Conodont fauna and biostratigraphy of the Famennian of Büyükada, İstanbul, Northwestern Turkey

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KEY WORDS – Conodonts, Taxonomy, Biostratigraphy, Late Devonian (Famennian), İstanbul, Turkey

ABSTRACT – A Famennian conodont fauna, restricted generally to palatomorphid biofacies, is obtained from Ayine Burnu in the southwest of Büyükada, İstanbul. A total of 31 species and subspecies are identified and figured, three of which are new: Mehlina arcuca n.sp., Palmatolepis giabra angusta n.subsp., Polynathus longiscutulus n.ssp., one species (Polynathus n.sp.A) is not formally named.

This fauna represents the Upper rhomboidea and Lower marginiceps Zones, and its age range corresponds to middle Famennian.

RIASSUNTO – [Fauna a conodonti e biostratigrafia del Famenniano (Devoniano sup.) di Büyükada, İstanbul, Turchia nord occidentale] – Viene descritta una fauna a conodonti, per lo più restrittasi a biofacies a palatomorfi provenienti da una sequenza di calcari nodolari appartenente al membro Ayineburnu della Formazione Tuzla (Eisfelia - Famenniano), nell'area sud ovest di Büyükada, İstanbul. Sono state identificate e figurate complessivamente 31 specie e sottospecie, 3 delle quali sono state proposte come nuove (Mehlina arcuca n.sp., Palmatolepis giabra angusta n.subsp., Polynathus longiscutulus n.ssp.) mentre una specie (Polynathus n.sp.A) è lasciata a nomenclatura aperta. Questa fauna rappresenta le zone Upper rhomboidea e Lower marginiceps ed ha quindi una età corrispondente al Famenniano medio.

INTRODUCTION

The İstanbul Zone of the Pontides is subjected to a number of studies (Baykal & Kayava, 1963; Abdüsselamoğlu, 1963; Haas, 1968a, 1968b; Gedik, 1975; Kaya, 1971, 1973, 1978a, 1978b; Sayar, 1978, 1979; Onalan, 1982, 1988; Gürer et al., 1993; Okay, 1987; Okay et al., 1994; Seymen, 1995 etc.), but few works on conodonts have been published. The first paper containing conodont is the study of Abdüsselamoğlu (1963), but in that paper, the illustrated conodonts have not been systematically searched. Haas (1968b), who studied the Devonian of Bithynia, stated some Silurian and Devonian conodonts determined by Ziegler. Gedik (1975) studied the Triassic conodonts from the Kocaeli Peninsula. A Famennian conodont fauna has been obtained from a nodular limestone sequence belonging to the Ayineburnu member of the Eisfelian-Famennian Tuzla Formation in the southwestern part of Büyükada, İstanbul (Text-fig. 1). The purpose of this study is to describe the taxonomy and biostratigraphy of this conodont fauna.

LITHOSTRATIGRAPHY

The İstanbul Zone of the Pontides is characterized by a thick and well-developed middle Or-


Okay et al., 1994). This sequence comprising many formations and members is strongly affected by the Hercynian and Alpine tectonic movements, therefore, complete stratigraphic sections are not present. The investigated stratigraphic section, 1.40 m thick, is a part of the Eisfelian-Famennian Tuzla Formation (Text-fig. 2), and it is known as the Ayineburnu Member (Onalan, 1982, 1988). Its type locality is Ayine Burnu in the southwest of Büyükada, İstanbul (Text-fig. 1). The entire section is overturned, and its lower contact is of fault. The upper part lies in the Sea of Marmara. Lithology consists mainly of thin, nodular limestone with beige, thin mudstone nodules, and a yellowish light-

brown, clay-rich matrix. The stylolitic structures with iron-oxides are common in many samples. Fossil constituents are low both in diversity and abundance, and consist mainly of ostracoded shells. Their abundance is less than 10 percent but in some samples it can attain 10 percent.

Similar rocks are attributed SMF-3 by Wilson (1975) who considered a basin (FZ-1) or slope environment (FZ-3) for their deposition. The conodont fauna representing the palatomorphid biofacies obtained from this section also supports this.

BIOSTRATIGRAPHY

The conodont faunas of the investigated section are dominated by species and subspecies of
Palmatelepis. Therefore, they can be correlated directly with the standard zonation, which is based on species of Palmatelepis (Ziegler, 1962a; Sandberg & Ziegler, 1973; Ziegler in Kapper & Ziegler, 1979; Ziegler & Sandberg, 1984; Ziegler & Sandberg, 1990). The conodont faunas from 36 samples (I-1 to I-36) are listed in Table 1. These 36 collections represent the Upper rhomboidea and the Lower marginifera Zones and their age corresponds to the middle Famennian.

**Upper rhomboidea Zone**

The Upper rhomboidea Zone is characterized by the relatively abundant occurrence of Palmatelepis rhomboidea after the disappearance of Palmatelepis pooleri and before the first appearance of Palmatelepis marginifera marginifera (Sandberg & Ziegler, 1973). The diagnostic form Palmatelepis pooleri does not occur in the investigated section. However this boundary can be defined by the lowest appearance of Palmatelepis gracilis gracilis that first appears at the base of the Upper rhomboidea Zone (Ziegler in Kapper & Ziegler, 1979, text-fig. 6). According to this, the interval between the lowest occurrences of Palmatelepis gracilis gracilis and Palmatelepis marginifera marginifera belongs to the Upper rhomboidea Zone (Table 1; Samples from I-36 to I-24).

**Lower marginifera Zone**

The association of Palmatelepis marginifera marginifera, Palmatelepis quadrantinodoso inflexa, and Palmatelepis quadrantinodoso inflexoida characterizes the Lower marginifera Zone (Ziegler & Sandberg, 1984). According to this, the top 6 meters of the studied stratigraphic section overlying the Upper rhomboidea Zone is assigned to the Lower marginifera Zone (Text-fig. 2; Table 1; Samples I-23 to I-29). Palmatelepis marginifera marginifera defining the upper boundary of this zone and the lower boundary of the overlying Lower marginifera Zone first appears in sample I-23. The diagnostic of the upper boundary, Palmatelepis marginifera utahensis, is not seen in the studied section. Therefore the upper boundary of the studied section could not correspond to the upper boundary of the Lower marginifera Zone.

**SYSTEMATIC PALEONTOLOGY**

The suprageneric classification in this paper follows that of Sweet (1988). The conodonts discussed belong to Icriodontidae, Polygnathidae, Palmatolepididae and Spathognathodontidae families. The most abundant conodont genera is Palmatelepis (Tab. 1). Although ramiform elements are also
present in the collection, the platform elements are the focus of this study. Figured specimens and faunal slides are reposited at Karadeniz Teknik Üniversitesi, Jeoloji Mühendisliği Bölümü (Trabzon, Turkey), under the numbers ranging from I-1 to I-36.

