palmatolepis glabra prima* Ziegler & Huddle, morphotype 1 *sensu* Sandberg & Ziegler (1973). Hypotype n. 20374, x 40, upper view, sample 1, Lower *rhomboidea* Subzone.  
Figs. 10a-c - *Palmatolepis glabra prima* Ziegler & Huddle, morphotype 2 *sensu* Sandberg & Ziegler (1973). Hypotype n. 20349, x 40, upper, lower, oblique-upper views, sample 1, Lower *rhomboidea* Subzone.  
Fig. 11 - *Palmatolepis glabra pectinata* Ziegler. Hypotype n. 20373, x 40, upper view, sample 1, Lower *rhomboidea* Subzone.  
Figs. 12-13 - *Palmatolepis cf. regularis* Cooper. Hypotype n. 20437, x 60, upper view, sample 1; 13) Hypotype n. 20438, x 40, upper view, sample 1, Lower *rhomboidea* Subzone.  
Figs. 14-15 - *Palmatolepis subperlobata* Sannemann. 14) Hypotype n. 20446, x 40, upper view, sample 1, Lower *rhomboidea* Subzone; 15) Hypotype n. 20447, x 40, upper view, sample 0, Upper *crepida* Subzone.  
Fig. 16 - *Palmatolepis glabra acuta* Helms. Hypotype n. 20351, x 40, Upper view, sample 1, Lower *rhomboidea* Subzone.  
Figs. 17-18 - *Palmatolepis quadrantinodosalobata* Sanneman. Hypotypes n. 20430-20431, x 40, two upper views, sample 1, Lower *rhomboidea* Subzone.  
Fig. 19 - *Palmatolepis crepida* Sannemann. Hypotype n. 20328, x 40, upper view of a specimen with anterior platform broken, sample 1, Lower *rhomboidea* Subzone.  
Fig. 20 - *Palmatolepis poolei* Sandberg & Ziegler. Hypotype n. 20426, x 60, upper view, sample 1, Lower *rhomboidea* Subzone.  
Fig. 21 - *Nothognathella sublaevis* Sannemann. Hypotype, 20247, x 60, upper view, sample 0, Upper *crepida* Subzone.  
Fig. 22 - *Nothognathella palmatoformis* Druce. Hypotype n. 20247, x 60, Upper view, sample 1/i, Upper *marginifera* Subzone.





of the main carina. Platform depressed on the sides of the carinas and with a nodular ornamentation. Anterior lobe bordered by the largest nodes.

*Remarks* — Among the studied material are present some small specimens with a very reduced lateral lobe resembling the specimen illustrated by Ziegler (1958, pl. 10, fig. 4). These specimens are considered juvenile forms of *A. triangularis*.

*Occurrence* — Sequence I, sample 1/g.

*Range* — *A. triangularis* Zone - basal Upper *gigas* Subzone (Ziegler in Ziegler (ed.) 1981, p. 24).

*Material* — 3 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20325-20326 (figured hypotypes), 20327 (hypotypes not figured).

#### Genus ANCYROLEPIS Ziegler, 1959

*Type species* — *Ancyrolepis cruciformis* Ziegler, 1959.

*Description* — The diagnostic feature of this genus is a wide platform with four lobes. Anterior, posterior and outer-lateral lobes are generally well developed and distally tapering. Inner lateral lobe less developed, but always recognizable. Main carina extending between the distal ends of the anterior and posterior lobes. No free blade. A secondary carina, at times, bisects the outer lateral lobe. Variable ornamentation consisting of nodes or ridges. The lower side shows a well defined, generally wide basal pit and keels converging towards it.

*Remarks* — This is a very rare genus represented in the literature, until now, by only two species: *Ancyrolepis walliseri* (Wittekindt) and *A. cruciformis* Ziegler. The former is stratigraphically limited to the top of the Lower *varcus* Subzone and to the basal Middle *varcus* Subzone of Givetian age; whereas the latter is characteristic of the Lower and Middle *crepida* Subzones in the Famennian age.

*Ancyrolepis cixerriensis* n. sp. has been found in the Middle *varcus* Subzone.

#### ANCYROLEPIS CIXERRIENSIS n. sp.

Pl. 1, figs. 1a-6b

*Derivatio nominis* — From the name of the Cixerri River running across the Cixerri Valley in the Iglesias area.

*Holotype* — Figured specimen in pl. 1, figs. 1a-b, cat. n. 20235, Institute of Paleontology, Modena University.

*Paratypes* — Figured specimens in pl. 1, figs. 2-6, cat. n. 20236-20240, ibidem; specimen not figured, cat. n. 20241, ibidem.

*Locus typicus* — Su Nuargi, 2 Km NE of Domusnovas (Iglesias, Sardinia), F. 233, IV NE I.G.M..

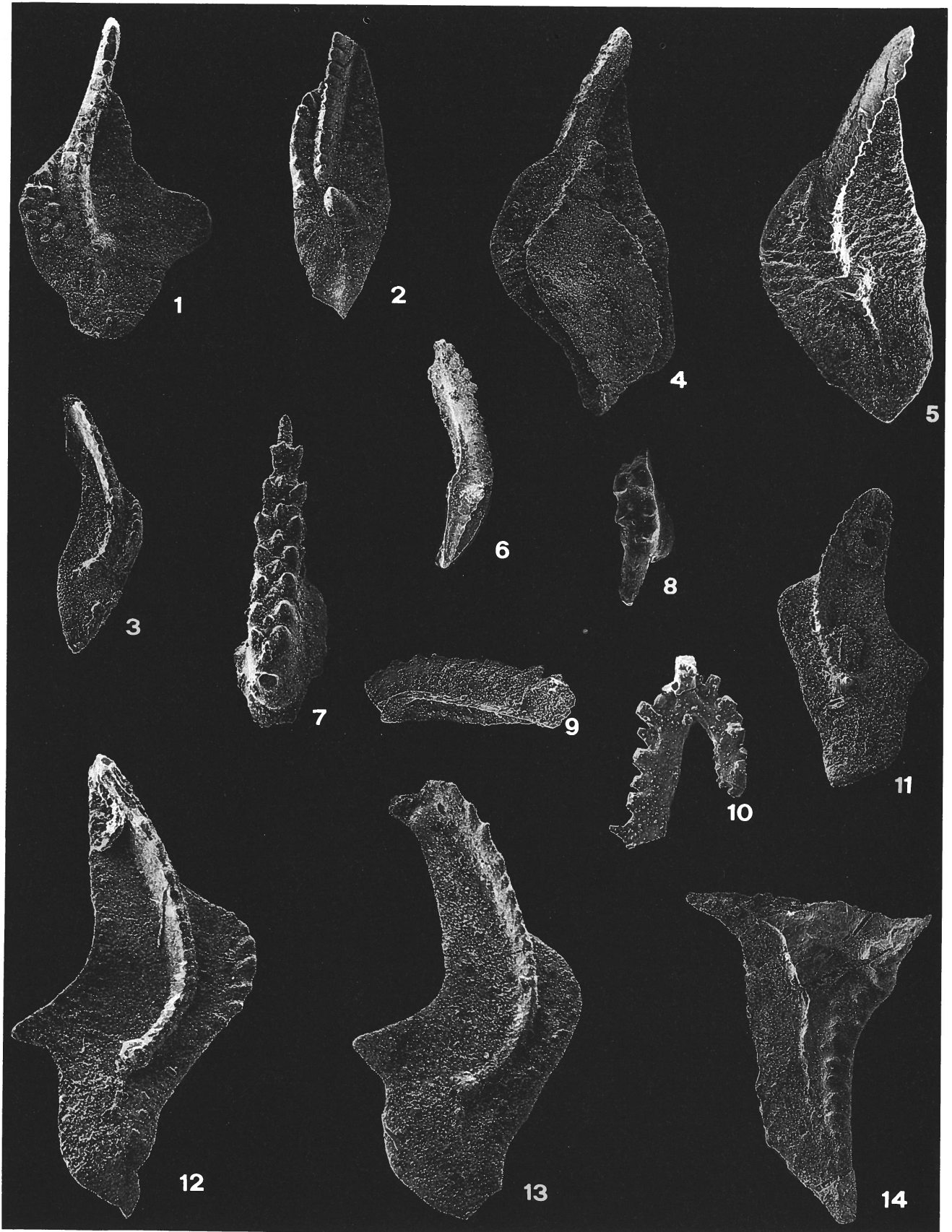
*Stratum typicum* — Su Nuargi, sequence II, bed 2/A, Middle *varcus* Subzone, Givetian.

*Diagnosis* — A species of *Ancyrolepis* with a well developed and distally tapered outer lateral lobe. This lobe is generally oblique to the main carina which extends between the distal ends of the anterior and posterior lobes. A poorly developed, but always vi-

#### EXPLANATION OF PLATE 5

All the specimens are from Su Nuargi, sequence I.

- Fig. 1 - *Palmatolepis quadrantinodosalobata* Sannemann, Hypotype n. 20432, x 60, upper view, sample 0, Upper *crepida* Subzone.  
 Figs. 2-3 - *Palmatolepis termini* Sannemann, Hypotypes n. 20461-20462, x 60, upper views, sample 0, Upper *crepida* Subzone.  
 Figs. 4-5 - *Palmatolepis crepida* Sannemann, Hypotypes n. 20329-20330, x 60, 4): lower view showing the preserved basal plate; 5): upper view, sample 0, Upper *crepida* Subzone.  
 Fig. 6 - *Palmatolepis gracilis gracilis* Branson & Mehl, Hypotype n. 20385, x 60, oblique-upper view, sample 1/f, Upper *marginifera* Subzone.  
 Fig. 7 - *Icriodus alternatus* Branson & Mehl, Hypotype n. 20470, x 60, upper view, sample 0, Upper *crepida* Subzone.  
 Fig. 8 - *Icriodus cornutus* Sannemann, Hypotype n. 20471, x 60, upper view, sample 1/1, Upper *marginifera* Subzone.  
 Fig. 9 - *Pelekisgnathus planus* Sannemann, Hypotype n. 20473, x 60, oblique-lateral view, sample 0, Upper *crepida* Subzone.  
 Fig. 10 - *Apathognathus varians* Branson & Mehl, Hypotype n. 20472, x 60, posterior view, sample 1/f, Upper *marginifera* Subzone.  
 Figs. 11-13 - *Palmatolepis perlobata schindewolfi* Müller, 11, 12) Hypotypes n. 20416-20417, x 60, upper views, sample 1/d, Upper *marginifera* Subzone; 13) Hypotype n. 20418, x 60, upper view, sample 1/a, Upper *rhomboidea* Subzone.  
 Fig. 14 - *Palmatolepis perlobata* cf. *grossi* Ziegler, Hypotype n. 20415, x 60, upper view of the posterior part of the platform, sample 1/d, Upper *marginifera* Subzone.



sible rounded inner lateral lobe. Markedly wide, but shallow basal cavity.

*Description* — In upper view the specimens display a slender platform with a well developed outer lateral lobe, thick in its proximal half, but rapidly tapering distally. A modest sized, but clearly defined inner lateral lobe is present; it is rounded in outline in most specimens, angular in rare cases, as in the specimen illustrated at pl. 1, fig. 4. A nodular main carina is bounded by depressions. The ornamentation is limited to a crenulation along the posterior lobe margins in the holotype and normal sized specimens. The larger sized specimens display larger lobes and also sporadic nodes randomly distributed over their surfaces (pl. 1, figs. 5a-6b). A secondary carina bisects the distal part of the outer lateral lobe obliquely to the main carina, rarely normal to it (pl. 1, fig. 2b). In lower view a very wide but shallow basal cavity extends completely below the inner lateral lobe and for a large part of the external lobe. A sturdy and furrowed main keel is interrupted by the basal cavity. A secondary keel, almost always present towards the distal part of the outer lateral lobe, is oriented as the overlying secondary carina.

