

ZOFIA KIELAN-JAWOROWSKA

NEW ORDOVICIAN GENERA OF POLYCHAETE JAW  
APPARATUSES

*Abstract.* — Five new Middle and Upper Ordovician genera of polychaete jaw apparatuses from the erratic boulders of Poland are described. All are recorded within the superfamily Eunicea, *Atraktoprion* n. gen. and *Skalenoprion* n. gen. being of prionognatha type, *Kalloprion* n. gen. and *Ramphoprion* n. gen. of labidognatha type, *Xanioprion* n. gen. represents a new, so far unknown type of apparatus. Some new terms are introduced and there is a discussion on the numbering and homology of the jaws in some recent and fossil eunicid apparatuses.

## INTRODUCTION

In 1960 the author started to investigate the Ordovician polychaete jaw apparatuses from the erratic boulders of Poland, collected by Professor Roman Kozłowski and kindly put at the writer's disposal. A part of this collection has been elaborated by Kozłowski (1956), who described three species assigned to the genera *Polychaetaspis* Kozłowski and *Polychaetura* Kozłowski. Moreover, the present writer described (1961) two species assigned to the genera *Vistulella* Kielan-Jaworowska and *Mochtyella* Kielan-Jaworowska.

In 1961 (p. 237) the writer stated that in the collection from the erratic boulders: "The scolecodonts are especially well preserved, including some dozens of entire or nearly entire jaw assemblages". As the boulders have been continually collected since that time by Prof. Roman Kozłowski, Dr Adam Urbanek and the writer, and systematically dissolved in hydrochloric and acetic acids, the collection of Ordovician polychaete jaw apparatuses has considerably increased and it embraces now more than four hundred, more or less complete jaw assemblages. As the complete elaboration of this new material must take some time, the writer decided to publish separately the descriptions of five new genera.

The present paper has a preliminary character, and only the dia-

gnosis of new genera and descriptions of type species are given. The material concerning these forms is much greater than that described and more data will be published later.

All the genera here described, as well as those described before (Kozłowski, 1956, Kielan-Jaworowska, 1961), are assigned to the superfamily Eunicea. An erection of the families and subfamilies within the fossil eunicid polychaetes will be provided later. It would also be beyond the scope of the present paper to publish here any phylogenetic considerations.

The methods and terminology are mostly the same as described by Kielan-Jaworowska (1961). Some new terms are introduced in the present paper and the discussion on the numbering of the jaws in recent and fossil eunicid apparatuses is given.

All the specimens are housed in the Palaeozoological Laboratory of the Polish Academy of Sciences in Warsaw. The collection is numbered in the following way: e.g. No. 0.400/15: 0 — means Ordovician, 400 — gives the number of the boulder, 15 — gives the number of the specimen in the sample from this boulder. Thus the number of the specimen shows, from which boulder it was etched out.

The characteristics of the boulders from which the specimens were prepared have been kindly given by Prof. R. Kozłowski.

The writer is greatly indebted to Prof. Roman Kozłowski and Dr. Adam Urbanek for placing the material collected by them at her disposal. During the preparation of the paper, discussions with Prof. Kozłowski have been of great value for the writer's investigations.

The following persons kindly identified the fossils occurring in the particular boulders, and this has helped a great deal in estimating the age of the boulders:

Prof. Roman Kozłowski: Foraminifera, Hydroidea, Dendroidea and Crustoidea; Dr. Adam Urbanek: Graptoloidea; Dr. Gertruda Biernat: Brachiopoda; Miss Zdzisława Wolska: Conodontophorida; Dr. Franciszek Adamczak: an ostracod from the boulder 0.398; Dr. Valdar Jaanusson (Uppsala University): a trilobite from the boulder 0.366. Dr Andrew Packard (Zoological Station, Naples) kindly corrected the English of the present paper. The accompanying drawings have been made by Mrs. Ewa Gadomska from the writer's pencil sketches.

The writer wishes to express her thanks to all these persons.

#### CHARACTERISTICS OF THE BOULDERS WITH A DISCUSSION OF THEIR AGE

Boulder No. 0.59, Władysławowo (prov. of Gdańsk). Light-grey organogenic, fine-grained limestone which furnished: Foraminifera: *Blastammia polymorpha* Eisenack, Tuboidea, Graptolithina: *Bulmani-*

*crusta latialata scutellifera* Kozłowski, polychaete jaw apparatuses: *Skalenoprion alatus* n. sp., sclecodonts and Chitinozoa. No index fossils which could throw light on the age of the boulder.