Phylum CONODONTA Pander, 1856
Class CONODONTI Branson, 1938
Order ÖZAKODINIDA Dzik, 1976
Family PALMATELIDAE Sweet, 1988
Genus PALMATELEPS Ulrich & Bassler, 1926
Type species - Palmateleps perlubata Ulrich & Bassler, 1926
Palmateleps glabra Ulrich & Bassler, 1926

Palmateleps glabra acuta Helms, 1963
Pl. 1, figs. 1-6

1963 Palmateleps (Panderolepis) serrata acuta Helms, pp. 468-469, pl. 3, figs. 1-4, 6.
1977 Palmateleps glabra acuta Helms - Ziegler in Ziegler (ed.), Palmateleps, pl. 6, figs. 2, 3 (cum syn.).

Remarks - The Pa element is distinguished from other subspecies of Palmateleps glabra by the acute angle between parapet crest and blade, and by the narrow, elongate, usually large platform.

Range - From about the start of the Uppermost crepida Zone into the Upper marginifera Zone (Ziegler & Sandberg, 1984, fig. 3, p. 183; Ziegler & Sandberg, 1990, p. 25).

Material - 84 Pa elements.

Palmateleps glabra angusta n. subsp.
Pl. 2, figs. 8-15

1959 Palmateleps glabra Ulrich & Bassler, Beta morphotype - Scott & Collinson, pl. 75, figs. 11-3, 16 (only).
1968 Palmateleps glabra Ulrich & Bassler - Huddleston, pl. 14, fig. 11 (only).

Derivatio nominis - From Latin angustus, narrow, referring to extremely narrow anterior inner platform.

Holotype - The specimen illustrated on Pl. 2, fig. 11.

Locus typicus - Ayine Burnu, the southwest of Büyükada, İstanbul (Text-fig. 1).

Stratum typicum - Bed of beige and yellowish light-brown, thin, nodular limestone (mudstone), 0.90 m above the base of the studied section (Text-fig. 2, sample I-33).

Diagnosis - A Palmateleps glabra subspecies characterized by a Pa element with an extremely narrow anterior inner platform, the outer margin of which is nearly parallel to the blade-carina. The free blade is absent or very short.

Description - The Pa element has a narrow and extended platform with a sharply pointed posterior end. The anterior inner platform is greatly reduced, and its outer margin is parallel to the blade-carina. The posterior part of the platform is flexed upward after the central node. The blade-carina is sigmoidal. The free blade is absent or very short.

Remarks - Some specimens are transitional to Palmateleps glabra lepta (Pl. 2, figs. 8-10), but the latter differs from the new subspecies by having a triangular inner parapet. The Pa element of
<table>
<thead>
<tr>
<th>Zone</th>
<th>Upper rhomboidea</th>
<th>Lower marginifera</th>
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<td>70, 75, 35, 60, 60, 65</td>
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<tr>
<td>Sample Number (1)</td>
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<td>23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1</td>
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<td>Icriodus cornutus</td>
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<td>4</td>
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<tr>
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<td>4</td>
</tr>
<tr>
<td>Pa. glabra distorta</td>
<td></td>
<td>5</td>
</tr>
<tr>
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<td>2</td>
<td>1</td>
</tr>
<tr>
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<td>2</td>
<td>11</td>
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<tr>
<td>Pa. glabra prima</td>
<td>20</td>
<td>1</td>
</tr>
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<td>10</td>
<td>1</td>
</tr>
<tr>
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<td>17</td>
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</tr>
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<td>Polygnathus brevispinus</td>
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<td>Po. n. sp. A</td>
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<tr>
<td>Po. cf. Po. pennatoides</td>
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<tr>
<td>Mehlina arcana n. sp.</td>
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<td>Mehlina strigosa</td>
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<tr>
<td>indet. &quot;spathognathid&quot;</td>
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Tab. 1 - Distribution of conodont taxa within the studied stratigraphic section.
**Palmatolepis glabra prima** with a similar platform outline is distinguished by its wider anterior inner platform, the outer margin of which is not parallel to the blade-carina.

**Occurrence** - Upper **rhomboidea** to Lower **marginifera** zones (see Tab. 1).

**Material** - 113 Pa elements.

**Palmatolepis glabra distorta**
Branson & Mehl, 1934
Pl. 1, figs. 12, 13

1934 *Palmatolepis distorta* Branson & Mehl, pp. 237-238, pl. 18, figs. 13, 14.
1963 *Palmatolepis distorta* Branson & Mehl - Abdüsselamoglū, pl. 1, fig. 6.
1977 *Palmatolepis glabra distorta* Branson & Mehl - Ziegler in Ziegler, pp. 297-300, *Palmatolepis*-pl. 6, figs. 4-6 (cum syn.).

**Remarks** - The Pa element has a prominent bulge anterior of the central node, and a strongly sigmoidal blade-carina. The inner parapet with a denticulate or sharp crest is parallel to the blade-carina.

The anterior outer platform is flat in the Pa element of *Palmatolepis glabra pectinata* with a platform outline similar to that of *Palmatolepis glabra distorta*.

**Range** - From the base of the Lower **marginifera** Zone into the upper part of the Lower **trachytera** Zone (Ziegler & Sandberg, 1984, fig. 2).

**Material** - 24 Pa elements.

**Palmatolepis glabra lepta**
Ziegler & Huddle, 1969
Pl. 1, figs. 7-11

1969 *Palmatolepis glabra lepta* Ziegler & Huddle, pp. 380-381.

**Remarks** - The Pa element of this subspecies has an extremely slender, elongate platform with a triangular anterior inner part that is slightly to strongly curved upward. They correspond to "early" and "typical" forms of Sandberg & Ziegler (1973).

**Range** - "Early forms" range from within the Upper **crepida** Zone through the **rhomboidea** Zone, and "typical forms" from the base of the Lower **marginifera** Zone into the upper part of the Upper **trachytera** Zone (Ziegler in Ziegler, ed., 1977; Ziegler & Sandberg, 1984, fig. 3; Ziegler & Sandberg, 1990, p. 24).

**Material** - 44 Pa elements.

**Palmatolepis glabra pectinata**
Ziegler, 1962b
Pl. 1, figs. 14-19

1962b *Palmatolepis glabra pectinata* Ziegler, pl. 2, figs. 3-5.