*Remarks* — For the general aspect *Ancyrolepis cixerriensis* n. sp. resembles *A. walliseri* (Wittekindt), but it can be distinguished from it by the much greater size of the basal cavity, the shape of the outer lateral lobe and the scarce ornamentation.

*Age* — Givetian (Middle Devonian). Conodont zonation: Middle *varcus* Subzone.

*Material* — 12 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20235 (figured holotype), n. 20236-20240 (figured paratypes), n. 20241 (paratypes not figured).

Genus NATHOGNATHELLA Branson & Mehl, 1934

*Type species* — *Nothognathella typicalis* Branson & Mehl, 1934.

NOTHOGNATHELLA PALMATOFORMIS Druce, 1976

Pl. 4, fig. 22

1966 *Nothognathella sublaevis* Sannemann - GLENISTER & KLAPPER, p. 806, pl. 95, figs. 7-9.

1976 *Nothognathella palmatoformis* DRUCE, p. 135, pl. 42, figs. 3, 5-7.

*Remarks* — The specimens studied display all the morphological characteristics of the holotype illustrated by Druce (1976, pl. 42, fig. 3). The platform, with a shagreen-like upper surface, is well developed on both sides of the carina. Remarkable anteriorward development of the platform allowed Druce to distinguish this species from *Nothognathella sublaevis* Sannemann. In fact, the platform in Sannemann's species is mostly limited to the sides of the posterior carina.

*Occurrence* — Sequence I, sample 1/a, 1/b, 1/i, 1/m.

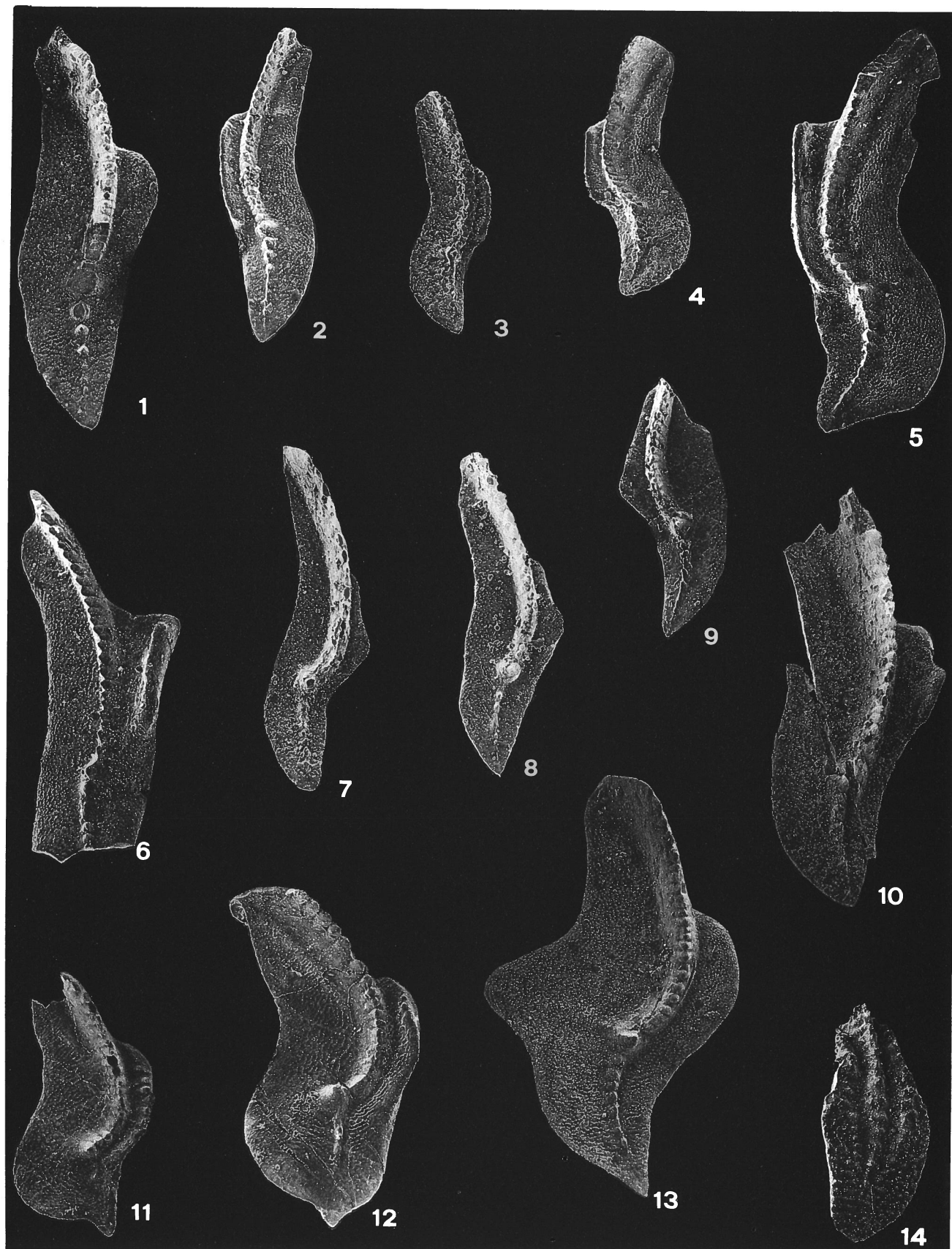
*Range* — Middle *crepida* Subzone - Middle *velifer* Subzone (Druce, 1976).

*Material* — 8 specimens.

#### EXPLANATION OF PLATE 6

All the specimens are from Su Nuargi sequence I.

- Fig. 1 - *Palmatolepis glabra prima* Ziegler & Huddle. Hypotype n. 20335, x 60, upper view, sample 1/b, Upper *marginifera* Subzone.
- Figs. 2-3 - *Palmatolepis glabra pectinata* Ziegler. Hypotypes n. 20374-20375, x 60, upper views, sample 1/b, Upper *marginifera* Subzone.
- Figs. 4-5 - *Palmatolepis glabra distorta* Branson & Mehl. Hypotypes n. 20358-20359, x 60, upper views, sample 1/b, Upper *marginifera* Subzone.
- Fig. 6 - *Palmatolepis glabra acuta* Helms. Hypotype n. 20352, x 60, upper view, sample 1/d, Upper *marginifera* Subzone.
- Figs. 7-9 - *Palmatolepis glabra lepta* Ziegler & Huddle. 7) Hypotype n. 20364, x 60, upper view, sample 1/c; 8, 9) Hypotypes n. 20365-20366, x 60, upper views, sample 1/e, Upper *marginifera* Subzone.
- Fig. 10 - *Palmatolepis glabra pectinata* Ziegler, morphotype 1 *sensu* Sandberg & Ziegler (1973). Hypotype n. 20383, upper view, sample 1/a, Upper *rhomboidea* Subzone.
- Figs. 11-12 - *Palmatolepis marginifera marginifera* Helms. 11) Hypotype n. 20394, x 60, upper view sample 1/f; 12) Hypotype n. 20395, x 60, upper view, sample 1/d, Upper *marginifera* Subzone.
- Fig. 13 - *Palmatolepis tenuipunctata* Sannemann. Hypotype n. 20459, x 60, upper view, sample 0, Upper *crepida* Subzone.
- Fig. 14 - *Polylophodonta cf. confluens* (Ulrich & Bassler). Hypotype n. 20474, x 60, oblique-upper view, sample 1/a, Upper *rhomboidea* Subzone.



*Repository* — Institute of Paleontology, Modena University, cat. n. 20242 (figured hypotype), 20243-20246 (hypotypes not figured).

NOTHOGNATHELLA *SUBLAEVIS* Sannemann, 1955

Pl. 4, fig. 21

- 1955 *Nothognathella sublaevis* SANNEMANN, p. 132, pl. 3, figs. 10, 12.  
 1956 *Nothognathella sublaevis* Sannemann - BISCHOFF, p. 127, pl. 10, figs. 30, 31.  
 1967 *Nothognathella sublaevis* Sannemann - WOLSKA, p. 384, pl. 3, figs. 6, 7.  
 1971 *Nothognathella sublaevis* Sannemann - SZULCZEWSKI, p. 26, pl. 8, fig. 11.  
 1976 *Nothognathella sublaevis* Sannemann - DRUCE, p. 137.

*Remarks* — A nothognathellid with a shagreen-like platform restricted to the posterior half of the unit. Rather high carina, straight or curved. Most specimens studied have the two platform halves offset from the median carina, as observed in Sannemann's holotype. Noteworthy is the tight inward curvature of the anterior free blade.

*Occurrence* — Sequence I, samples 0, 1.

*Range* — Lower *asymmetricus* Subzone (Druce, 1976); Middle *crepida* Subzone - *rhomboidea* Zone (Szulczewski, 1971); *crepida* Zone - *velifer* Zone (Wolska, 1967).

*Material* — 12 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20247 (figured hypotype), 20248-20249 (hypotypes not figured).

Genus OZARKODINA Branson & Mehl, 1933

*Type species* — *Ozarkodina typica* Branson & Mehl.

OZARKODINA *BREVIS* (Bischoff & Ziegler, 1957)

Pl. 2, figs. 9-11

- 1957 *Spathognathodus brevis* BISCHOFF & ZIEGLER, p. 116, pl. 19, figs. 24, 27-29.  
 1966 *Spathognathodus brevis* Bischoff & Ziegler - WITTEKINDT, pl. 3, figs. 23, 24.  
 1977 *Ozarkodina brevis* (Bischoff & Ziegler) - Klapper, in ZIEGLER (ed.), pp. 263-265, *Ozarkodina* - pl. 3, figs. 9, 11 (*cum syn.*).

*Remarks* — The P element of *Ozarkodina brevis* differs from those of other ozarkodinian elements in that it presents an almost rectangular basal cavity located at the posterior end of the short denticulated blade whose last denticle, above the basal cavity, is the most developed in both height and cross-section.

*Occurrence* — Sequence II, sample 2/A.

*Range* — Upper part of Lower *varcus* Subzone - Lowermost *asymmetricus* Subzone (Klapper, in Ziegler (ed.), 1977; Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 9 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20250-20252 (figured hypotypes), 20253 (hypotypes not figured).

Genus PALMATOLEPIS Ulrich & Bassler, 1926

*Type species* — *Palmatolepis perlobata* Ulrich & Bassler, 1926.