Boulder No. 0.142, Wyszogród-Zakroczym (prov. of Warsaw). Grey, coarse-grained limestone, yielding Graptolithina: *Climacograptus* cf. *uplandicus* (Wiman), and *C.* cf. *brevis mutabilis* Strachan, polychaete jaw apparatuses: *Xanioprion borealis* n. sp. and sclecodonts. Both graptolites occur in Sweden, Tvären, Södermanland, in the Middle Ordovician, Lower *Ludibundus* limestone, being an equivalent of the Kukruse stage CII of Estonian sequence. Boulder 0.142 is probably of this age.

Boulder No. 0.159, Jarosławiec (prov. of Koszalin). Compact limestone, similar to Baltic limestone (Ostseekalk), yielding unidentified Foraminifera and isolated jaws of *Skalenoprion alatus* n. sp. Age of the boulder unknown.

Boulder No. 0.174, Wyszogród-Zakroczym (prov. of Warsaw). Light fine-grained limestone, yielding unidentified Foraminifera and isolated jaws of *Skalenoprion alatus* n. sp. Age of the boulder unknown.

Boulder No. 0.182, Mochty (prov. of Warsaw). Coarse grained, light-grey, organogenic limestone, yielding: Algae: *Glaeocapsomorpha prisca* Zalessky, Foraminifera: *Tasmanites martinsoni* Eisenack, Hydroida: *Rhabdohydra tridens* Kozł., *Diplohydra solida* Kozł., *Kystodendron longicarpus* (Eisenack), *Cylindrotheca subtilis* Kozł., *Gonotheca Forma E* Kozł., 1962, Graptolithina: *Ruedemannicrusta geniculata* Kozł., Dendroidea, *Mastigograptus* sp., *Climacograptus brevis mutabilis* Strachan, *Pseudoclimacograptus scharenbergi* (Lapworth), polychaete jaw apparatuses: *Mochtyella cristata* Kielan-Jaworowska, *Atraktoption* sp. a (here described), *Kalloprion ovalis* n. sp. and numerous sclecodonts.

*Pseudoclimacograptus scharenbergi* (Lapworth) has a wide stratigraphic range (Upper Arenigian — Upper Caradocian), but *Climacograptus brevis mutabilis* Strachan is known so far only from Tvären, Södermanland, Sweden — from the Middle Ordovician, Lower *Ludibundus* Limestone (cf. Strachan, 1959), equivalent of Kukruse stage (CII) of Estonian sequence. The boulder No. 0.182 is probably of this age, the same as the boulder No. 0.142.

Boulder No. 0.279, Mochty (prov. of Warsaw). Baltic limestone, yielding Chitinozoa, Foraminifera, Dasycladaceae?, Graptolithina: *Climacograptus* sp., polychaete jaw apparatuses: *Xanioprion borealis* n. sp. Age of the boulder unknown.

Boulder No. 0.301, Ustka (prov. of Koszalin). Light grey, coarse-grained limestone, yielding fragmentary Chitinozoa and sclecodonts, isolated jaws of *Skalenoprion alatus* n. sp. among them. Age of the boulder unknown.

Boulder No. 0.366, Zakroczym (prov. of Warsaw). Grey, coarse-grained limestone, consisting mostly of fragments of silicified brachiopods, yielding: Foraminifera: *Tasmanites martinssoni* (Eisenack), Hydroida: *Rhabdohydra tridens* Kozłowski, and others, Brachiopoda: *Clinambon anomalus* (Schlotheim), *Sowerbyella* sp., Trilobita: *Asaphus* (*Neoasaphus*) *jewensis* Schmidt, Graptolithina: *Mastigograptus* sp., *Idiotubus* sp., *Wimanicrusta urbaneki* Kozłowski, Graptoblasti, Polychaete jaw apparatuses: *Mochtyella cristata* Kielan-Jaworowska, *Vistulella kozłowskii* Kielan-Jaworowska, *Polychaetaspis wyszogrodensis* Kozłowski, *Kallopriion ovalis* n. sp. and numerous scolecodonts.

*Clinambon anomalus* (Schlotheim) and *Asaphus* (*Neoasaphus*) *jewensis* Schmidt are characteristic of the Middle Ordovician of Estonia (Kukruse stage CII, and Idavere stage CIII of Estonian sequence). The boulder is probably of this age.