**Remarks** - The Pa elements of this subspecies have an inner margin parapet with a denticulate or sharp crest parallel to the carina. One morphotype has been differentiated by Sandberg & Ziegler (1973). Many Pa elements correspond to typical specimens, but a few specimens show close similarities to Morphotype 1 with a short, high parapet on the anterior inner platform. Some specimens show characteristics transitional to *Palmatolepis glabra acuta*.

**Range** - From the base of the Uppermost **crepida** Zone through the Upper **marginifera** Zone; Morphotype 1 accompanies the typical forms up to the upper part of the Upper **rhomboidea** Zone (Ziegler in Ziegler, ed., 1977, pp. 307-308; Ziegler & Sandberg, 1990).

**Material** - 131 Pa elements.

**Palmatolepis glabra prima**
Ziegler & Huddle, 1969
Pl. 2, figs. 1-7

1963 *Palmatolepis glabra* Ziegler & Huddle - Abdüsselamoglū, p. 1, fig. 4.

**Remarks** - The Pa elements are characterized by having a rounded convex, inner platform margin parapet. Sandberg & Ziegler (1973) described two morphotypes of this subspecies. Many specimens correspond to typical specimens, but a few specimens show close similarities to Morphotype 1, which is distinguishable from the typical specimens by the greater width of platform.

**Range** - From the base of the Upper **crepida** Zone to the end of the Upper **marginifera** Zone. Morphotype 1: from within the Upper **crepida** Zone through the **rhomboidea** Zone. Morphotype 2: from high in the Upper **crepida** Zone through the Lower

**Material** – 537 Pa elements.

**Palmatolepis gracilis** Branson & Mehl, 1934
**Palmatolepis gracilis gracilis**
Branson & Mehl, 1934
Pl. 2, figs. 16-18

1934 *Palmatolepis gracilis* Branson & Mehl, p. 238, pl. 18, fig. 8 (only).


**Remarks** – A relatively short, narrow platform, the anterior margins of which generally terminate at about midlength of the blade, and a high carina are the most characteristic features of the Pa elements of *Palmatolepis gracilis gracilis*. Furthermore, platform margins form a raised rounded rim (Sandberg & Ziegler, 1979).

**Range** – From the Upper *rhomboidea* Zone through the Upper *praeulata* Zone and barely into the *Siphanodina sulcata* Zone of the Lower Carboniferous (Sandberg & Ziegler, 1979, p. 177; Ziegler & Sandberg, 1984, fig. 3, p. 185).

**Material** – 322 Pa elements.

**Palmatolepis aff. Palmatolepis gracilis gracilis**
Branson & Mehl, 1934
(sensu Metzger, 1994)
Pl. 2, figs. 22-24


**Remarks** – The Pa element has an inner platform with a convex outline and an outer platform with a weak lobe. The outer platform margin meets the free blade somewhat farther anteriorly than the inner margin. The carina extending to the posterior end of the platform, is strongly deflected the posterior of the central node. Metzger (1994) indicates that specimens assigned to *Palmatolepis aff. P. gracilis gracilis* appear to be morphologically intermediate between *Palmatolepis minutula minutula* and *Palmatolepis gracilis gracilis*.

**Occurrence** – Samples I-29, I-27, I-24, I-21, I-20 (Tab. 1).

**Material** – 6 Pa elements.

**Palmatolepis marginifera** Helms, 1959
**Palmatolepis marginifera marginifera**
Helms, 1959
Pl. 3, figs. 1-10

1959 *Palmatolepis quadrantioculosa marginifera* Ziegler (sic.) - Helms, p. 649, Pl. 5, figs. 22, 23.

1969 *Palmatolepis inflata* Müller - ABDOLLAMOĞLU, pl. 1, fig. 8.

1977 *Palmatolepis marginifera marginifera* Helms - Ziegler in Ziegler (ed.), pp. 327-330, *Palmatolepis*-pl. 7, figs. 17, 18; pl. 8, figs. 1, 2 (com syn.).

**Remarks** – The shape of the platform is generally rounded to oval, but may also be narrow and elongate. A few specimens have a nodule anterior outer platform (Pl. 3, figs. 1-4). The parapet with denticulate or generally sharp crest may or may not extend to the posterior tip of the platform, and it is parallel to the carina. In some small specimens, the parapet is formed by the crenulation of the inner platform margin (Pl. 3, fig. 4).

**Range** – From the base of the Lower *marginifera* Zone into the lowermost part of the Lower *trachytera* Zone (Ziegler & Sandberg, 1984, fig. 2).

**Material** – 224 Pa elements.

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**EXPLANATION OF PLATE I**

All figures are upper views of Pa elements.

Figs. 1-6 - *Palmatolepis glabra acuta* Helms, 1963.
1) Sample I-2, x40. 2) Sample I-35, x33. 3) Sample I-14, x34. 4) Sample I-26, x34. 5) Sample I-27, x50. 6) Sample I-12, x52.

Figs. 7-11 - *Palmatolepis glabra leptica* Ziegler & Huddleston, 1969.
7) Sample I-10, x51. 8) Sample I-9, x32. 9) Sample I-27, x50. 10) Sample I-26, x52. 11) Sample I-34, x52.

Figs. 12, 13 - *Palmatolepis glabra distorta* Branson & Mehl, 1934.
12) Sample I-6, x60. 13) Sample I-4, x35.

14) Sample I-1, x52. 15) Sample I-6, x62. 16) Sample I-6, x60. 17) Sample I-8, x50. 18) Sample I-17, x45. 19) Sample I-30, x45.
Palmatoelepis minutula Branson & Mehl, 1934
Palmatoelepis minutula minutula
Branson & Mehl, 1934
Pl. 2, figs. 19-21

1934 Palmatoelepis minutula Branson & Mehl., pp. 236-237, pl. 18, figs. 1, 6, 7.
1963 Palmatoelepis minutula Branson & Mehl - Abdussalamoglu, pl. 1, fig. 5.
1977 Palmatoelepis minutula minutula Branson & Mehl - Ziegler in Ziegler (ed.), pp. 335-338, Palmatoelepis-pl. 9, figs. 1-5 (cum syn.).

Remarks - The platform, which is the widest in the central node position, is generally subovate to elongate. It is very reduced in some specimens. Some of them show an incipient outer lobe development. The carina, variable in height, is generally weakly developed, and in many specimens, it disappears in a longitudinal depression. It may or may not extend to the posterior end of the platform. A few specimens show morphological similarity to Palmatoelepis minutula schelzitza having the raised platform margins.

Range - From the base of the Upper triangularis Zone to the upper part of the Upper trachytera Zone (Ziegler in Klapper & Ziegler, 1979, text-figs. 5-6; Ziegler & Sandberg, 1984, fig. 3; Ziegler & Sandberg, 1990, p. 23).

Material - 268 Pa elements.