PALMATOLEPIS *CREPIDA* Sannemann, 1955

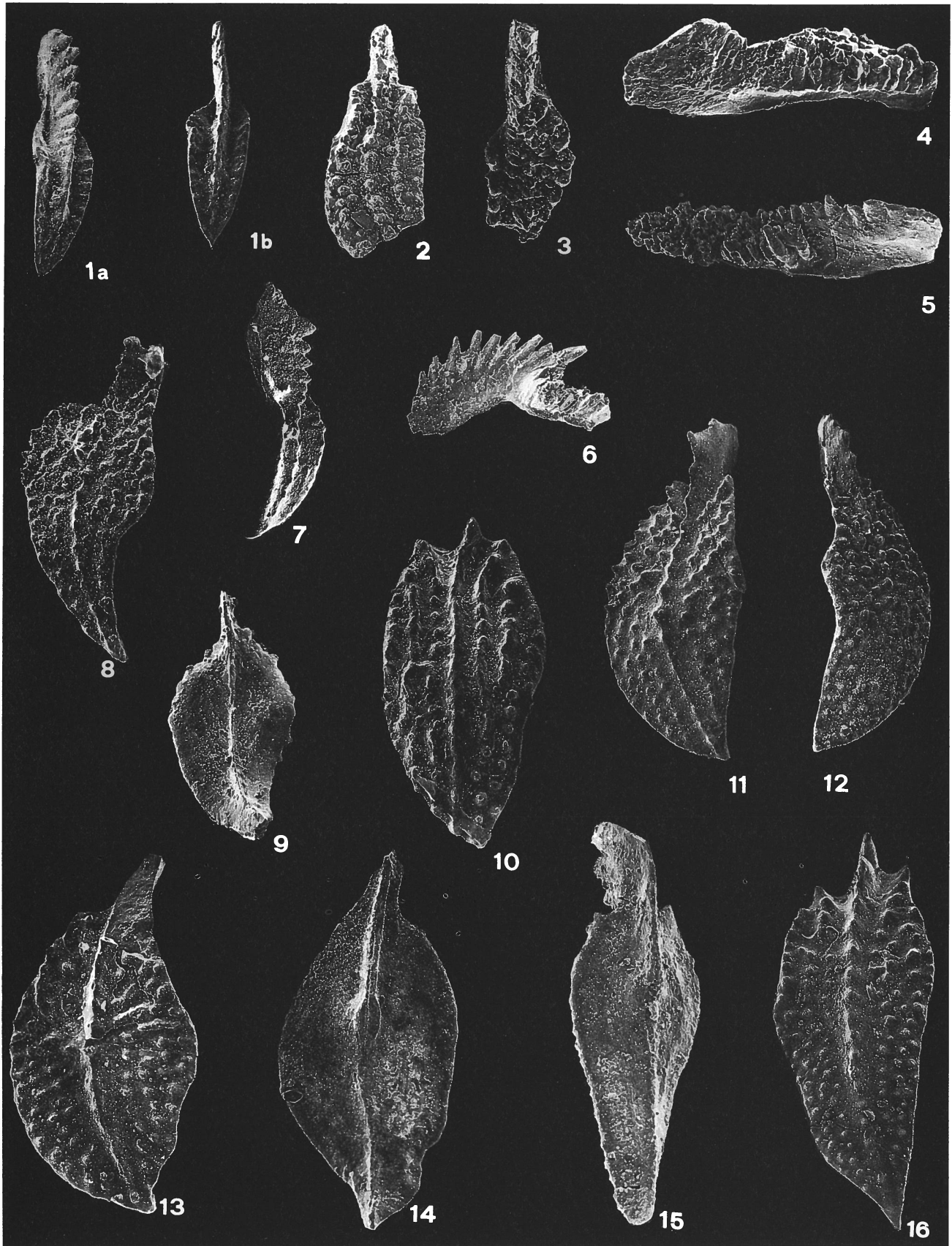
Pl. 4, fig. 19; Pl. 5, figs. 4-5

- 1955b *Palmatolepis crepida* SANNEMANN, p. 134, pl. 6, fig. 21.

EXPLANATION OF PLATE 7

All the specimens are from Su Nuargi sequence I, unless specified.

- Figs. 1a-b - *Polygnathus decorosus* Stauffer. Hypotype n. 20283, x 60, oblique-upper and upper views, sample 1/g, *Ancyrognathus triangularis* Zone.  
 Figs. 2-5 - *Polygnathus diversus* Helms. 2) Hypotype n. 20475, x 60, upper view, sample 1/d; 3-5) Hypotypes n. 20476-20478, upper, lateral and oblique-upper views, sample 1/f, Upper *marginifera* Subzone.  
 Fig. 6 - *Ozarkodina lacera* Helms. Hypotype n. 20478, x 60, lateral view, sample 1/c, Upper *marginifera* Subzone.  
 Fig. 7 - *Polygnathus procerus* Sannemann. Hypotype n. 20316, x 60, oblique-upper view, sample 2, sequence II, Middle *asymmetricus* - basal Upper *gigas* Subzone.  
 Figs. 8-9 - *Polygnathus* sp. *a*. Specimens n. 20478-20479, x 60, upper and lower views, sample 1/i, Upper *marginifera* Subzone.  
 Figs. 10-12 - *Polygnathus nodocostatus* s.l. Branson & Mehl. 10) Hypotype n. 20480, x 60, upper view, sample 1, Lower *rhomboidea* Subzone; 11-12) Hypotypes n. 20481-20482, x 60, two oblique-upper views, sample 1/i, Upper *marginifera* Subzone.  
 Figs. 13-14 - *Polygnathus* sp. *b*. Specimens n. 20483-20484, x 60, upper and lower views, sample 1/l, Upper *marginifera* Subzone.  
 Figs. 15-16 - *Polygnathus* sp. *c*. Specimens n. 20485-20486, x 60, sample 1/i, Upper *marginifera* Subzone.



- 1973 *Palmatolepis crepida* Sannemann - Ziegler in ZIEGLER, (ed.), pp. 263-264, *Palmatolepis* - pl. 3, figs. 5,6, (*cum syn.*)  
 1973 *Palmatolepis crepida* Sannemann - SANDBERG & ZIEGLER, p. 103, pl. 5, figs. 9-11.

*Remarks* — The studied specimens correspond well to the typical *Palmatolepis crepida* in having a characteristic elongated and drop-shaped platform with an undeveloped or vestigial outer lateral lobe. For its general outline *P. crepida* looks like *P. linguiformis* Müller. In any case, typical specimens of the two species can always be distinguished. In *P. crepida* the outer margin of the platform inserts, anteriorly, at the end of the blade, and the inner margin about half-way between the end of the blade and the central node; whereas, in *P. linguiformis* the lateral margins of the platform meet the blade at about the same position. An additional discriminating feature is the shape of the carina which in *P. crepida* becomes slender posteriorly to the central node and disappears before reaching the tip of the more or less upward curved platform, whereas in *P. linguiformis* the carina is heavy and always reaches the posterior tip of the flat or downward curved platform.

*Occurrence* — Sequence I, sample 0,1/a, 1/1.

*Range* — *Crepida* Zone - basal Lower *rhomboidea* Subzone (Klapper & Ziegler, 1979, Text-fig. 6).

*Material* — 63 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20328-20329 (figured hypotypes), 20330-20332 (hypotypes not figured).

PALMATOLEPIS GLABRA ACUTA Helms, 1963

Pl. 4, fig. 16; Pl. 6, fig. 6

- 1963 *Palmatolepis (Panderolepis) serrata acuta* HELMS, p. 468, pl. 3, figs. 1-4; text-fig. 2, fig. 23.  
 1969 *Palmatolepis glabra acuta* Helms - ZIEGLER & HUDDLE, p. 381.  
 1977 *Palmatolepis glabra acuta* Helms - Ziegler in ZIEGLER, (ed.), pp. 293-296, *Palmatolepis* - pl. 6, figs. 2, 3, (*cum syn.*)  
 1983 *Palmatolepis glabra acuta* Helms - WANG & ZIEGLER, p. 82, pl. 3, fig. 20.

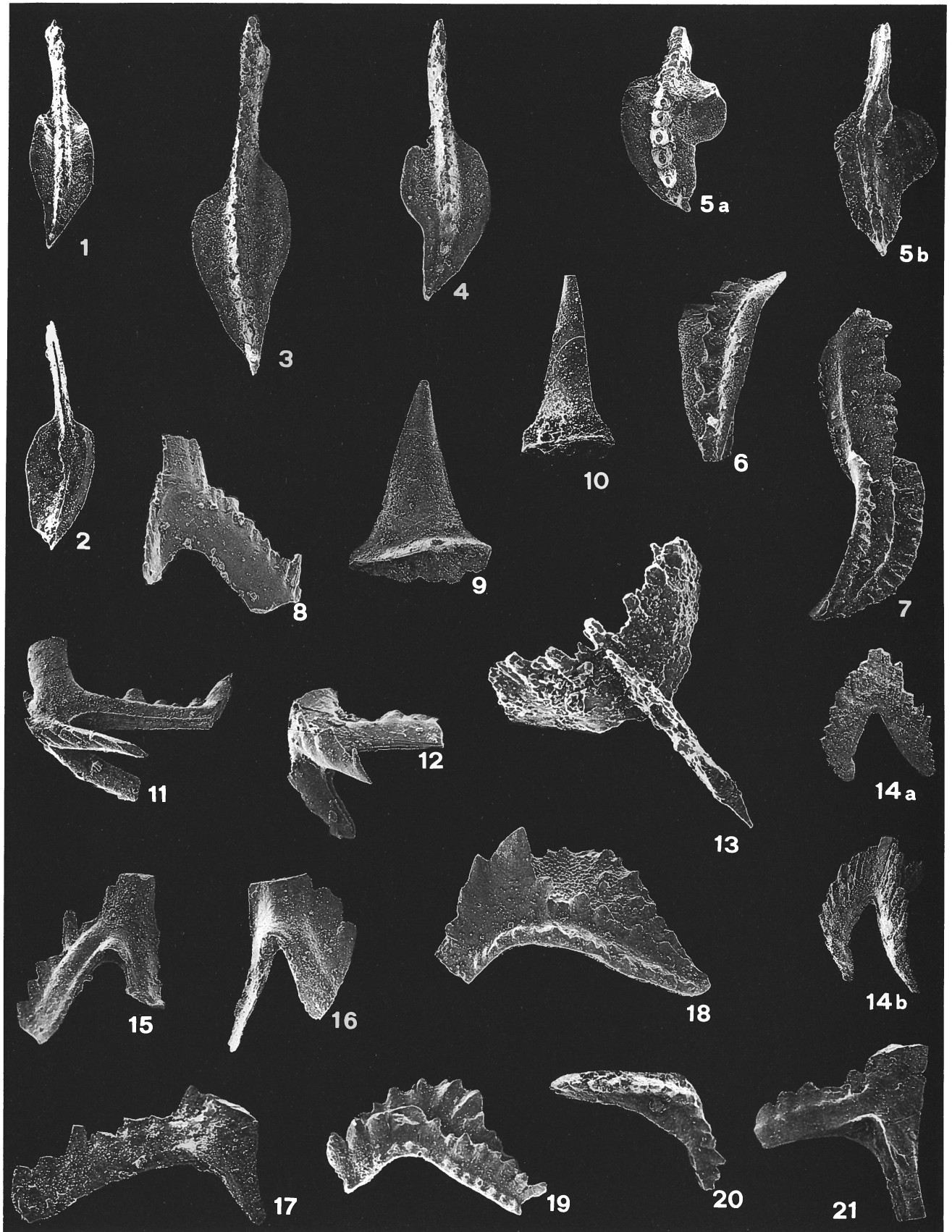
*Remarks* — Specimens in various growth stages, the younger ones mostly well preserved. The main diagnostic feature of this subspecies having a very elongate and shagreen-like upper side, is the inner antero-lateral margin of the platform raised into a parapet oblique with respect to the blade-carina. Blade-carina and parapet meet at a 45° angle open anteriorward. The parapet terminates slightly before the anterior margin of the platform, which ends in a thorn-like projection oriented in a lateral and forward direction.

#### EXPLANATION OF PLATE 8

All the specimens are from Su Nuargi sequence I, unless specified.