Boulder No. 0.398, Mochty (prov. of Warsaw). Light-grey, compact, coarse-grained limestone, yielding Foraminifera, Crinoidea, Hydroida, Conodontophorida: *Amorphognathus ordovicica* Branson & Mehl, *Icriodella superba* Rhodes, *Panderodus gracilis* (Branson & Mehl), *Panderodus equicostatus* (Rhodes), Ostracoda: *Bolbina major* (Krause), polychaete jaw apparatuses: *Ramphoprion elongatus* n.sp. and scolecodonts.

*Bolbina major* (Krause) is known from the Ordovician erratic boulders of Germany. Sarv (1959) described from the Middle Ordovician, (DII of Estonian sequence), *Bolbina lehmetzaensis* Sarv, which, according to Jaanusson (1961), is a synonym of *B. major* (Krause). The conodonts yielded by the boulder are characteristic of the Upper, or of the Middle and Upper Ordovician of the United States or Great Britain. *Icriodella superba* Rhodes and *Panderodus equicostatus* (Rhodes) occur in the Gelli-grin Limestone and Pen-y-garnedd Limestone which belong to the Caradocian Series of Great Britain. It is thus possible that the age of the boulder corresponds to the Keila stage (DII of Estonian sequence).

Boulder No. 0.400, Mochty (prov. of Warsaw). Grey, coarse-grained limestone which furnished Foraminifera: *Tasmanites* sp., silicified Brachiopoda: *Dalmanella* cf. *wesenbergensis* Wysogorski, *Platystrofia* sp., *Sowerbyella* cf. *öpiki* Rõõmusoks, *Dinorthis* sp., Crustoidea, poorly preserved fragment of a diplograptid, resembling *Pseudoclimacograptus scharenbergi* (Lapworth), numerous polychaete jaw apparatuses: *Polychaetaspis wyszogrodensis* Kozłowski, *Polychaetura* sp., *Atraktoprion cornutus* n. sp. *Kallopriion ovalis* n. sp., *Xanioprion borealis* n. sp.

Unfortunately, no certain index fossils were found in the boulder. The brachiopods (all identified tentatively) remained the assemblage

characteristic of the Rakvere Stage (E of Estonian sequence), belonging to the lowermost part of the Upper Ordovician. It is possible that the boulder 0.400 is of this age.

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The age of all the boulders here discussed ranges from the Kukruse Stage (CII) to the Rakvere Stage (E) of Estonian sequence, corresponding to the upper part of the Middle Ordovician and the lowermost part of the Upper Ordovician.

Tentative stratigraphic range of the described species\*  
(correlation based on Jaanusson, 1956, 1960)

Geological age		Graptolite succession	Sweden	Estonia		<i>Atraktoprion</i> <i>cornutus</i>	<i>Atraktoprion</i> <i>sp. a</i>	<i>Kalloprion</i> <i>ovalis</i>	<i>Ramphoprion</i> <i>elongatus</i>	<i>Xanioprion</i> <i>borealis</i>
Upper Ordo- vician	E	<i>Pleurograptus linearis</i>	Slandrom limestone	E	Rakvere Stage	+	-	+	-	+
		Middle Ordo- vician	<i>Dicranograptus clingani</i>	<i>Macrourus</i> Limestone	DIII	Oandu Stage	-	-	-	-
DII	Keilla Stage				-	-	-	+	-	
D	<i>Diplograptus multidens</i>		<i>Ludibundus</i> Limestone <i>sensu lato</i>	DI	Jõhvi Stage	-	-	+	-	-
				CIII	Idavere Stage	-	-	+	-	-
C	<i>Nemagraptus gracilis</i>		CII	Kukruse Stage	-	+	+	-	+	

\* Stratigraphic range of *Skalenoprion alatus* n. sp. unknown.

#### TERMINOLOGY

(text-fig.1)

The terminology used in the present paper is mostly that of Kielan-Jaworowska (1961). Descriptions of the new jaw apparatuses here given require, however, the introduction of some new terms.

In descriptions of the whole apparatuses and particular jaws the following abbreviations are used: *long*: — longitudinal, running antero-

-posteriorly, parallel to the plane of symmetry of the animal (estimated by comparison with recent forms), and consequently parallel to the plane dividing the apparatus into two more or less symmetrical parts, and *tr.* — transversal, perpendicular to the plane of symmetry.

Length and width of the bight are defined as shown on fig. 1 A.