Palmatoelepis perlobata Ulrich & Bassler, 1926
Palmatoelepis perlobata schindewolfii Müller, 1956
Pl. 4, figs. 23-26

1956 Palmatoelepis (Palmatoelepis) schindewolfii Müller, pp. 27-28, pl. 8, figs. 23-31; pl. 9, figs. 33.
1963 Palmatoelepis perlobata Sannemann - Abdussalamoglu, pl. 1, figs. 9, 11.
1977 Palmatoelepis perlobata schindewolfii Müller - Ziegler in Ziegler (ed.), pp. 361-364, Palmatoelepis-pl. 11, figs. 1-7 (cum syn.).

Remarks - The Pa elements of this subspecies show a quite widely morphological variety as indicated and illustrated by many authors (Müller, 1956; Sandberg & Ziegler, 1979). Variation is observed especially in the platform outline and in the development of the outer lobe (see pl. 4, figs. 23-26).

Range - From the uppermost part of the Upper crepida Zone to the end of the Upper expansa Zone (Ziegler & Sandberg, 1984, fig. 3; Ziegler & Sandberg, 1990, p. 24).

Material - 47 Pa elements.

Palmatoelepis quadrantinodosa Branson & Mehl, 1934
Palmatoelepis quadrantinodosa inflexa Müller, 1956
Pl. 3, figs. 11-20

1956 Palmatoelepis (Palmatoelepis) inflexa Müller, pp. 30-31, pl. 10, fig. 5 (only).
1977 Palmatoelepis quadrantinodosa inflexa Müller - Ziegler in Ziegler (ed.), pp. 377-379, Palmatoelepis-pl. 12, figs. 3-10 (cum syn.).

Remarks - Ziegler (in Ziegler, ed., 1977) indicated that at least three morphotypes are recognizable near the top of the uppermost rhomboidea Zone.

EXPLANATION OF PLATE 2

Figs. 1-7 - Palmatoelepis glabra prima Ziegler & Huddle, 1969. Upper views of Pa elements.
1) Sample I-34, x52. 2) Sample I-11, x50. 3) Sample I-20, x52. 4) Sample I-26, x52. 5) Sample I-23, x50. 6) Sample I-28, x50. 7) Sample I-11, x50.
Figs. 8-15 - Palmatoelepis glabra angusta n. subsp. Upper views of Pa elements.
8) Sample I-33, x51. Paratype. 9) Sample I-30, x60, Paratype. 10) Sample I-33, x51. Paratype. 11) Sample I-21, x50, Holotype. 12) Sample I-26, x50. Paratype. 13) Sample I-33, x50. Paratype. 14) Sample I-19, x60. Paratype. 15) Sample I-33, x50. Paratype.
Figs. 16-18 - Palmatoelepis gracilis gracilis Branson & Mehl, 1934. Oblique lateral views of Pa elements.
16) Sample I-5, x70. 17) Sample I-5, x70. 18) Sample I-5, x70.
Figs. 19-21 - Palmatoelepis minutula minutula Branson & Mehl, 1934. Upper views of Pa elements.
19) Sample I-10, x50. 20) Sample I-22, x50. 21) Sample I-19, x50.
22) Sample I-24, x60. 23) Sample I-27, x70. 24) Sample I-27, x70.
25) Sample I-36, x50. 26) Sample I-35, x50. 27) Sample I-34, x50. 28) Sample I-30, x60. 29) Sample I-36, x52. 30) Sample I-32, x62. 31) Sample I-33, x50.
The specimens under study correspond partly to the short, oval morphotype in which the inner platform is flat, and the morphotype with a round-topped short bulge on the anterior inner platform.

**Range** – From the uppermost part of the Upper *rhomboida* Zone through the Lower *marginifera* Zone (Sandberg & Ziegler, 1973; Ziegler & Sandberg, 1984, fig. 2).

**Material** – 330 Pa elements.

**Palmatolepis quadratrinodosa inflexoidea**
Ziegler, 1962a
Pl. 3, figs. 21-24
1962a *Palmatolepis quadratrinodosa inflexoidea Ziegler*, pp. 74-75, pl. 5, figs. 14-18.

**Remarks** – The Pa element has a more elongate platform and a central node with a more posterior position than the other subspecies.

**Range** – From the uppermost part of the Upper *rhomboida* Zone through the Lower *marginifera* Zone (Ziegler in Klapper & Ziegler, 1979, text-fig. 6; Ziegler & Sandberg, 1984, fig. 2).

**Material** – 17 Pa elements.

**Palmatolepis rhomboidea** Sannemann, 1955a
Pl. 2, figs. 25-31
1955a *Palmatolepis rhomboidea Sannemann*, p. 329, pl. 24, fig. 14.
1973 *Palmatolepis rhomboidea Sannemann* - Ziegler in Ziegler (ed.), pp. 299-301, *Palmatolepis*-pl. 1, figs. 6, 7 (cum syn.).

**Remarks** – The platform of the Pa element is variable from generally oval to rhomboidal. Many specimens are small. The carina is either not developed or weakly developed posterior of the central node.

**Range** – From the base of the Lower *rhomboidea* Zone into the Lower *marginifera* Zone and in the Lower *marginifera* Zone only few specimens have been observed as yet (Sandberg & Ziegler, 1973, p. 106; Ziegler in Ziegler, ed., 1973, p. 300; Ziegler in Klapper & Ziegler, 1979, text-fig. 6).

**Material** – 81 Pa elements.

**Palmatolepis subperlobata** Branson & Mehl, 1934
**Palmatolepis subperlobata helmsi**
Ovnatanaova, 1976
Pl. 3, fig. 25
1963 *Palmatolepis (Pend.) subperlobata* n. subsp. a Helms, pl. 1, fig. 19; pl. 2, figs. 23, 24; pl. 3, fig. 10; text-fig. 2, fig. 17.
1967 *Palmatolepis subperlobata* Branson & Mehl - Wolska, p. 407, pl. XII, fig. 10 (only).
1970 *Palmatolepis subperlobata* Branson & Mehl - Ovchir, pp. 53-55, pl. 18, fig. 13 (only).
1976 *Palmatolepis subperlobata* subsp. a Helms - Druce, p. 171, pl. 58, figs. 2, 3, 5.
1976 *Palmatolepis subperlobata helmsi* Ovnatanaova, pp. 216-217, pl. 9, fig. 7.
1987 *Palmatolepis subperlobata helmsi* Ovnatanaova - Barskov, Aleksev, Kononova & Miroshnichenko, p. 29, pl. 4, figs. 23-30, text-fig. 3A-12.