- Figs. 1-3 - *Polygnathus glaber glaber* Ulrich & Bassler. 1-2) Hypotypes n. 20485-20486, x 50, upper and lower views, sample 1, Lower *rhomboidea* Subzone; 3) Hypotype, n. 20487, x 60, sample 1/i, Upper *marginifera* Subzone.  
 Figs. 4-5b - *Polygnathus glaber bilobatus* Ziegler. 4) Hypotype n. 20488, x 60, upper view, sample 1/i, Upper *marginifera* Subzone; 5a-b) Hypotype n. 20489, x 60, upper and lower views, sample 1/b, Upper *marginifera* Subzone.  
 Fig. 6 - *Polygnathus glaber medius* Helms & Wolska. Hypotype n. 20490, x 60, oblique-upper view, sample 1/i, Upper *marginifera* Subzone.  
 Fig. 7 - *Polygnathus webbi* Stauffer. Hypotype n. 20491, x 60, oblique-upper view, sample 1/g, *Ancyrognathus triangularis* Zone.  
 Fig. 8 - *Synprioniodina alternata* Bassler. Hypotype, n. 20492, x 60, inner-lateral view, sample 1/f, Upper *marginifera* Subzone.  
 Fig. 9 - *Acodina* sp. Specimen n. 20493, x 60, lateral view, sample 1/m, Upper *marginifera* Subzone.  
 Fig. 10 - *Acodina inopinata* Stauffer. Hypotype n. 20494, x 60, lateral view, sample 1, Lower *rhomboidea* Subzone.  
 Fig. 11 - *Diplododella franca* (Sannemann), Hypotype n. 20495, x 60, oblique-lateral view, sample 0, Upper *crepida* Subzone.  
 Fig. 12 - *Diplododella prava* (Helms). Hypotype n. 20496, x 60, antero-lateral view, sample 1/f, Upper *marginifera* Subzone.  
 Fig. 13 - *Avignathus beckmanni* Lys & Sarre. Hypotype n. 20500, x 60, upper view of a specimen showing its anterior part missing, sample 1/g, *Ancyrognathus triangularis* Subzone.  
 Figs. 14a-b - *Diplodella* sp. Specimen n. 20501, x 40, anterior and antero-lateral views, sequence II, sample 2/r, Upper *varcus* Subzone.  
 Figs. 15-16 - *Enantiognathus inversus* (Sannemann). Hypotypes n. 20501-20502, x 40, sample 0, Upper *crepida* Subzone.  
 Fig. 17 - *Neoprioniodus obtusus* (Branson & Mehl). Hypotype n. 20503, x 60, outer-lateral view, sample 1/i, Upper *marginifera* Subzone.  
 Fig. 18 - *Nothognathella condita* Branson & Mehl. Hypotype n. 20504, x 60, oblique-upper view, sample 1, Lower *rhomboidea* Subzone.  
 Fig. 19 - *Nothognathella flumendosae* Olivieri. Hypotype n. 20505, x 60, oblique-upper view, sample 1/c, Upper *marginifera* Subzone.  
 Fig. 20 - *Nothognathella* sp. Specimen n. 20506, x 60, upper view, sample 1/g, *Ancyrognathus triangularis* Zone.  
 Fig. 21 - *Neoprioniodus postinversus* Helms. Hypotype n. 20507, x 60, outer-lateral view, sample 1/1, Upper *marginifera* Subzone.





*Occurrence* — Sequence I, sample 1, 1a, 1/d, 1/i, 1/l, 1/m.

*Range* — Upper part of Upper *crepida* Subzone - into the Upper *marginifera* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 17 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20351-20352 (figured hypotypes), 20353-20357 (hypotypes not figured).

PALMATOLEPIS GLABRA DISTORTA  
Branson & Mehl, 1934

Pl. 6, figs. 4-5

- 1934 *Palmatolepis distorta* BRANSON & MEHL, p. 237, pl. 18, figs. 13, 14 [fig. 13 = lectotype selected by Ziegler, 1962b, p. 58].  
1962b *Palmatolepis distorta* Branson & Mehl - ZIEGLER, pp. 57-58, pl. 5, figs. 8-13.  
1977 *Palmatolepis glabra distorta* Branson & Mehl - Ziegler in ZIEGLER (ed.), pp. 297-300, *Palmatolepis*, pl. 6, figs. 4-6, (*cum syn.*).  
1983 *Palmatolepis glabra distorta* Branson & Mehl - WANG & ZIEGLER, p. 82, pl. 3, fig. 17.

*Description* — Subspecies of *Palmatolepis glabra* characterized by an elongate, narrow and strongly sigmoidal platform which shows a shagreen-like upper

surface. The anterior inner platform bears a well developed sharp or denticulated parapet which parallels the blade-carina. The anterior outer platform shows a strong bulge which extends to the central node.

*Remarks* — Ziegler (1977, p. 298) treats *P. distorta* as a subspecies of *P. glabra* due to both its general features and evolutionary connections. *P. glabra distorta* is considered to be derived from *P. glabra pectinata* in developing the typical bulge on the anterior part of the outer platform which instead is flat or concave in *P. glabra pectinata*.

*Occurrence* — Sequence I, samples 1/b, 1/d, 1/e, 1/f.

*Range* — Basal Lower *marginifera* Subzone - into the Middle *velifer* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 72 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20358-20359 (figured hypotypes), 20360-20363 (hypotypes not figured).

PALMATOLEPIS GLABRA LEPTA  
Ziegler & Huddle, 1969

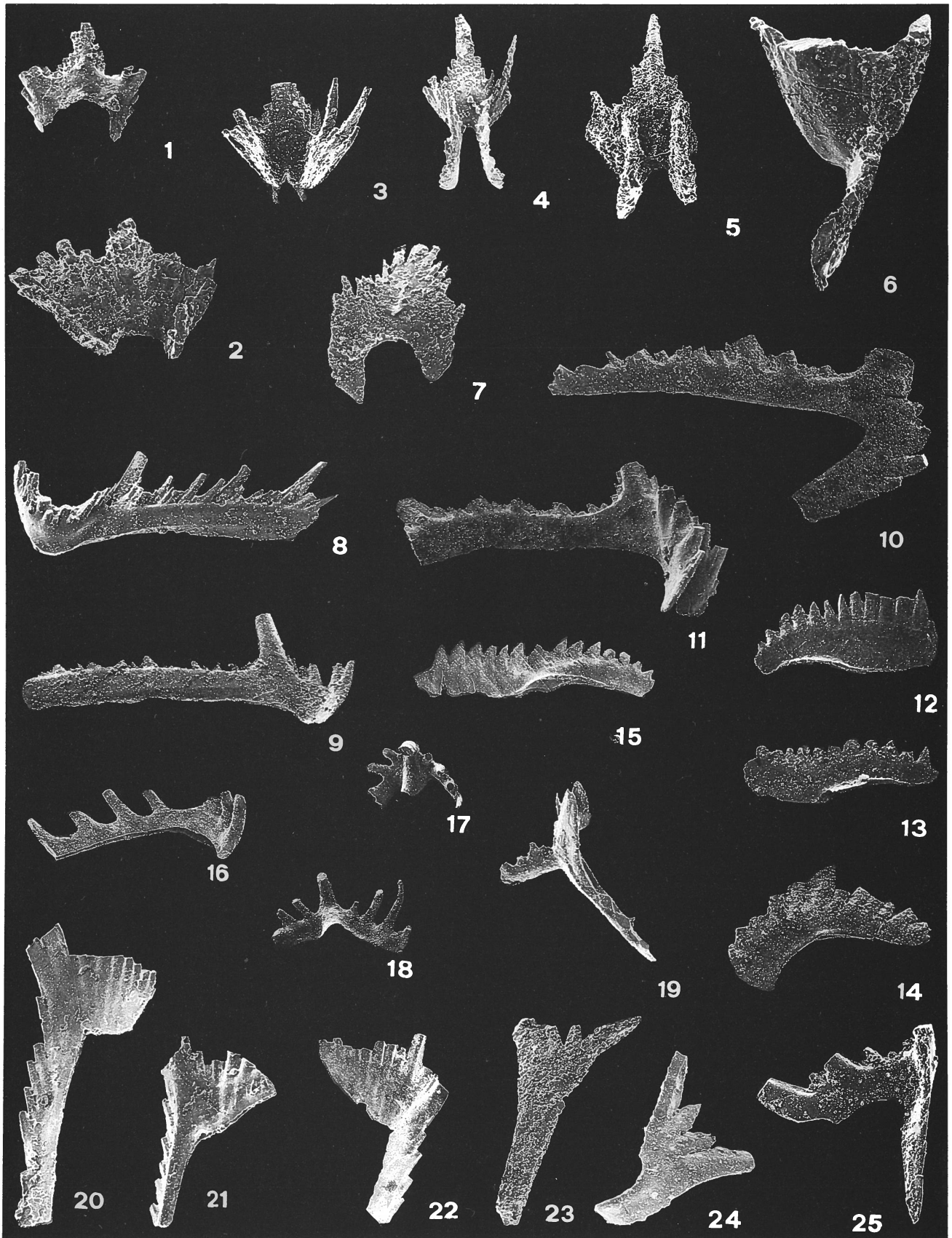
Pl. 6, figs. 7-9

1969 *Palmatolepis glabra lepta* ZIEGLER & HUDDLE, p. 380.

EXPLANATION OF PLATE 9

All the specimens are from Su Nuargi sequence I, unless specified.

- Figs. 1-2 - *Scutula sinepennata* Ziegler. Hypotypes n. 20508-20509, x 60, anterior and posterior views, sample 1/g, *Ancyrognathus triangularis* Zone.  
Figs. 3-5 - *Scutula bipennata* Sannemann. 3) Hypotype n. 20510, x 120, posterior view, sample 1/b; 4) Hypotype n. 20511, x 120, anterior view, sample 1/d; 3, 4) Upper *marginifera* Subzone; 5) Hypotype n. 20512, x 100, anterior view, sample 1, Lower *rhomboidea* Subzone.  
Fig. 6 - *Scutula venusta* Sannemann. Hypotype n. 20513, x 60, anterior view, sample 1/g, *Ancyrognathus triangularis* Subzone.  
Fig. 7 - *Falcodus variabilis* Sannemann. Hypotype n. 20514, x 75, lateral view, sample 1/a, Upper *rhomboidea* Subzone.  
Fig. 8 - *Hindeodella uncata* (Hass). Hypotype n. 20515, x 60, outer-lateral view, sample 1, Lower *rhomboidea* Subzone.  
Fig. 9 - *Hindeodella subtilis* Bassler. Hypotype n. 20516, x 60, inner-lateral view, sample 1/g, *Ancyrognathus triangularis* Subzone.  
Fig. 10 - *Ligonodina franconica* Sanneman. Hypotype n. 20517, x 60, lateral view, sample 0, Upper *crepida* Subzone.  
Fig. 11 - *Diplododella* sp. Specimen n. 20518, x 60, lateral view, sample 1/m, Upper *marginifera* Subzone.  
Figs. 12-13 - *Bispathodus stabilis* (Branson & Mehl). Hypotypes n. 20519-20520, x 60, lateral views, samples 1/c, 1/e, Upper *marginifera* Subzone.  
Fig. 14 - *Ozarkodina macra* Branson & Mehl. Hypotype n. 20521, x 60, lateral view, sample 0, Upper *crepida* Subzone.  
Fig. 15 - *Ozarkodina semialternans* Wirth. Hypotype n. 20522, x 40, lateral view showing an expanded basal cavity, sequence II, sample 2/r, Upper *varcus* Subzone.  
Fig. 16 - *Ligonodina panderi* Hinde, Hypotype n. 20523, x 40, sequence II, sample 2/r, Upper *varcus* Subzone.  
Figs. 17-18 - *Lonchodina* sp. Specimens n. 20524-20525, x 40, upper and inner-lateral views, sequence II, sample 2/r, Upper *varcus* Subzone.  
Fig. 19 - *Tripodellus robustus* Bischoff. Hypotype n. 20526, x 60, upper view, sample 1/d, Upper *marginifera* Subzone.  
Figs. 20-22 - *Palmatodella delicatula* Ulrich & Bassler. 20) Hypotype n. 20527, x 60, lateral view, sample 1/d Upper *marginifera* Subzone; 21-22) Hypotypes n. 20528-20529, x 60, lateral views, sample 1/g, *Ancyrognathus triangularis* Subzone.  
Figs. 23-24 - *Palmatodella unca* Sannemann. Hypotypes n. 20530-20531, x 60, lateral view, sample 1/i, Upper *marginifera* Subzone.  
Fig. 25 - *Prioniodina? smithi* (Stauffer). Hypotype n. 20532, x 60, inner lateral view, sample 1/f, Upper *marginifera* Subzone.