In the right forceps (MI) of *Skalenoprion* n. gen. there occur two ridges of denticles: one, situated longitudinally along the internal marg-

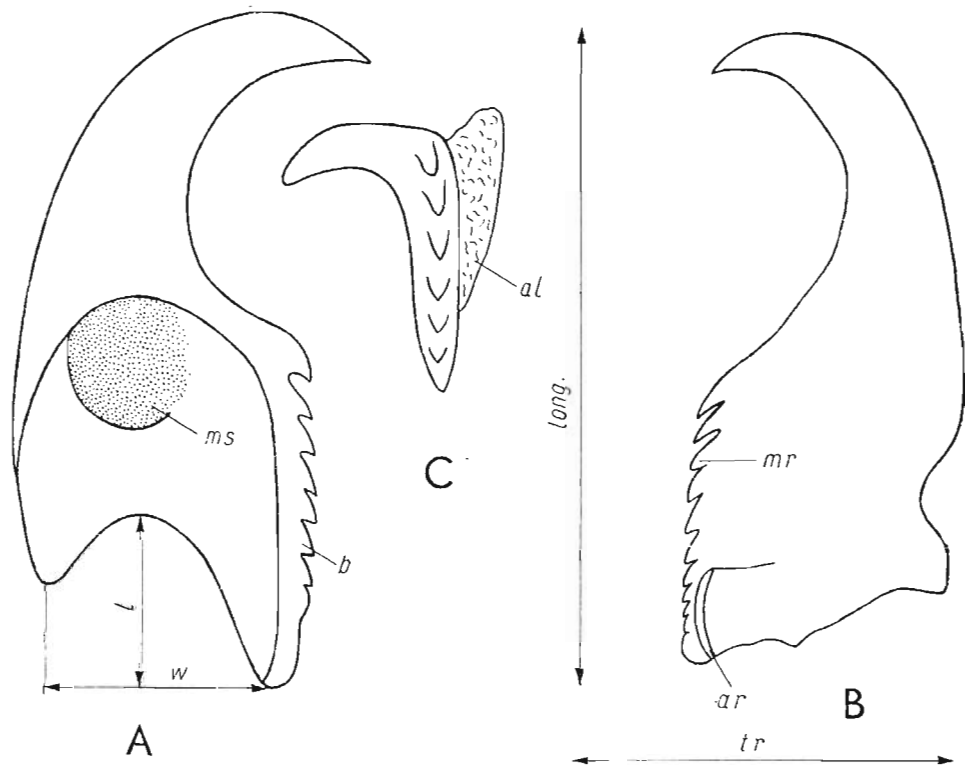


Fig. 1. — A MI right of *Atraktoprion*, in ventral view; B MI right of *Skalenoprion*, in dorsal view; C MII left of *Atraktoprion*, in dorsal view

*Tr* transversal direction, *long.* longitudinal direction, *l* length of the bight, *w* width of the bight. *b* belt, *ms* muscle scar, *al* attachment lamella, *mr* main ridge, *ar* additional ridge.

in of the jaw and called here the *main ridge*, synonym of dentary (Croneis, 1941), and a shorter (long.) ridge, parallel to the main one, situated in the posterior part of the jaw, called the *additional ridge*. The additional ridge in *Skalenoprion* may be more or less prominent, denticulated or smooth.

In the ventral view of MI, the opening of the pulp cavity is delimited from the dentary by the more or less narrow part of the jaw wall, for which the word *belt* is suggested. The belt may be oblique with respect to the dorsal wall of the jaw, or may be subparallel to it, in the

prolongation of the ventral wall of the jaw. In MI in some genera, opposite the anterior part of the opening, is a more or less large depression in the dorsal wall, probably corresponding to a muscular attachment. Usually no swelling is visible on the dorsal side of the wall, associated with this depression, which is caused by a reduction of the wall thickness only. It is suggested that this depression be called *muscle scar*.

Often the internal border of the jaw is prolonged into a lamella, which may be very large, directed perpendicularly to the dorsal surface of the jaw. This lamella is usually more delicate than the rest of the jaw, more transparent, with a somewhat coarse surface. The name *attachment lamella*, is suggested for it.

Kozłowski (1956) in *Polychaetaspis warkae* Kozłowski described two teeth, called by him *lateral teeth* (dents latérales) covering right and left forceps (MI) dorsally, situated obliquely behind the somewhat inflated antero-lateral borders of MI. In the author's collection there are numerous so far undescribed specimens of *Polychaetaspis* with lateral teeth. In *Ramphoprion borealis* n. sp. described here a similar tooth on the right side of the apparatus occurs. By analogy with *P. warkae* Kozłowski one can assume that there were two lateral teeth in *Ramphoprion* as well, the right one only being preserved in the described specimens.