**Remarks** – The Pa element has a prominent transverse bulge on the outer lobe with an anterior margin of deep sinuses and a straight or slightly concave posterior margin. The carina is weakly developed posterior of the central node and does not reach to posterior end.

This subspecies is distinguished from the nominate subspecies by having a prominent transverse bulge on the outer lobe. The latter has a more prominent outer lobe with a flat upper surface that is differentiated from the platform by deep sinuses in its anterior and posterior sides.

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**EXPLANATION OF PLATE 3**

Figs. 1-10 - *Palmatolepis marginifera marginifera* Helms, 1959.
1) Sample I-8, x50. 2) Sample I-8, x60. 3) Sample I-6, x50. 4) Sample I-8, x52. 5) Sample I-5, x52. 6) Sample I-6, x52. 7) Sample I-6, x52. 8) Sample I-2, x35. 9) Sample I-2, x50. 10) Sample I-2, x50.

Figs. 11-20 - *Palmatolepis quadratrinodosa inflexa* Müller, 1956.
11) Sample I-15, x60. 12) Sample I-23, x50. 13) Sample I-21, x50. 14) Sample I-26, x50. 15) Sample I-26, x50. 16) Sample I-24, x60. 17) Sample I-15, x60. 18) Sample I-24, x60. 19) Sample I-19, x50. 20) Sample I-9, x50.

21) Sample I-2, x60. 22) Sample I-5, x50. 23) Sample I-12, x50. 24) Sample I-12, x50.

Fig. 25 - *Palmatolepis subperlobata helmsi* Ovnatanaova, 1976.
Sample I-26, x50.
Range – From the base of the Lower crepida Zone into the Lower marginifera Zone (Barskov, Alekseev, Kononova & Migdisova, 1987, p. 29, text-fig. 2).

Material – 2 Pa elements.

Family POLYGNAITHIDAE Bassler, 1925
Genus POLYGNAITHUS Hinde, 1879
Type species – POLYGNAITHUS dubius Hinde, 1879

POLYGNAITHUS brevilaminus Branson & Mehl, 1934
Pl. 4, fig. 8

1934 POLYGNAITHUS brevilaminus Branson & Mehl, p. 246, pl. 21, figs. 3-6.
1955b POLYGNAITHUS brevilaminus Branson & Mehl - SANDGEMANN, pl. 3, fig. 13.
1968 POLYGNAITHUS brevilaminus Branson & Mehl - ANDERSON & OZIAS, p. 264, pl. 1, figs. 1-15, pl. 2, figs. 1-16, pl. 3, figs. A-K.
1976 POLYGNAITHUS brevilaminus Branson & Mehl - DRUCE, pp. 183-184, pl. 70, figs. 3-5.

Remarks – All the Pa elements are within the range of variation indicated by Anderson & Ozius (1968). The illustrated specimen has a weakly ornamented platform terminating before reaching the posterior tip of the unit (small and weakly ornamented platform type of Anderson & Ozius, 1968).

Range – Probably from the Upper vacans Subzone and/or hermanni-cristatus Zone to do V (Uyeno in Norris, Uyeno & McCabe, 1982).

Material – 11 Pa elements.

POLYGNAITHUS DIVERSEUS Helms, 1959
Pl. 5, fig. 15

1959 POLYGNAITHUS DIVERSEUS Helms, pp. 650-651, pl. 5, figs. 5-8; text-fig. 2.
1961a POLYGNAITHUS DIVERSEUS Helms - HELMS, p. 681, pl. 1, figs. 4-6; pl. 2, figs. 2-5; text-figs. 2a-c.
1966 POLYGNAITHUS DIVERSEUS Helms - GLENISTER & KLAGNER, p. 828, pl. 94, fig. 7.
1967 POLYGNAITHUS DIVERSEUS Helms - WOLSKA, p. 412, pl. 16, figs. 5-7.
1985 POLYGNAITHUS DIVERSEUS Helms - OLIVIERI, pl. 7, figs. 2-5.
1990 POLYGNAITHUS DIVERSEUS Helms - PERRI & SPALLETTA, pp. 64-65, pl. 4, figs. 8a-b.

Remarks – The free blade of the Pa element is offset from the carina, and the upper platform surface is ornamented with fine, needlelike denticles. The free blade is partly broken.

Range – Lower and Upper marginifera Zones, and may occur slightly higher (Ziegler in Klapper & Ziegler, 1979, text-fig. 6).

Material – One and one questionably assigned Pa elements.

POLYGNAITHUS FALLAX Helms & Wolska, 1967
Pl. 5, fig. 10

1967 POLYGNAITHUS FALLAX Helms & Wolska, pp. 231-233, fig. 3a-b.
1976 POLYGNAITHUS FALLAX Helms & Wolska - DRUCE, pp. 186-187, pl. 72, figs. 4-5.

Remarks – The anterior part of the specimen is missing; however, it is still assignable to this species because of the characteristic upper surface ornamentation. The platform ornament consists mainly of irregular transverse ridges that are replaced by

EXPLANATION OF PLATE 4

Figs. 1, 2 - Icriodus cornutus Sannemann, 1955b.
1) Lateral view of Pa element, sample l-32, x10. 2) Upper view of Pa element, sample l-32, x60.
Figs. 3-7 - Melina striata (Branson & Mehl, 1934). Side views of Pa elements.
3) Sample l-4, x63. 4) Sample l-15, x63. 5) Sample l-2, x63. 6) Sample l-2, x63. 7) Sample l-7, x63.
Fig. 8 - POLYGNAITHUS brevilaminus Branson & Mehl, 1934. Side view of Pa element, sample l-10, x40.
Fig. 9 - POLYGNAITHUS cf. Polynogastria pennatoides Holmes, 1928. Upper view of Pa element, sample l-30, x50.
Figs. 10-12 - Melina arcata n. sp. A.
10, 11) Upper and lower views of Pa element, sample l-7, x50. 12) Upper view of Pa element, sample l-4, x50.
Figs. 13-22 - Melina arcata n. sp.
13, 14) Side and lower views of Pa element (paratype), sample l-15, x63. 15, 16) Outer lateral and lower views of Pa element (paratype), sample l-32, x63. 17, 18) Side and lower views of Pa element (paratype), sample l-33, x63. 19, 20) Outer lateral and lower views of Pa element (holotype), sample l-33, x63. 21, 22) Outer lateral and lower views of Pa element (paratype), sample l-32, x63.
Figs. 23-26 - Polynogastria peribata schindewolfii Müller, 1956. Upper views of Pa elements.
23) Sample l-2, x50. 24) Sample l-8, x50. 25) Sample l-7, x32. 26) Sample l-3, x42.
nodes, especially in the posterior outer side of the platform.


Material - 1 Pa element.