1977 *Palmatolepis glabra lepta* Ziegler & Huddle - Ziegler in ZIEGLER (ed.), pp. 301-304, *Palmatolepis* - pl. 7, figs. 1-3, (cum syn.).

1983 *Palmatolepis glabra lepta* Ziegler & Huddle - WANG & ZIEGLER, p. 82, pl. 3, fig. 19.

*Remarks* — Numerous typical specimens characterized by an extremely elongate shagreen-like platform. The main diagnostic feature is the more or less bowed-up inner triangular parapet. Noteworthy is that sample 1/a, which belongs to the Upper *rhomboidea* Subzone yielded some specimens which a parapet similar to that of *P. glabra prima* but with a roughly triangular outline. The latter corresponds well with Sandberg and Ziegler's (1979) so called «early form», namely the ancestral form of the typical *P. glabra lepta*.

*Occurrence* — Sequence I, samples 1/a, 1/b, 1/c, 1/d, 1/e, 1/i, 1/m.

*Range* — «Early form»: within Upper *crepida* Subzone - Upper *rhomboidea* Subzone; «typical form»: Lower *marginifera* Subzone - Upper *velifer* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 92 specimens: 4 early forms; 88 typical forms.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20364-20366 (figured hypotypes), 20367-20372 (hypotypes not figured).

PALMATOLEPIS GLABRA PECTINATA Ziegler, 1962

Pl. 4, fig. 11; Pl. 6, figs. 2-3

1962c *Palmatolepis glabra pectinata* ZIEGLER, p. 398, pl. 2, figs. 3-5.

1977 *Palmatolepis glabra pectinata* Ziegler in ZIEGLER (ed.), pp. 305-307, *Palmatolepis* - pl. 6, figs. 7-10 (cum syn.).

1983 *Palmatolepis glabra pectinata* Ziegler - WANG & ZIEGLER, p. 82, pl. 3, fig. 18.

*Remarks* — Many well preserved typical specimens of *Palmatolepis glabra pectinata* with a more or less sigmoidal shagreen-like platform. This subspecies strongly resembles *P. glabra distorta* because of the location of the parapet and the general platform outline. The discriminating feature between the two taxa is in the anterior part of the outer platform: this is flat or concave in *P. glabra pectinata* and convex in *P. glabra distorta*.

*Occurrence* — Sequence I, samples 1, 1/a, 1/b, 1/c, 1/d, 1/e, 1/f.

*Range* — Top of the Upper *crepida* Subzone - Upper *marginifera* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 85 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20373-20375 (figured hypotypes), 20376-20382 (hypotypes not figured).

PALMATOLEPIS GLABRA PECTINATA Ziegler, 1962, morphotype 1 *sensu* Sandberg & Ziegler, 1973

Pl. 6, fig. 10

1973 *Palmatolepis glabra pectinata* Ziegler, Morphotype 1 SANDBERG & ZIEGLER, p. 104, pl. 2, figs. 4, 12-15; pl. 5, fig. 14.

*Remarks* — *Palmatolepis glabra pectinata* morphotype 1 shows a high parapet which is however much shorter than in the typical form. Indeed, the parapet never reaches the anterior margin of the inner platform. Specimens of this morphotype from Sardinia have a less slender platform than those of the typical *P. glabra pectinata*.

*Occurrence* — Sequence I, sample 1/a.

*Range* — Highest part of Upper *crepida* Subzone - within the Upper *rhomboidea* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 6 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20383 (figured hypotype), 20384 (hypotypes not figured).

PALMATOLEPIS GLABRA PRIMA Ziegler & Huddle, 1969

Pl. 4, figs. 7-8; Pl. 6, fig. 1

1969 *Palmatolepis glabra prima* ZIEGLER & HUDDLE, p. 379 (cum syn.).

1973 *Palmatolepis glabra prima* Ziegler & Huddle - SANDBERG & ZIEGLER, pl. 2, figs. 1, 7.

*Remarks* — Well preserved specimens having the typical characteristics of *Palmatolepis glabra prima*. These specimens are slender forms lacking a lateral lobe and with a shagreen-like upper surface. The anterior inner platform is flat or slightly convex, but its margin never raises into a true parapet.

*P. glabra prima* is considered phylogenetically connected by transitional forms to *P. tenuipunctata* from which it evolved by reduction of the outer lateral lobe (Ziegler, 1962b, text-fig. 8).

Sandberg & Ziegler (1973) recognized, besides the typical *P. glabra prima*, two different morphotypes (1 and 2) with a more limited stratigraphic range.

*Occurrence* — Sequence I, samples 0, 1, 1/a, 1/b, 1/c, 1/d, 1/e, 1/f, 1/l, 1/m.

*Range* — Basal Upper *crepida* Subzone - Upper *marginifera* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 314 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20333-20335 (figured hypotypes), 20336-20346 (hypotypes not figured).

PALMATOLEPIS GLABRA PRIMA

Ziegler & Huddle, 1969,  
morphotype 1 *sensu* Sandberg & Ziegler, 1973

Pl. 4, fig. 9

1973 *Palmatolepis glabra prima* Ziegler & Huddle, Morpho-

type 1 SANDBERG & ZIEGLER, p. 103, pl. 2, figs. 2, 8-10.

1976 *Palmatolepis glabra prima* Ulrich & Bassler [Sic], morpho-

type 1 Sandberg & Ziegler - DUSAR & DREESEN, p. 560, pl. 3, figs. 3, 4.

1976 *Palmatolepis glabra prima* Ziegler & Huddle - BOUCKAERT & DREESEN, p. 580, pl. 1, figs. 12, 13.

*Remarks* — *Palmatolepis glabra prima* morpho-  
type 1, can be easily distinguished from the typical  
*P. glabra prima* by a greater width of the platform,  
hence specimens belonging to this morphotype show  
a much heavier appearance. For a detailed description,  
see Sandberg & Ziegler (1973, p. 103).

*Occurrence* — Sequence I, sample 1.

*Range* — From within the Upper *crepida* Sub-  
zone - Upper *rhomboidea* Subzone (Klapper & Zie-  
gler, 1979, text-fig. 6).

*Material* — 6 specimens.

*Repository* — Institute of Paleontology, Modena  
University, cat. n. 20347 (figured hypotype), 20348  
(hypotypes not figured).

PALMATOLEPIS GLABRA PRIMA

Ziegler & Huddle, 1969,  
morphotype 2 *sensu* Sandberg & Ziegler, 1973

Pl. 4, figs. 10a-c

1971 *Palmatolepis quadrantinodosa* aff. *inflexa* Müller - SZUL-  
CZEWKI, p. 39, pl. 15, fig. 9 [not fig. 8 = *P. klapp-*  
*peri*].

1973 *Palmatolepis glabra prima* Ziegler & Huddle, Morphotype  
2 SANDBERG & ZIEGLER, p. 103, pl. 2, fig. 11.

*Remarks* — *Palmatolepis glabra prima* morpho-  
type 2 has a wide and heavy platform, whose outer

platform outline changes from concave in the ante-  
rior third to markedly convex posteriorly. For its  
general outline this morphotype is similar to *P. klapp-*  
*peri*, but it can be easily distinguished from it by the  
absence, on the inner side of the platform, of the  
ramp (an elongate bulge with flattened top) charac-  
teristic of *P. klapperi*.

*Occurrence* — Sequence I, sample 1.

*Range* — Highest part of Upper *crepida* Subzone  
- Lower *rhomboidea* Subzone (Klapper & Ziegler,  
1979, text-fig. 6).

*Material* — 2 specimens.

*Repository* — Institute of Paleontology, Modena  
University, cat. n. 20349 (figured hypotype), 20350  
(hypotype not figured).

PALMATOLEPIS GRACILIS GRACILIS

Branson & Mehl, 1934

Pl. 5, fig. 6

1934 *Palmatolepis gracilis* BRANSON & MEHL, p. 238, pl. 18,  
figs. 2, 8 [not fig. 5].

1963 *Palmatolepis gracilis* Branson & Mehl - MEHL & ZIEGLER,  
pp. 200-202, pl. 1, figs. 1, 2.

1977 *Palmatolepis gracilis gracilis* Branson & Mehl - Ziegler  
in ZIEGLER (ed.), pp. 315-317, *Palmatolepis* - pl. 7, figs.  
8-10, (*cum syn.*).

1979 *Palmatolepis gracilis gracilis* Branson & Mehl - SANDBERG  
& ZIEGLER, p. 177, pl. 1, figs. 1, 2.

1983 *Palmatolepis gracilis gracilis* Branson & Mehl - WANG &  
ZIEGLER, pl. 3, fig. 9.

*Remarks* — The specimens studied perfectly match  
the nominate subspecies of *Palmatolepis gracilis*. In-  
deed, these present a high blade-carina slightly curved  
in a horizontal plane, and a narrow platform with  
raised margins forming a small rim on the entire  
upper side of the platform, whose greatest width is  
at a point corresponding to the large central node.

*Occurrence* — Sequence I, sample 1/a, 1/b, 1/c,  
1/d, 1/e, 1/f.

*Range* — Upper *rhomboidea* Subzone - Upper  
*costatus* Subzone and into the highest part of the  
*Siphonodella praesulcata* Zone (Sandberg & Ziegler,  
1979, p. 177).

*Material* — 75 specimens.

*Repository* — Institute of Paleontology, Modena  
University, cat. n. 20385 (figured hypotype), 20386-  
20391 (hypotypes not figured).

## PALMATOLEPIS HASSI Müller &amp; Müller, 1957

Pl. 3, fig. 9

- 1957 *Palmatolepis hassi* MÜLLER & MÜLLER 1102, pl. 139, fig. 2, pl. 140, figs. 2-4.  
 1973 *Palmatolepis hassi* Müller & Müller - Ziegler in ZIEGLER (ed.), pp. 281-282, *Palmatolepis*- pl. 2, fig. 4 (*cum syn.*).  
 1976 *Palmatolepis hassi* Müller & Müller - DRUCE, p. 158, pl. 65, figs. 3-5.  
 1979 *Palmatolepis hassi* Müller & Müller - BALINSKI, p. 76, pl. 20, fig. 8.  
 1983 *Palmatolepis hassi* Müller & Müller - WANG & ZIEGLER, p. 84, pl. 4, fig. 7.

*Description* — Specimens with heavy platform whose posterior tip is upward arched. Outer lobe not clearly differentiated from the rest of the platform and located slightly anteriorly of the central node. Weakly sigmoidal blade-carina tapering posteriorly and not reaching the tip of the posterior platform. Rather uniformly distributed nodular ornamentation.

*Remarks* — *P. hassi* is similar to several species of *Palmatolepis*, but most closely resembles *P. subrecta*. They can be distinguished because *P. hassi* has a larger and wider platform. Very important for distinguishing the two species is the aspect of the outer platform, which, in *P. subrecta* shows a better defined lobe. The examined specimens most closely resemble those figured by Ziegler (1958, pl. 7, fig. 4) and Balinski (1979, pl. 20, fig. 8). For a detailed discussion of the species see Ziegler in Ziegler (ed.), 1973, p. 281.

*Occurrence* — Sequence I, sample 1/g.

*Range* — Uppermost part of the Upper *asymmetricus* Subzone-basal Upper *gigas* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 15 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20392 (figured hypotypes), 20393 (hypotypes not figured).

PALMATOLEPIS MARGINIFERA MARGINIFERA  
Helms, 1959

Pl. 6, figs. 11-12

- 1959 *Palmatolepis quadrantinodosa marginifera* Ziegler [sic] - HELMS, p. 649, pl. 5, figs. 22-23.  
 1966 *Palmatolepis quadrantinodosa marginifera* Helms ex Ziegler ms. [ms. = manuscript] - GLENISTER & KLAPPER, p. 280, pl. 91, figs. 6, 15.  
 1973 *Palmatolepis marginifera marginifera* Helms - SANDBERG & ZIEGLER, p. 104, pl. 3, figs. 13-14.  
 1977 *Palmatolepis marginifera marginifera* Helms - Ziegler in

ZIEGLER (ed.), pp. 328-330, *Palmatolepis*- pl. 7, figs. 17-18; pl. 8, figs. 1-2, (*cum syn.*).