#### REMARKS ON THE NUMBERING AND HOMOLOGY OF JAWS IN SOME RECENT AND FOSSIL APPARATUSES

(text-fig. 2 and 3)

Particular jaws in recent and fossil jaw apparatuses have been called different names by various authors and, as has been already stated by the present writer (1961), the most convenient seems to be the method used by Fauvel (1923), Hartman (1944) and others, of numbering them by successive Roman numerals from back to front as MI — MV. This method is generally adopted in the present paper, however the elaboration of the new fossil forms has made it necessary to introduce some emendations.

#### *Labidognatha* type

Recent labidognatha forms (comp. Ehlers, 1864—68) embrace three lines, grouped into three families: Onuphidae, Eunicidae and Lumbrineridae. The Lumbrineridae are characterized by a symmetrical jaw apparatus, composed of 4 paired elements. In Onuphidae and Eunicidae the jaw apparatuses are asymmetrical, MIII left being single. Lange

(1949, p. 58) has pointed out that the Devonian *Paulinites* described by him: „...should be regarded as representing a primitive condition of the forms now included into the families Onuphidae and Eunicidae”. In addition to *Paulinites*, one labidognatha fossil genus was described by Šnajdr (1951): *Kettnerites* Žebera, 1935, emend. Šnajdr, 1951, two by Kozłowski (1956): *Polychaetaspis* Kozłowski and *Polychaetura* Kozłowski, and two more: *Ramphoprion* n. gen. and *Kalloprion* n. gen.