POLYGATHUS GLABER Ulrich & Bassler, 1926

POLYGATHUS GLABER GLABER
Ulrich & Bassler, 1926
Pl. 5, figs. 1-4

1926 Polýgnathus glaber Ulrich & Bassler, p. 46, pl. 7, fig. 13.
1967 Polýgnathus glabra glabra Ulrich & Bassler - Wolska, p. 413, pl. 15, fig. 1a-b.
1970 Polýgnathus glabra glabra Ulrich & Bassler - Olivier, pp. 122-123, pl. 21, figs. 1-5.
1976 Polýgnathus glaber glaber Ulrich & Bassler - Druce, pp. 190-191, pl. 74, figs. 4-5 (only).
1985 Polýgnathus glaber glaber Ulrich & Bassler - Olivier, pl. 8, figs. 1-3.

Remarks - See under Polýgnathus glaber media.

Range - From the base of the Upper rhomboida Zone into the Lower trachytera Zone (Ziegler in Klapper & Ziegler, 1979, text-fig. 6).

Material - 55 Pa elements.

POLYGATHUS GLABER MEDIAH
Helms & Wolska, 1967
Pl. 5, figs. 5-9

1962a Polýgnathus glabra glabra Ulrich & Bassler - Ziegler, p. 89, pl. 10, figs. 18-20.
1967 Polýgnathus glabra media Helms & Wolska, pp. 233-234, text-fig. 4.
1967 Polýgnathus glabra media Helms & Wolska, pl. 15, figs. 2, 3.
1976 Polýgnathus glabra glaber Ulrich & Bassler - Druce, pp. 190-191, pl. 76, fig. 1 (only).
1990 Polýgnathus glabra media Helms & Wolska - Peri & Spalletta, p. 65, pl. 5, figs. 3a-b.

Remarks - Distinctions based on the arrangement of the carina and the shape of the posterior platform have been used to establish Polýgnathus glaber media by Helms & Wolska (1967). According to their remarks, Polýgnathus glaber media has a carina consisting of closely spaced nodes, and a flattened or shallowly depressed upper platform surface the posterior of the pit. Furthermore, Klapper (in Ziegler, ed., 1975) noted that the platform is characteristically constricted near the posterior end in the nominate subspecies, but this feature is not present in all Pa elements.

In this paper, the deflection pattern downward of the anterior part of the platform is considered the main diagnostic criterion. In the Pa elements of Polýgnathus glaber media, the anterior third of the platform is more strongly deflected downwards in contrast to the nominate subspecies, and this deflection line generally forms a moderately sharp ridge on the upper surface of the platform that is especially more definite in the inner side. The

EXPLANATION OF PLATE 5

Figs. 1-4 - Polýgnathus glaber glaber Ulrich & Bassler, 1926. Upper views of Pa elements.
1) Sample I-27, x60. 2) Sample I-13, x50. 3) Sample I-19, x60. 4) Sample I-12, x50.
Figs. 5-9 - Polýgnathus glaber media Helms & Wolska, 1967. Upper views of Pa elements.
5) Sample I-6, x50. 6) Sample I-6, x50. 7) Sample I-1, x50. 8) Sample I-4, x50. 9) Sample I-4, x50.
Fig. 10 - Polýgnathus falax Helms & Wolska, 1967. Upper view of broken Pa element, sample I-2, x60.
Fig. 11 - Polýgnathus nodosocostatus ovatus Helms, 1961. Upper view of Pa element, sample I-36, x33.
Figs. 12, 13 - Polýgnathus nodosocostatus nodosocostatus Branson & Mehl, 1934.
12) Upper view of Pa element, sample I-26, x50.
13) Upper view of Pa element with broken free blade, sample I-2, x50.
Fig. 14 - Polýgnathus somaticus Branson & Mehl, 1934. Upper view of broken Pa element, sample I-35, x50.
Fig. 15 - Polýgnathus diversus Helms, 1959. Upper view of Pa element, sample I-6, x60.
Figs. 16, 17 - Polýgnathus triplyllatus (Ziegler, 1960). Upper and lower views of broken Pa element, sample I-27, x60.
Fig. 18 - Polýgnathus somaticus Vorontsova & Kuzmin, 1984. Upper view of broken Pa element, sample I-5, x50.
Figs. 19-25 - Polýgnathus longusculus n. sp.
19) Upper view of Pa element with broken free blade (paratype), sample I-8, x60, 20, 21) Upper and lower views of Pa element with broken free blade (paratype), sample I-3, x60, 22, 23) Upper and lower views of Pa element with broken free blade (holotype), sample I-3, x60, 24, 25) Upper and inner lateral views of Pa element with unbroken free blade (paratype), sample I-8, x60.
corresponding part of the nominate subspecies is in a convex curve.


**Material** - 61 Pa elements.

**POLYGONATHUS LONGIUSCULUS n. sp.**

Pl. 5, figs. 19-25.

**Derivatio nominis** - From Latin *longiusculus*, rather long, referring to the narrow and elongate platform.

**Holotype** - The specimen illustrated on Pl. 5, figs. 22, 23.

**Locus typicus** - Ayine Burnu, the southwest of Büyükkada, Istanbul (Text-fig. 1).

**Stratum typicum** - Bed of beige and yellowish light-brown, thia, nodular limestone, 12.00 m above the base of the studied section (Text-fig. 2; sample 1-3).

**Diagnosis** - Platform narrow, elongate, and slightly asymmetrical; posterior end sharply pointed; upper surface ornamented with weak nodes which are restricted to platform margins; shallow adcarinal grooves; carina consists of fused denticles anteriorly which are replaced by discrete nodes posteriorly; unit nearly straight longitudinally; small, elliptical pit located just on anterior end of platform.

**Description** - The slightly asymmetrical platform is narrow and elongate, three times as long as wide. The inner platform margin is generally straight, but the outer one is slightly convex. Posterior end is sharply pointed. The upper surface of the platform is ornamented with weak nodes which are restricted to platform margins, and have shallow adcarinal grooves. The unit is nearly straight longitudinally and has a moderately arched lower margin profile. The carina consists of fused denticles in the anterior third, and in the remaining part it consists of isolated nodes which are more discrete posteriorly. The free blade is moderately high, slightly shorter than platform, and highest anteriorly. Small and elliptical pit is located just on the anterior end of the platform.

**Remarks** - A relatively narrow and long platform with a sharply pointed posterior end, an upper surface ornamented with weak nodes which are restricted to platform margins, and a carina consisting of fused denticles anteriorly and isolated nodes posteriorly are the most characteristic features of the Pa element of *Polygonathus longiusculus* n. sp. In all specimens except for one (Pl. 5, figs. 24, 25), the free blade is broken, but also in this specimen, the posterior part of the platform is missing. The free blade is shorter than the platform.