- 1983 *Palmatolepis marginifera marginifera* Helms - WANG & ZIEGLER, p. 82, pl. 3, fig. 13.

*Remarks* — Well preserved specimens showing the typical characters of the nominate subspecies of *P. marginifera*. Sandberg & Ziegler's (1973) opinion is that *P. marginifera marginifera* evolved from the *P. quadrantinodosa* stock via *P. stoppeli* or directly from *P. quadrantinodosa inflexa* by the appearance of the characteristic parapet on the anterior inner platform. The parapet is a sharp ridge which may be denticulated; it lies parallel to the blade-carina and may continue posteriorly to the azigous node. Sporadic nodes may be present on the anterior outer platform, but are not regarded as significant taxonomic character.

*Occurrence* — Sequence I, samples 1/b, 1/c, 1/d, 1/e, 1/f.

*Range* — Lower *marginifera* Subzone - Lower *velifer* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 39 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20394-20395 (figured hypotypes), n. 20396-20400 (hypotypes not figured).

PALMATOLEPIS MINUTA MINUTA  
Branson & Mehl, 1934

Pl. 4, figs. 1-3

- 1934 *Palmatolepis minuta minuta* BRANSON & MEHL, p. 236, pl. 18, figs. 1, 6, 7.  
 1977 *Palmatolepis minuta minuta* Branson & Mehl - Ziegler in ZIEGLER (ed.), pp. 335-338, *Palmatolepis*- pl. 9, figs. 1-5, (*cum syn.*).  
 1983 *Palmatolepis minuta minuta* Branson & Mehl - WANG & ZIEGLER, p. 82, pl. 3, fig. 14.

*Remarks* — Small specimens with subovate platform showing a shagreen-like upper surface and the other typical features of *Palmatolepis minuta minuta*. Indeed, the outer platform meets the blade at a point closer its anterior extremity than the inner platform; the platform widens around the central node and, at times, gives rise to a very small and flat lobe. Posteriorly to the central node, the carina, variable in height in the different specimens, generally reaches the posterior tip of the platform, but, sometimes, disappears in a longitudinal depression.

*Occurrence* — Sequence I, samples 0, 1, 1/a, 1/b, 1/c, 1/d, 1/e, 1/f, 1/i, 1/l, 1/m.

*Range* — Upper *P. triangularis* Subzone - Upper *velifer* Subzone (Klapper & Ziegler, 1979, text-fig. 5, 6).

*Material* — 261 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20401-20403 (figured hypotypes), n. 20404-20414 (hypotypes not figured).

PALMATOLEPIS PERLOBATA cf. GROSSI Ziegler, 1960

Pl. 5, fig. 14

1960 *Palmatolepis rugosa grossi* ZIEGLER, p. 37, pl. 1, figs. 1, 2.  
1977 *Palmatolepis perlobata grossi* Ziegler - Ziegler in ZIEGLER (ed.), pp. 353-354, *Palmatolepis* - pl. 10, figs. 1-4, (*cum syn.*).

*Remarks* — The single specimen studied is only compared to *Palmatolepis perlobata grossi* because of its incompleteness. The available fragment represents the posterior half of the platform, whose inner part clearly shows the typical row of nodes which parallels the margin and almost reaches the posterior tip of the platform. The slightly expanded outer platform bears a few nodes only toward the distal end.

*Occurrence* — Sequence I, sample 1/d.

*Range* — Upper *marginifera* Subzone - Upper *velifer* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 1 specimen.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20415 (figured hypotype).

PALMATOLEPIS PERLOBATA SCHINDEWOLFI  
Müller, 1956

Pl. 5, figs. 11-13

1956b *Palmatolepis (Palmatolepis) perlobata schindewolfi* MÜLLER, p. 27, pl. 8, figs. 22-31; pl. 9, fig. 33.  
1977 *Palmatolepis perlobata schindewolfi* Müller - Ziegler in ZIEGLER (ed.), pp. 361-364, *Palmatolepis* - pl. 11, figs. 1-7, (*cum syn.*).  
1979 *Palmatolepis perlobata schindewolfi* Müller - SANDBERG & ZIEGLER, p. 180, pl. 1, figs. 22-24; pl. 2, fig. 13.  
1983 *Palmatolepis perlobata schindewolfi* Müller - WANG & ZIEGLER, p. 82, pl. 4, fig. 3.

*Remarks* — *Palmatolepis perlobata schindewolfi* is considered phylogenetically connected with *P. perlobata perlobata* Ulrich & Bassler, but differs from the nominate subspecies by a smaller outer lateral lobe, by a less coarse surface ornament and by a more slender outline.

Ziegler's (1977) opinion is that the current definition of *P. perlobata schindewolfi* is very broad and

that, further investigations may allow to recognize other subspecies within the *P. perlobata* taxon.

*Occurrence* — Sequence I, sample 1, 1/a, 1/b, 1/c, 1/d, 1/e, 1/f.

*Range* — Upper *crepida* Subzone - Middle *costatus* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 45 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20416-20418 (figured hypotypes), n. 20419-20425 (hypotypes not figured).

PALMATOLEPIS POOLEI Sandberg & Ziegler, 1973

Pl. 4, fig. 20

1973 *Palmatolepis poolei* SANDBERG & ZIEGLER, p. 106, pl. 4, figs. 14-26.

1983 *Palmatolepis poolei* Sandberg & Ziegler - WANG & ZIEGLER, p. 82, pl. 3, fig. 12.

*Description* — Specimens with a rather elongate platform, whose outer margin meets the blade close to its anterior end, whereas the anterior margin of the inner platform meets the blade about mid-way between its anterior tip and the central node. Outer lateral lobe poorly developed, oriented posteriorly and downwards. Anterior inner surface of the platform (parapet area) strongly nodose, with small nodes roughly arranged over the rest of the platform. In the specimens from Sardinia the carina does not extend posterior to the central node.

*Remarks* — The present species can be distinguished from *P. quadrantinodosalobata* by a much smaller outer lateral lobe. The specimens with an obsolescent lobe show an outline similar to that of *P. crepida*, but they can be distinguished by the strongly nodose parapet area.

*Occurrence* — Sequence I, sample 1.

*Range* — Lower *rhomboidea* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 4 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20426 (figured hypotype), n. 20427 (hypotypes not figured).

PALMATOLEPIS QUADRANTINODOSALOBATA  
Sannemann, 1955

Pl. 4, figs. 17-18; pl. 5, fig. 1

1955a *Palmatolepis quadrantinodosalobata* SANNEMAN, p. 328, pl. 24, fig. 6.

- 1973 *Palmatolepis quadrantinodosalobata* SANNEMAN - Ziegler in ZIEGLER (ed.), pp. 295-298, *Palmatolepis* - pl. 4, figs. 6-8, (*cum syn.*).  
 1973 *Palmatolepis quadrantinodosalobata* Sannemann - SANDBERG & ZIEGLER, p. 105, pl. 4, figs. 33-41.  
 1983 *Palmatolepis quadrantinodosalobata* Sanneman - WANG & ZIEGLER, pl. 3, fig. 11.

*Remarks* — The specimens here studied show the typical characteristics of *P. quadrantinodosalobata* whose platform, though similar in outline to *P. subperlobata*, is easily distinguished by a cluster of coarse nodes on the anterior inner platform, whereas its outer platform completely lacks nodes and has a shagreen-like surface

Sandberg & Ziegler (1973) identified, besides the typical form of *P. quadrantinodosalobata*, the morphotype 1 which has a more limited stratigraphic range. *P. quadrantinodosalobata* morphotype 1 *sensu* Sandberg & Ziegler shows the parapet area with nodes arranged in rows almost parallel with the curved portion of the carina and converging towards the central node; also the anterior outer platform is strongly nodose. The outer lateral lobe is smaller than in the typical form.

*Occurrence* — Sequence, I, samples 0,1. [Also specimens reworked in samples 1/i, 1/l, 1/m].

*Range* — Lower *crepida* Subzone - basal Lower *rhomboidea* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 66 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20430-20432 (figured hypotypes), 20433-20436b (hypotypes not figured).

#### PALMATOLEPIS cf. REGULARIS Cooper, 1931

Pl. 4, figs. 12-13

- 1931 [cf.] *Palmatolepis regularis* COOPER, p. 242, pl. 28, fig. 36.  
 1966 *Palmatolepis* cf. *regularis* Cooper - GLENISTER & KLAPPER, p. 821, pl. 92, figs. 14-16, (*cum syn.*).  
 1967 *Palmatolepis* cf. *regularis* Cooper - WOLSKA, p. 404, pl. 6, figs. 11-15.  
 1970 *Palmatolepis* cf. *regularis* Cooper - OLIVIERI, p. 113, pl. 19, figs. 12a-b.  
 1970b *Palmatolepis regularis* Cooper - SEDDON, pl. 12, figs. 7-10.  
 1971 *Palmatolepis* cf. *regularis* Cooper - SZULCZEWSKI, p. 40, pl. 13, fig. 7.  
 1983 *Palmatolepis* cf. *regularis* Cooper - WANG & ZIEGLER, pl. 4, fig. 6.

*Remarks* — When Cooper (1931) established the species *P. regularis*, he only illustrated the lower side of the type, because the upper surface was partially embedded in a shaly matrix. Therefore it is not pos-

sible to carry out an exact comparison with the type of forms referred to the species by succeeding authors.

The major diagnostic feature is a strongly sigmoidal platform with shagreen-like upper surface.

In the specimens examined, which correspond to the late phylogenetic stages, the outer lateral lobe is missing.

*Occurrence* — Sequence I, samples 0, 1.

*Range* — Upper *P. triangularis* Subzone - basal Lower *rhomboidea* Subzone (Klapper & Ziegler, 1979, text-fig. 5, 6).

*Material* — 18 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20437-20438 (figured hypotypes), n. 20439-20440 (hypotypes not figured).

#### PALMATOLEPIS RHOMBOIDEA Sannemann, 1955

Pl. 4, figs. 4-6

- 1955a *Palmatolepis rhomboidea* SANNEMANN, p. 329, pl. 24, fig. 14.  
 1972 *Palmatolepis rhomboidea* Sannemann - MATYJA, p. 746, pl. 4, fig. 6.  
 1973 *Palmatolepis rhomboidea* Sannemann - Ziegler in ZIEGLER (ed.), pp. 229-301, *Palmatolepis* - pl. 1, figs. 6-7, (*cum syn.*).

*Description* — A species of *Palmatolepis* with a rather small platform, whose outline is variable from oval to rhomboidal. The anterior outer platform begins behind the distal end of the blade, whereas the inner platform begins at a more posterior point: about half-way between the anterior margin of the blade and the central node. The upper surface is smooth or shagreen-like. A characteristic bulge, which suggests a parapet, is found on the anterior inner platform. Blade-carina is sigmoidal and high anteriorly, but posteriorly to the central node the carina is thin and in many specimens disappears towards the posterior tip of the platform in a longitudinal groove.

*Remarks* — For a discussion of the relationships between *P. rhomboidea* and other species of *Palmatolepis*, see Ziegler in Ziegler ed. (1973, p. 299).

*Occurrence* — Sequence I, samples 1, 1/a.

*Range* — Lower *rhomboidea* Subzone - basal Lower *marginifera* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 63 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20441-10443 (figured hypotypes), n. 20444-20445 (hypotypes not figured).