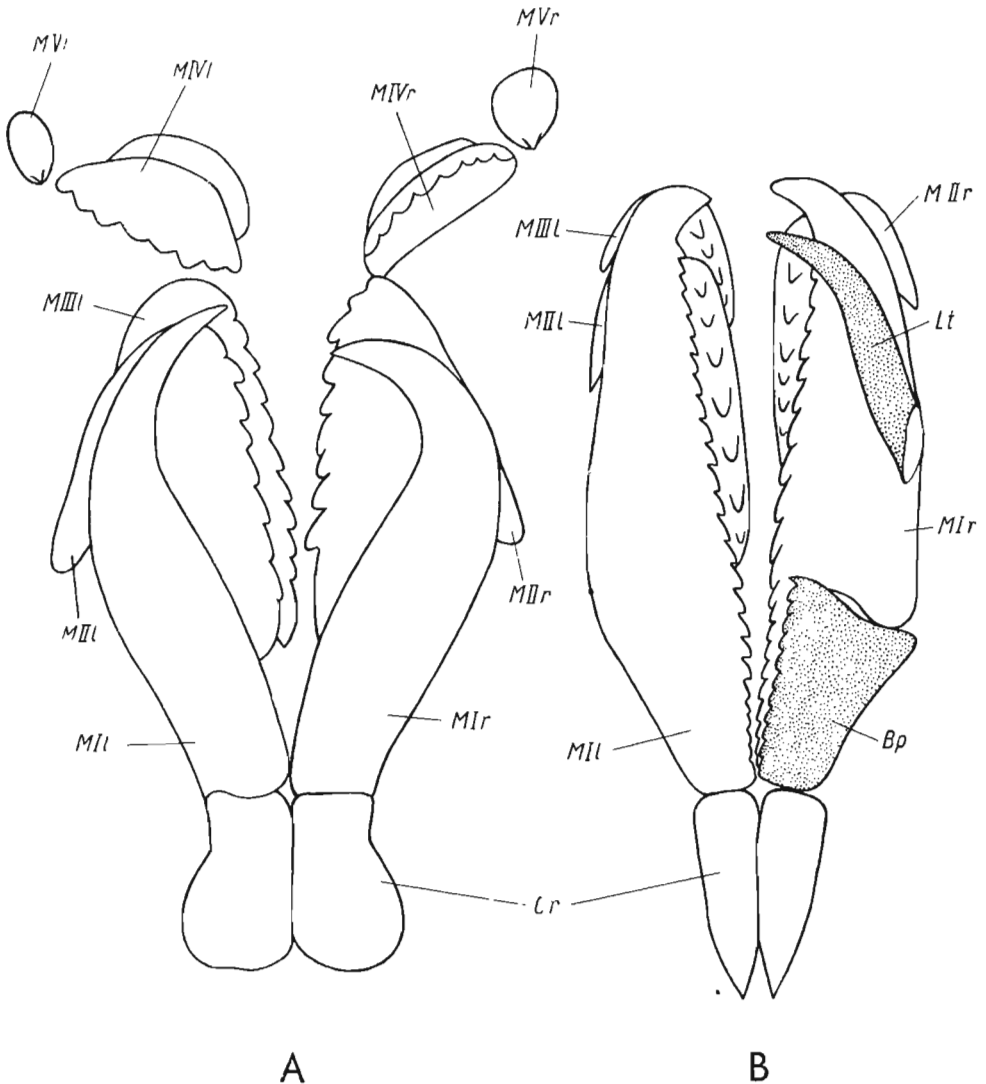


Fig. 2. — Diagrammatic sketches of recent and fossil labidognatha apparatuses: A *Onuphis eremita* Audouin & Milne-Edwards, recent; B *Ramphoprion elongatus* n. gen., n. sp., Ordovician

Cr carriers. Bp basal plate, Lt lateral tooth, MI-MV particular maxillary plates, right and left (MIV and MV in *Ramphoprion elongatus* unknown.).



are described in the present paper. It seems that the above cited statement of Lange is more or less true for all these genera. It should be stressed that neither any of the fossil labidognatha apparatuses hitherto known, nor any in the author's collection so far undescribed, represent the condition characteristic of recent Lumbrineridae. That is why in the present considerations of homology, this family cannot, for the time being, be taken into account.

In Devonian *Paulinites paranaensis* Lange, Lange (1949) noted the occurrence of one additional right piece, called by him the *basal piece*. Kozłowski (1956) in Ordovician *Polychaetaspis wyszogrodensis* Kozłowski noted the occurrence of a small tooth, situated in front of the basal plate, called the *intercalary tooth*, and in *P. warkae* Kozłowski the presence of two teeth called *lateral teeth*.

It is here suggested that the basal plate, intercalary tooth and the lateral teeth be called by names only, without numbering them by successive numerals. Thus, the manner of numbering the jaws in recent labidognatha apparatuses can be adopted without changes for fossil apparatuses of the same type, and the elements regarded here as homologous in fossil and recent forms will receive the same numerals (see fig. 2).

### *Prionognatha* type

Within the recent prionognatha forms (not taking into account the Dorvilleidae which have the jaw apparatuses consisting of large numbers of denticulated plates, arranged in two longitudinal series on each side, and which in the present writer's opinion should be excluded from prionognatha type) there occur two different types of jaw apparatuses:

1° Characteristic e. g. of *Aglaurides fulgida* Savigny<sup>1</sup>, *Halla parthenopeia* (Delle Chiaje), *Notocirrus californiensis* Hartman and *Arabella geniculata* Claparède, in which the first plate on the right side is not hooked and distinctly smaller than the next one.

2° Characteristic e. g. of *Arabella iricolor* Montagu, *A. setosa* Treadwell and *A. maculosa* Verill, in which both right and left first plates are hooked and more or less of similar size. The discussion on the interpretation of particular jaws in this type will be published later.

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<sup>1</sup> The apparatus in *A. fulgida* Savigny is usually asymmetrical, but sometimes specimens with symmetrical jaw apparatuses were found within this species (cf. Fauvel 1919, 1953, Crossland, 1924, Hartman, 1944). The interpretation of the occurrence of symmetrical jaw apparatuses in this species will be published later, and for the moment the writer restricts her considerations to the most common asymmetrical apparatus.

With regard to the first type, it was a practice generally accepted by the specialists in eunicids to match all the successive jaws of the right and left sides in recent apparatuses in pairs, in spite of the considerable differences in size and shape of the jaws matched as a pair. The fossil evidence is strongly against this interpretation. As has been already pointed out by Kozłowski (1956), the first plate on the right side in recent e.g. *Halla parthenopeia* (Delle Chiaje) situated in the right on the posterior margin of the next larger plate, is, as to shape and position, very like the basal plate of fossil forms, such as *Paulinites*, *Kettnerites*, *Polychaetaspis* and *Polychaetura*. Fossil prionognatha apparatuses have not been hitherto known, but some isolated forceps with strong hooks, described under the names of *Arabellites* Hinde, *Protarabellites* Stauffer or *Ildraites* Eller (cf. Hinde, 1879, Stauffer, 1933, Eller, 1936) could be interpreted as belonging to prionognatha type.

In the present paper the fossil prionognatha apparatuses are described for the first time. They are recorded here as the genera: *Atraktoprion* n. gen. and *Skalenoprion* n. gen.