The Pa element of this species is closely similar to that of *Polygonathus procerus* Sannemann but their free blades, and the upper margin profiles of the platform show some differences. The Pa element of *Polygonathus procerus* has a high free blade that shows an irregular denticulation with the largest one in the midlength. Furthermore, in the lateral view, the upper margin of the platform is in a convex curve. However, the Pa element of the new species has a free blade with more regular denticulation consisting of denticles nearly of equal size, and in lateral view, the upper margin of the platform is nearly straight.

**Occurrence** - Lower marginifera Zone. Samples 1-3 and 1-8 (Tab. 1).

**Material** - 17 Pa elements.

**POLYGONATHUS NODOCOSTATUS**

Branson & Mehl, 1934

**POLYGONATHUS NODOCOSTATUS NODOCOSTATUS**

Branson & Mehl, 1934

Pl. 5, figs. 12, 13

1934 *Polygonathus nodocostatus* Branson & Mehl, pp. 246-247, pl. 20, figs. 9-13; pl. 21, fig. 15.
1961a *Polygonathus nodocostatus nodocostatus* Branson & Mehl - Helms, pp. 687-688, pl. 1, figs. 17, 21, 23; pl. 2, figs. 16-20, 22, text-fig. 6.
1961b *Polygonathus nodocostatus nodocostatus* Branson & Mehl - Helms, pl. 3, fig. 11.
1966 *Polygonathus nodocostatus nodocostatus* Branson & Mehl - Glenister & Klapper, p. 829, pl. 94, figs. 8, 9, 14, 15.

**Remarks** - Helms (1961) recognized three subspecies of *Polygonathus nodocostatus: nodocostatus nodocostatus, nodocostatus ovatus, and nodocostatus incurvus*. The Pa elements with a moderately arched platform, that is ornamented with longitudinally aligned nodes, are assigned to *Polygonathus nodocostatus nodocostatus* Branson & Mehl.

**Range** - From the base of the Lower crepida Zone to the end of the Uppermost marginifera Zone and/or into the Uppermost marginifera Zone (Ziegler in Klapper & Ziegler, 1979, text-fig. 6).
Material - 5 Pa elements.

POLYGONATHUS NODOCOSTATUS OVATUS Helms, 1961
Pl. 5, fig. 11

1961a Polygonathus nodocostatus ovatus Helms, pp. 688-690, pl. 1, figs. 25, 26; pl. 2, figs. 24, 27, 28; text-fig. 7.

Remarks - The Pa element of Polygonathus nodocostatus ovatus has a more nearly symmetrical, less highly arched platform displaying an irregular arrangement of nodes on the upper surface, in contrast to the nominate subspecies (Glenister & Klapper, 1966; p. 829). The most significant difference from the nominate subspecies is the irregular arrangement of nodes on the upper surface. The Pa elements of Polygonathus nodocostatus incurus Helms with a similar platform outline show an X-shaped arrangement of nodes on the upper surface. This taxon is accepted as the synonymy of Polygonathus nodocostatus ovatus by Glenister & Klapper (1966).

Range - From the base of the Upper crepida Zone into the Upper rhomboides Zone (Ziegler in Klapper & Ziegler, 1979; text-fig. 6).

Material - 1 Pa element.

POLYGONATHUS SEMICOSTATUS Branson & Mehl, 1934
Pl. 5, fig. 14

1934 Polygonathus semicostatus Branson & Mehl, pp. 247-248, pl. 21, figs. 1, 2.
1974 Polygonathus semicostatus Branson & Mehl - Dreesen & Orchard, pp. 3-5, pl. 1, figs. 1-8; pl. 2, figs. 1-25.
1975 Polygonathus semicostatus Branson & Mehl - Klapper in Ziegler, ed., pp. 317-319, Polygonathus-pl. 5, fig. 6 (com. syn.).
1989 Polygonathus semicostatus Branson & Mehl - Metzger, p. 82, figs. 15.17-15.19, 15.39.

Remarks - The Pa elements fall within the range of variation indicated by Dreesen & Orchard (1974) and Sandberg & Ziegler (1979).

Range - From within the Middle crepida Zone into the Lower prosopecta Zone (Dreesen & Orchard, 1974; Sandberg & Ziegler, 1979, p. 187).

Material - 3 Pa elements.

POLYGONATHUS SUBNORMALIS Vorontzova & Kuzmin, 1984
Pl. 5, fig. 12

1970 Polygonathus sp. nov. Seddon, pl. 16, figs. 15, 16.
1984 Polygonathus subnormalis Vorontzova & Kuzmin, p. 62, pl. 1, figs. 6-10.
1990 Polygonathus subnormalis Vorontzova & Kuzmin - Kuzmin, pp. 67-68, pl. 4, figs. 7, 10.

Remarks - The Pa element has a platform ornamented with short, generally weak transverse ridges posteriorly and nodes anteriorly. The anterior platform margins are strongly upturned. The deep adcarinal grooves of the anterior platform shallow posteriorly. Sinistral and dextral Pa elements have different platform outlines. In the sinistral Pa elements, the outer platform margin shows an anterior constriction and a posterior expansion. The dextral Pa elements have a lanceolate platform that is the widest at the anterior end.

Polygonathus suzunakovi Kuzmin by having a more symmetrical platform, and Polygonathus valentinae Kuzmin by having anterior platform margins that are distinctly serrated differ from Polygonathus subnormalis Vorontzova & Kuzmin.

Range - From the base of the Lower rhomboides Zone into the trachytera Zone (Kuzmin, 1990).

Material - 21 Pa elements.

POLYGONATHUS TRIPHYLLATUS Helms, 1961a
Pl. 5, figs. 16, 17

1961a Polygonathus tripheyllatus (Ziegler) - Helms, pp. 696-697, pl. 1, figs. 2, 3; pl. 3, figs. 12, 15-17; text-fig. 13.
1961b Polygonathus tripheyllatus (Ziegler) - Helms, pl. 2, fig. 5.
1962a Polyphorodontat tripheyllatus Ziegler - Ziegler, p. 97, pl. 9, fig. 15.
1962b Polyphorodontat tripheyllatus Ziegler - Ziegler, pp. 402-403, pl. 1, fig. 5; pl. 2, figs. 1, 2.
1967 Polygonathus tripheyllatus (Ziegler) - Wolska, pp. 417-418, pl. 17, fig. 4.
1970 Polygonathus tripheyllatus (Ziegler) - Olivier, pp. 130-131, pl. 23, fig. 1.
1976 Polygonathus tripheyllatus (Ziegler) - Druce, pp. 203-204, pl. 81, figs. 4-6.