## PALMATOLEPIS SUBPERLOBATA

Branson &amp; Mehl, 1934

Pl. 4, figs. 14-15

- 1934 *Palmatolepis subperlobata* BRANSON & MEHL, p. 235, pl. 18, figs. 11, 21.  
 1966 *Palmatolepis subperlobata* Branson & Mehl - GLENISTER & KLAPPER, p. 822, pl. 92, figs. 5-7, (*cum syn.*).  
 1967 *Palmatolepis subperlobata* Branson & Mehl - WOLSKA, p. 407, pl. 12, figs. 7, 10.  
 1971 *Palmatolepis subperlobata* Branson & Mehl - SZULCZEWSKI, p. 40, pl. 13, fig. 12.  
 1976 *Palmatolepis subperlobata* Branson & Mehl - DRUCE, p. 170, pl. 58, figs. 1, 4; pl. 63, figs. 3-4.  
 1983 *Palmatolepis subperlobata* Branson & Mehl - WANG & ZIEGLER, p. 84, pl. 3, figs. 24-26, 28.

*Remarks* — Many well preserved specimens in different growth stages. *P. subperlobata* is distinguished from other species of *Palmatolepis* in having a similar platform outline, by the shagreen-like upper surface devoid of nodes. *P. subperlobata* is phylogenetically connected with *P. tenuipunctata* from which it is distinguished by a larger outer lateral lobe.

*Occurrence* — Sequence I, samples 0, 1, [also specimens reworked in samples 1/i, 1/l, 1/m].

*Range* — From within Lower *P. triangularis* Subzone - to basal Lower *rhomboidea* Subzone (Klapper & Ziegler, 1979, text-figs. 5, 6).

*Material* — 110 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20446-20447 (figured hypotypes) n. 20448-20452 (hypotypes not figured).

## PALMATOLEPIS SUBRECTA

Miller &amp; Youngquist, 1947

Pl. 3, figs. 10-13

- 1947 *Palmatolepis subrecta* MILLER & YOUNGQUIST, p. 513, pl. 75, figs. 7-11.  
 1971 *Palmatolepis subrecta* Miller & Youngquist - SZULCZEWSKI, p. 41, pl. 10, figs. 8, 9; pl. 12, figs. 4-8, (*cum syn.*).  
 1978 *Palmatolepis subrecta* Miller & Youngquist - ORCHARD, p. 936, pl. 115, figs. 28-30, 34, 40.  
 1979 *Palmatolepis subrecta* Miller & Youngquist - BALINSKI, p. 77, pl. 20, figs. 9-10.  
 1980 *Palmatolepis subrecta* Miller & Youngquist - PERRI & SPALLETTA, p. 302, pl. 6, figs. 1-2.  
 1982 *Palmatolepis subrecta* Miller & Youngquist - MORZADEC & WEYANT, p. 33, pl. 1, figs. 30-32.  
 1983 *Palmatolepis subrecta* Miller & Youngquist - WANG & ZIEGLER, pl. 3, fig. 27.

*Description* — Species of *Palmatolepis* with a widely variable general shape of the platform. Adult specimens show a well defined outer lateral lobe. Po-

sterior tip always arched downwards. Sigmoidal blade-carina. Upper surface of the platform, ornamented with coarse nodes tending to gather near the antero-lateral margins. The juvenile forms show a weak ornamentation and a rhomboid general shape, because of the modest development of the outer lobe.

*Remarks* — Similarities and differences between *P. subrecta* and *P. bassi* are discussed at p. 298. *P. subrecta* also closely resembles *P. triangularis*, but the two species can be easily distinguished by the aspect of the posterior tip of the platform: bowed downward in *P. subrecta*, upward in *P. triangularis*.

*Occurrence* — Sequence I, samples 1/g, 1/h; sequence II, sample 2.

*Range* — Uppermost part of Middle *asymmetricus* Subzone - basal Middle *P. triangularis* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 105 specimens from sequence I; 17 specimens from sequence II.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20453-20456 (figured hypotypes), 20457-20458 (hypotypes not figured).

## PALMATOLEPIS TENUIPUNCTATA Sannemann, 1955

Pl. 6, gf. 13

- 1955b *Palmatolepis tenuipunctata* SANNEMANN, p. 136, pl. 6, fig. 22.  
 1973 *Palmatolepis tenuipunctata* Sannemann - Ziegler in ZIEGLER (ed.), pp. 203-305, *Palmatolepis* - pl. 4, figs. 3-5, (*cum syn.*).  
 1976 *Palmatolepis tenuipunctata* Sannemann - DRUCE, p. 173, pl. 60, figs. 1-4.  
 1983 *Palmatolepis tenuipunctata* Sannemann - WANG & ZIEGLER, p. 84, pl. 4, fig. 5.

*Remarks* — Many well preserved specimens having the typical features of *P. tenuipunctata*. *P. tenuipunctata* is considered by Ziegler (1962b, n. 80, text-fig. 2) phylogenetically connected with both *P. subperlobata*, from which it evolved by reduction of the outer lateral lobe, and *P. glabra prima*, to which are transitional those stages of *P. tenuipunctata* with an elongate platform and a small, but still present lateral lobe.

*Occurrence* — Sequence I, sample 0.

*Range* — Upper *P. triangularis* Subzone - Upper *crepida* Subzone (Klapper & Ziegler, 1979, text-figs. 5, 6).

*Material* — 57 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20459 (figured hypotype), n. 20460 (hypotypes not figured).

PALMATOLEPIS TERMINI Sannemann, 1955

Pl. 5, figs. 2-3

- 1955b *Palmatolepis termini* SANNEMANN, p. 149, pl. 1, figs. 1-3.  
 1973 *Palmatolepis termini* Sannemann - Ziegler in ZIEGLER (ed.), pp. 307-308, *Palmatolepis* - pl. 4, figs. 1-2 (*cum syn.*).  
 1976 *Palmatolepis termini* Sannemann - DUSAR & DRESEN, p. 548, pl. 4, fig. 6.

*Remarks* — The specimens examined fall within the field of variability of *P. termini* illustrated by Ziegler (1962b, text-fig. 9). The specimens show a small elongate platform lacking the outer lateral lobe and having, along the anterior inner margin, the characteristic nodular parapet. The carina does not continue beyond the heavy central node. Rare and scattered nodes can be observed on the anterior outer platform of some specimens. The rest of the upper surface is smooth.

*Occurrence* — Sequence I, sample 0.

*Range* — Middle *crepida* Subzone - within Upper *crepida* Subzone (Klapper & Ziegler, 1979, text-fig. 6).

*Material* — 26 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20461-20462 (figured hypotypes), n. 20463 (hypotypes not figured).

Genus POLYGNATHUS Hinde, 1879

*Type species* — *Polygnathus dubius* Hinde, 1879.

POLYGNATHUS LATIFOSSATUS Wirth, 1967

Pl. 2, figs. 14-15

- 1967 *Polygnathus latifossatus* WIRTH, p. 227, pl. 22, figs. 17-19, text-fig. 14 g-k.  
 1967 *Spathognathodus semialternans* Wirth transitional form to *P. latifossatus* - WIRTH, pl. 23, fig. 11.  
 1976 *Polygnathus latifossatus* Wirth - Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 120, pl. 3, figs. 11, 17, 18, 20, 21, 27-33.  
 1977 *Polygnathus latifossatus* Wirth - Klapper in ZIEGLER (ed.), pp. 457-459, *Polygnathus* - pl. 7, figs. 2, 3, 5, (*cum syn.*).  
 1980 *Polygnathus latifossatus* Wirth - BULTYNCK & HOLLARD, p. 43, pl. 9, figs. 11-12.

*Description* — Specimens of variable size. Narrow platform with arrow-like shape, about half the

total length of the unit. In upper view the platform is smooth in small specimens, but in more advanced stages it bears more or less strong nodes, while the adcarinal grooves become evident. In small specimens the basal cavity is symmetric and occupies the whole lower surface of the platform, whereas in larger specimens the cavity is wide, but is restricted to the anterior half of the platform.

*Remarks* — Ziegler & Klapper in Ziegler *et al.* (1976, p. 120) pointed out that the basal cavity becomes asymmetric in the larger specimens. This trend has not been observed in the specimen from Sardinia.

*Occurrence* — Sequence II, samples 2/r, 2/s, 2/t.

*Range* — Upper *varcus* Subzone - Upper *hermanni-cristatus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 16 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20254-20255 (figured hypotypes), n. 20256-20259 (hypotypes not figured).

POLYGNATHUS LINGUIFORMIS LINGUIFORMIS  
 Hinde, 1879

Pl. 2, figs. 17-21

- 1879 *Polygnathus linguiformis* HINDE, p. 367, pl. 17, fig. 15.  
 1970 *Polygnathus linguiformis linguiformis* Hinde, gamma forma nova BULTYNCK, p. 126, pl. 11, figs. 1-6.  
 1976 *Polygnathus linguiformis linguiformis* Hinde, gamma morphotype Bultynck - Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 122, pl. 4, figs. 9-13.  
 1977 *Polygnathus linguiformis linguiformis* Hinde, gamma morphotype Bultynck - Klapper in ZIEGLER (ed.), pp. 461-466, *Polygnathus* pl. 10, fig. 2, (*cum syn.*).  
 1977 *Polygnathus linguiformis linguiformis* Hinde - WEDDIGE, p. 315, pl. 5, figs. 80-82, text-fig. 4, fig. 24.  
 1978 *Polygnathus linguiformis linguiformis* Hinde - ORCHARD, p. 948, pl. 110, figs. 18, 22, 24, 27; pl. 114, figs. 24, 27, 28, 33-37.  
 1979 *Polygnathus linguiformis linguiformis* Hinde, gamma morphotype Bultynck - SAVAGE & AMUNDSON, p. 1399, pl. 1, figs. 25-29.  
 1980 *Polygnathus linguiformis linguiformis* Hinde, gamma morphotype Bultynck - BULTYNCK & HOLLARD, p. 43, pl. 7, figs. 2a-b.

*Remarks* — Noteworthy in *Polygnathus linguiformis linguiformis* is the great variability of the outer platform outline at the beginning of its posterior third (a tongue-like projection). At the latter point the the outer margin of the platform generally is deflected sharply inward and is marked by a well defined angle or by the appearance of an arc-like expansion. At the same point the beginning of the tongue may also

occur along a rounded convex curve, as in the juvenile specimens here illustrated in plate 2, figs. 18, 19.

*Occurrence* — Sequence II, samples 2/n, 2/o, 2/p, 2/q, 2/A, 2/s, 2/t.

*Range* — Uppermost *costatus costatus* Zone [early Middle Devonian] - *asymmetricus* Zone [early Late Devonian], (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 166 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20259-20263 (figured hypotypes), n. 20264-20270 (hypotypes not figured).

POLYGNATHUS LINGUIFORMIS LINGUIFORMIS  
Hinde, 1879,  
delta morphotype *sensu* Ziegler & Klapper, 1976  
Pl. 2, figs. 12a-13b

- 1966 *Polygnathus linguiformis linguiformis* Hinde - WITTEKINDT, p. 635, pl. 2, fig. 11.  
1976 *Polygnathus linguiformis linguiformis* Hinde, delta morphotype Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 123, pl. 4, figs. 4-8.  
1978 *Polygnathus linguiformis* Hinde delta morphotype Ziegler & Klapper - ORCHARD, p. 944, pl. 110, figs. 21, 23.  
1979 *Polygnathus linguiformis linguiformis* Hinde, delta morphotype Ziegler & Klapper - SAVAGE & AMUNDSON, p. 1399, pl. 1, figs. 9-11.  
1979 *Polygnathus linguiformis linguiformis* Hinde, delta morphotype Ziegler & Klapper - LANE, MÜLLER & ZIEGLER, p. 219, pl. 2, fig. 16.  
1980 *Polygnathus linguiformis linguiformis* Hinde, delta morphotype Ziegler & Klapper - BULTYNCK & HOLLARD, p. 44, pl. 7, fig. 8.