Let us compare *Atraktoprion cornutus* n. gen. n. sp. with the jaw apparatus of recent *Aglaurides fulgida* Savigny (asymmetrical form). The similarities between the apparatuses of two species are so striking (comp. text-fig. 3) that the present author believes that she is entirely justified in calling the first right jaw in *A. fulgida* — basal plate, and subsequently in numbering the remaining jaws by the numerals indicated in text-fig. 3. The manner of numbering the plates in *A. fulgida* adopted here differs from that used so far by zoologists in, that when the first right small jaw is called the basal plate, then the second right jaw and the first left become the MI pair, and this is strongly supported by their size and shape. Then third right and second left jaws become paired as MII, the third left jaw forms a single jaw MIII, and in front there are symmetrical MIV and symmetrical MV developed usually as single teeth.

The pattern of jaw apparatus, characteristic of the Ordovician *Atraktoprion*, seems to be very conservative, as we find it persisting almost without change in recent *Aglaurides fulgida* and other recent prionognatha eunicids. In the recent forms discussed here the forceps (MI) are not so distinctly hooked as in *Atraktoprion*, but otherwise the number of the jaws and their arrangement are the same. Also the carriers of *Atraktoprion* are paired, long, filiform, as is characteristic of recent prionognaths. The unpaired ventral piece in the carriers, occurring in most recent prionognatha forms, could hardly have been preserved together in fossil apparatuses in case it existed there.