Remarks - The free blade, and the posterior part of the platform of the Pa element are broken. However, the distinct constriction in the middle part of the platform, which is the most characteristic feature of the Pa element, is still distinguishable. Furthermore, the anterior part of the platform is covered with coarser nodes in contrast to posterior part.

This species was first defined in the preprint of Ziegler (1962b) that was not published until 1962.
However, as Metzger (1994) pointed out, the name of the species was first validated by Helms (1961a).

Range - The upper part of the Upper rhomboidea Zone and probably the lowermost part of the Lower marginifera Zone (Ziegler in Klapper & Ziegler, 1979, text-fig. 6).

Material - 1 Pa element.

POLYGNATHUS n. sp. A
Pl. 4, figs. 10-12

[cf.] 1985 Polynathus sp. a OLIVIERI, pl. 7, figs. 8, 9.

Description - The platform has a heart-shaped outline. The outer margin is strongly convex, and the inner margin is strongly sigmoidal. The posterior end is pointed. The unit is moderately arched, and slightly curved. The upper platform surface is flat or nearly flat, and is ornamented with random or slightly aligned nodes that are generally restricted to platform margins. The carina is highly fused, and distinctly sets above the platform level. In lateral view it has an upper margin that is straight in the anterior part and descends after the anterior half to third. The free blade is slightly shorter than the platform. It is the highest anteriorly and gradually declines posteriorly. A small and extremely narrow pit is located on the anterior third of the platform.

Remarks - The platform outline of this species is similar to that of Polynathus sp. a of Olivieri (1985), but the latter has a more densely nodose platform, and a carina and keel strongly deflected laterally at the posterior third.

Occurrence - Lower marginifera Zone. Samples I-4 and I-7 (Tab. 1).

Material - 5 Pa elements.

POLYGNATHUS cf. POLYGNATHUS PENNATULOIDEA
Holmes, 1928
Pl. 4, fig. 9

[cf.] 1928 Polynathus pennatuloideae HOLMES, pp. 52-33, pl. 11, fig. 14.
[cf.] 1961a Polynathus pennatuloideae Holmes - HOLMES, pp. 691, 692; pl. 1, fig. 22; pl. 2, fig. 25; text-fig. 9.

Remarks - The Pa element has an oval platform ornamented with weakly aligned nodes. The outer platform margin is strongly convex, whereas the inner platform margin is sigmoidal. The posterior end is sharply pointed. The carina is nearly straight and extends to the posterior end of the platform.

The Pa element of Polynathus cf. Polynathus pennatuloideae Holmes has a platform outline that is similar to that of Polynathus n. sp. A but differs in having a longer and more densely nodose platform.

Occurrence - Upper rhomboidea Zone. Sample I-30 (See Tab. 1).

Material - 2 Pa elements.

Family SPATHOGNATHODONTIDAE Hass, 1925
Genus MEHLINA Youngquist, 1945
Type species - Mehlina irregularis Youngquist, 1945 (= Mehlina gradata Youngquist, 1945)

MEHLINA ARCUATA n. sp.
Pl. 4, figs. 13-22

Derivatio nominis - From Latin arcus, arch, curve, referring to arching of the lower margin.

Holotype - The specimen illustrated on Pl. 4, figs. 19, 20.

Locus typicus - Ayine Burnu, the southwest of Büyükdere, İstanbul (Text-fig. 1).

Diagnosis - Lower margin moderately arched and upper margin convex; unit slightly curved laterally, thickest at anterior end and thinner gradually posteriorly; basal cavity narrow, long, nearly, symmetrical and with small lateral flare.

Stratum typicum - Bed of beige and yellowish light-brown, thin, nodular limestone, 90 cm above the base of the studied section (Text-fig. 2; sample I-33).

Remarks - This species has some resemblance to Mehlina strigosa but they are distinguished by their lower margin profiles. The Pa element of Mehlina arcuata n. sp. has a moderately arched lower margin profile and a longer basal cavity. The Pa element of Mehlina strigosa has a lower margin profile that is straight in the anterior half and moderately arched in the posterior half.

Occurrence - Upper rhomboidea and Lower marginifera Zones (see Tab. 1).

Material - 72 Pa elements.

MEHLINA STRIGOISA (BRANSON & MEHL, 1934)
Pl. 4, figs. 3-7
1934 Spathodus rigonius Branson & Mehl, p. 187, pl. 17, fig. 17.
1962a Spathognathodus rigonius (Branson & Mehl) - Ziegler, pp. 111-112, pl. 12, figs. 21, 23 (com syn.).
1967 Spatognathodus rigonius (Branson & Mehl) - Wolska, pp. 428-429, pl. 18, figs. 9-15.
1976 Spatognathodus rigonius (Branson & Mehl) - Proc. pp. 216-217, pl. 89, figs. 4, 8, 9, 11; pl. 90, figs. 1-3.
1989 Melilina rigonius (Branson & Mehl) - Metzger, p. 517, figs. 14, 15, 14, 15.

Remarks - The lower margin of the Pa element is straight in the anterior half and moderately arched in the posterior half. The unit is straight or slightly curved laterally. The denticles are subequal, and inclined progressively backward toward the posterior end. The lenticular base cavity with slight lateral flare extends from somewhat anterior of the midlength to somewhat anterior of the posterior tip of the unit.

Range - From the base of the Lower marginifera Zone to the end of the Middle praeasulcata Zone or probably higher (Ziegler & Sandberg, 1984, text-fig. 4).

Material - 314 Pa elements.

Order Prioniodontida Dzik, 1976
Family Icriodontidae Müller & Müller, 1957
Genus Icriodus Branson & Mehl, 1938
Type species - Icriodus expansus Branson & Mehl, 1938

Icriodus cornutus Sannemann, 1955b
Pl. 4, figs. 1, 2
1955b Icriodus cornutus Sannemann, p. 130, pl. 4, figs. 19-21.
1984 Icriodus cornutus Sannemann - Sandberg & Druce, pp. 162, 163, pl. 2, fig. 8, pl. 4, figs. 19, 20 (com syn.).

Remarks - The Pa elements, assigned to this species, have a strongly reched posterior cusp, an alternated upper surface deniculation, a narrow and elongate platform, and a symmetrical basal cavity. In a few specimens cusp is not so strongly reclined, but the other characteristics are similar to Icriodus cornutus.

Range - From within the Middle triangularis Zone at least to the top of the Upper marginifera Zone. Rare individuals of a late morphotype or descendant species occur through the Upper triasbifera Zone (Sandberg & Druce, 1984, p. 163).

Material - 10 Pa elements

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