*Remarks* — In their definition of *Polygnathus linguiformis linguiformis* « delta » morphotype, Ziegler & Klapper (1976, p. 123) stated that even though a tongue is not developed, the posterior end of the platform may be either crossed by a few weakly developed transverse ridges or bisected by a longitudinal carina that reaches its posterior tip. The anterior outer platform is rather flat and its margin forms a regularly convex curve. The ornamentation of the outer half of the platform consists of radially arranged short ridges.

*Occurrence* — Sequence II, samples 2/n, 2/o, 2/p, 2/q, 2/A.

*Range* — Basal Middle *varcus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 104 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20271-20272 (figured hypotypes), n. 20273-20276b (hypotypes not figured).

POLYGNATHUS LINGUIFORMIS LINGUIFORMIS  
Hinde, 1879  
epsilon morphotype *sensu* Ziegler & Klapper, 1976  
Pl. 2, fig. 22

- 1976 *Polygnathus linguiformis linguiformis* Hinde, epsilon morphotype Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 123, pl. 4 figs. 3, 12, 14, 24.  
1977 *Polygnathus linguiformis linguiformis* Hinde, epsilon morphotype Ziegler & Klapper - Klapper in ZIEGLER (ed.), pp. 461-466, *Polygnathus* - pl. 10, figs. 5, 9? 10, (*cum syn.*).  
1980 *Polygnathus linguiformis linguiformis* Hinde, epsilon morphotype Ziegler & Klapper - BULTYNCK & HOLLARD, p. 44, pl. 7, figs. 2-7, 9.

*Description* — Specimens with a well developed tongue crossed by transverse ridges. The outer platform, at the beginning of the tongue, turns inward in a rounded curve. The anterior outer platform bears short and strong transverse ridges separated from the carina by a smooth adcarinal trough. The anterior inner platform bears nodes arranged in a ridge nearly parallel to the carina.

*Remarks* — This morphotype differs from the specimens of the nominate subspecies of *P. linguiformis* by not having the high flange-like margin on the anterior outer platform.

*Occurrence* — Sequence II, samples 2/o, 2/A, 2/s.

*Range* — Uppermost *ensensis* Zone — basal Upper *varcus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 11 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20279 (figured hypotype), n. 20280-20282 (hypotypes not figured).

POLYGNATHUS LINGUIFORMIS MUCRONATUS  
Wittekindt, 1966  
Pl. 2, fig. 16

- 1957 *Polygnathus linguiformis* Hinde - BISCHOFF & ZIEGLER, p. 10, pl. 17, fig. 8.  
1966 *Polygnathus linguiformis mucronatus* WITTEKINDT, p. 636, pl. 2, figs. 13-15.  
1967 *Polygnathus linguiformis mucronatus* Wittekindt - ADRI-CHAM BOOGAERT, p. 184, pl. 3, fig. 2.  
1969 *Polygnathus linguiformis mucronatus* Wittekindt - PÖLS-LER, p. 424, pl. 3, figs. 1-3.  
1976 *Polygnathus linguiformis linguiformis* Hinde, zeta morphotype Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 124, pl. 4, figs. 20-21.  
1978 *Polygnathus linguiformis mucronatus* Wittekindt - OR-CHARD, p. 948, pl. 113, figs. 6, 7, 10-12, 14, 15, 17-20, 22, 24.  
1980 *Polygnathus linguiformis mucronatus* Wittekindt - BUL-TYNCK & HOLLARD, p. 44, pl. 7, figs. 12-13.

*Description* — Specimens characterized by the absence of a tongue in the posterior third of the unit, which, instead, is replaced by a free carina of variable length. The outer platform, slightly wider than the inner one, has a straight margin in its anterior part, which then turns inward in a sharply rounded curve to meet the carina at a point before its end. The inner platform margin parallels the nodular carina whose nodes tend to be transversely elongated in its posterior third. The lateral margins are strongly raised upward, bear short ribs and border two adcarinal troughs. Heavy anterior free blade, about one third the length of the unit.

*Remarks* — Due to its general shape *Polygnathus linguiformis mucronatus* Wittekindt, can be compared with *Polygnathus linguiformis linguiformis* Hinde, iota morphotype *sensu* Klapper in Klapper, Johnson & Trojan (1980). However the two taxa differ in minor characters. Klapper's morphotype shows a wider and flat platform and a residual posterior tongue which even if very narrow is crossed by short and thin transverse ridges.

*Occurrence* — Sequence II, sample 2/t.

*Range* — Middle *varcus* Subzone - basal Upper *varcus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 4 specimens.

*Repository* — Institute of Paleontology, Modena University cat. n. 20277 (figured hypotype), n. 20278 (hypotypes not figured).

#### POLYGNATHUS PROCERUS Sannemann, 1955

Pl. 7, fig. 7

- 1955b *Polygnathus procerus* SANNEMANN, p. 150, pl. 1, figs. 11a-b.  
 1962b *Polygnathus procera* Sannemann - ZIEGLER, p. 93.  
 1967 *Polygnathus procera* Sannemann - WOLSKA, p. 416, pl. 14, figs. 3-4.  
 1968 *Polygnathus procera* Sannemann - MOUND, p. 510, pl. 71, fig. 1.  
 1971 *Polygnathus procerus* Sannemann - MATYJA & ZBIKOWSKA, p. 682, pl. 6, figs. 3-4.

*Remarks* — Due to the general shape of its platform, *Polygnathus procerus* Sannemann can be easily confused with *P. decorosus* Stauffer. However, the two species can be distinguished, in side view, by the different characteristics of the free blade. In *P. procerus* the free blade is higher towards the anterior end where the denticles have a fan-shape arrangement, whereas in *P. decorosus* the upper and lower margins are subparallel and the blade is rectangular.

With respect to the Sannemann's holotype, the specimen here figured presents the median carina a little lower than the lateral margins, instead of at about the same level.

*Occurrence* — Sequence II, sample 2.

*Range* — Sporadically recovered: Upper *P. triangularis* Subzone - Upper *crepida* Subzone (Ziegler, 1962b); *A. triangularis* Zone (Mound, 1968); *asymmetricus* Zone and *gigas* Zone (Wang & Ziegler, 1983).

*Material* — 6 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20316 (figured hypotype) n. 20317 (hypotypes not figured).

#### POLYGNATHUS VARCUS Stauffer, 1940

Pl. 2, figs. 1-4

- 1940 *Polygnathus varcus* STAUFFER, p. 430, pl. 60, figs. 49, 55 (only).  
 1957 *Polygnathus varca* Stauffer - BISCHOFF & ZIEGLER, p. 98, pl. 18, fig. 32, pl. 19, figs. 7-9.  
 1970 *Polygnathus varcus* Stauffer - KLAPPER, PHILIP & JACKSON, p. 657, pl. 2, figs. 1-3, 23-25 (*cum syn.*).  
 1973 *Polygnathus varcus* Stauffer - Klapper in ZIEGLER (ed.), pp. 391-392, *Polygnathus* - pl. 2, fig. 5.  
 1975 *Polygnathus varcus* Stauffer - BULTYNCK, p. 23, pl. 5, figs. 6-7.  
 1978 *Polygnathus varcus* Stauffer - ORCHARD, p. 950, pl. 109, fig. 29.  
 1980 *Polygnathus varcus* Stauffer - BULTYNCK & HOLLARD, p. 46, pl. 6, fig. 19.

*Description* — Specimens with small platform, symmetric with respect to the median carina, and with smooth upper surface. Lateral margins strongly upturned and opposite geniculation points. The free blade extends about two-thirds the length of the unit. The basal cavity is present at the junction of the free blade with the anterior end of the platform.

*Remarks* — *Polygnathus varcus* Stauffer is distinguished from *Polygnathus xilux xilux* Stauffer by its relatively shorter platform in comparison with the length of the free blade, and by the more anterior position of the basal cavity.

*Occurrence* — Sequence II, sample 2/o, 2/p, 2/q, 2/A, 2/s, 2/t.

*Range* — From above the base of Lower *varcus* Subzone - to near the top of Upper *varcus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 65 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20294-20297 (figured hypotypes), n. 20298-20303 (hypotypes not figured).

POLYGNATHUS XILUS XILUS Stauffer, 1940

Pl. 2, figs. 5-6

- 1940 *Polygnathus xilus* STAUFFER, p. 430, pl. 60, figs. 54, 66, 72-74.  
 1970 *Polygnathus xilus* Stauffer - KLAPPER, PHILIP & JACKSON, p. 659, pl. 1, figs. 4-6, 11; pl. 2, figs. 4, 5, 7-9, 16-18, (non figs. 10-12 = *P. xilus ensensis*).  
 1975 *Polygnathus xilus* Stauffer - BULTYNCK, p. 24, pl. 5, fig. 5.  
 1976 *Polygnathus xilus xilus* Stauffer - Ziegler & Klapper in ZIEGLER, KLAPPER & JOHNSON, p. 125, pl. 3, fig. 1, (cum syn.).  
 1978 *Polygnathus xilus* Stauffer - UYENO, p. 17, pl. 4, figs. 1-3, 9-14 (P. element).  
 1979 *Polygnathus xilus xilus* Stauffer - Bultynck in BRICE, BULTYNCK, DEUNFF, LOBOZIAK & STREEL, pl. 27, fig. 15.

*Description* — Small sized specimens with a nearly symmetric platform, smooth in its upper surface. The free blade is about half the length of the unit. The lateral margins of the platform are upturned and nearly parallel, the geniculation points are opposite and the anterior trough margins decline steeply downward. In lower side a well developed basal cavity is found in the anterior third of the platform.

*Remarks* — The specimens from Sardinia correspond well to that illustrated by Stauffer 1940 (pl. 60, fig. 72) and selected by Wittekind 1966 (p. 642) as the lectotype of *P. xilus*.

The differences between *P. xilus xilus* and *P. varcus* are discussed with the latter species.

*Occurrence* — Sequence II, sample 2/A, 2/r.

*Range* — Lower *varcus* Subzone - Lower *asymmetricus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 37 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20304-20305 (figured hypotypes), n. 20306-20307 (hypotypes not figured).

POLYGNATHUS XILUS ENSENSIS  
Ziegler & Klapper, 1976

Pl. 2, figs. 7-8

- 1976 *Polygnathus xilus ensensis* Ziegler & Klapper, in ZIEGLER, KLAPPER & JOHNSON, p. 125, pl. 3, figs. 4-9, (cum syn.).  
 1977 *Polygnathus xilus ensensis* Ziegler & Klapper - WEDDIGE, p. 321, pl. 4, fig. 64 (only).  
 1978 *Polygnathus xilus ensensis* Ziegler & Klapper - ORCHARD, pl. 108, figs. 2, 21, 25.

1980 *Polygnathus xilus ensensis* Ziegler & Klapper - Klapper in JOHNSON, KLAPPER & TROJAN, p. 103, tabs. 14, 16, 17, 18, 23.

*Description* — Specimens showing an almost symmetrical platform with posterior part more or less bowed downward. The lateral margins, just behind the geniculation points, are characterized by the presence of two to four serrations. Faintly granular or absent upper surface ornamentation.

*Remarks* — The specimens figured by Weddige, 1977 (pl. 4, figs. 62, 63, 65) as *P. xilus ensensis* do not belong to the Ziegler & Klapper's subspecies because of the strong constriction of their anterior outer platform margin and the posteriorly expanded outer platform outline.

*Occurrence* — Sequence II, samples 2/n, 2/o, 2/p, 2/q, 2/A.

*Range* — Basal *ensensis* Zone - Middle *varcus* Subzone (Klapper & Ziegler, 1979, text-fig. 5).

*Material* — 38 specimens.

*Repository* — Institute of Paleontology, Modena University, cat. n. 20308-20309 (figured hypotypes), n. 20310-20314 (hypotypes not figured).

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