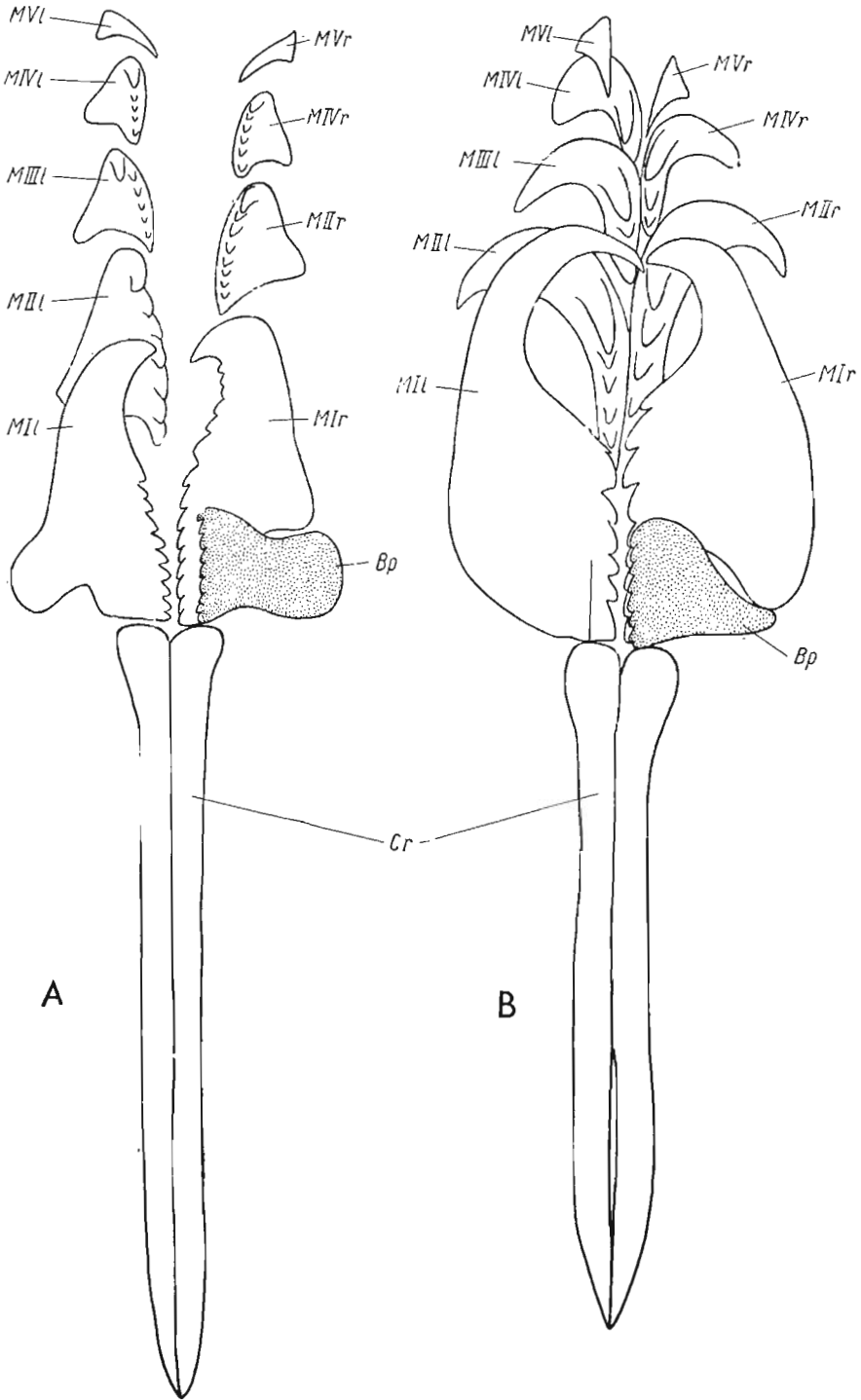


Fig. 3. — Diagrammatic sketches of recent and fossil prionognatha apparatuses:  
 A *Aglaurides fulgida* (Savigny), recent; B *Atraktoprion cornutus* n. gen., n. sp.  
 Ordovician

Cr carriers, Bp basal plate, MI-MV particular maxillary plates, right and left.

*Comparison of labidognatha and prionognatha types*

If one agrees with the interpretation of some recent prionognatha apparatuses suggested above, it appears that the differences between the prionognatha and labidognatha apparatuses are smaller than was generally believed. The main difference concerns the lack of the basal plate in recent labidognatha forms, which occurred in Palaeozoic representatives of this line, but disappeared more recently. In prionognatha forms, at least in some of them discussed here, the basal plate persisted until the present day. The second difference concerns the fact that the forceps (MI) in recent labidognatha forms are smooth, whereas they are denticulated in prionognatha forms. This however was not the case in fossil forms, where in the labidognatha type MI are denticulated as well, but not so distinctly hooked as in fossil prionognatha forms.

Otherwise, generally (except the Lumbrineridae) in both types MI and MII are paired, MIII single left, MIV paired and MV if present are also paired and developed as single teeth. One should however mention that in both types modifications of the above described general patterns, concerning the lack or the appearance of additional jaws are often found.

*Other types*

As has already been mentioned above, the Dorvilleidae are characterized by jaw apparatuses unique within the Eunicea and, in the present writer's opinion, they should be excluded from the prionognatha type. In the collection elaborated by the writer, are numerous, so far undescribed jaw apparatuses, similar to those occurring in recent *Dorvillea* Parfitt.

Neither *Mochtyella* Kielan-Jaworowska and *Vistulella* Kielan-Jaworowska, nor *Xanioprion* n. gen. here described, could be recorded within labidognatha or prionognatha types (cf. text-fig. 4 on p. 320). These new types of jaw apparatuses, as well as those of the Dorvilleidae will be discussed in detail in the forthcoming paper, and new names for their types of apparatuses will be coined.

When describing the genera *Vistulella* and *Mochtyella*, the present writer (1961) numbered their jaws by Arabic instead of Roman numerals, in order to avoid suggestions on the homology with the labidognatha and prionognatha types. The same method is adopted in the present paper with regard to the *Xanioprion* n. gen., as a discussion on homology of these new, so far poorly known types, requires more detailed comparative studies and the elaboration of the whole material from the writer's collection.

## DESCRIPTIONS

Superfamily *Eunicea*Genus *Atraktoprion* n. gen.

*Type species:* *Atraktoprion cornutus* n. sp.

*Occurrence:* Ordovician erratic boulders of Poland.

*Derivation of name:* Gr. *atraktos* — arrow, *prion* — saw, on account of the arrow-like carriers.

*Diagnosis.* — Asymmetrical jaw apparatus of prionognatha type. Carriers paired, filiform. Basal plate present, subtriangular, usually wider than long. MI with strong, curved hooks, MI right with a bight along the posterior border, corresponding to the place for the basal plate. MII symmetrical, with long (tr.), transverse shank. MIII single, left<sup>2</sup>, either subtriangular or with transverse shank. MIV subtriangular plates with up to 3 denticles or single teeth. MV if present — single teeth. MII — MV provided with large attachment lamellae. Pulp cavity of MI slightly enclosed, in the remaining jaws gaped. Imperfectly known paragnathes or small plates in front of MV. Mandibles, preserved in one specimen with smooth anterior edges, provided with a semicircular reticulated surface on the ventral side of the transverse branch forming a circle together with the semicircular surface of the opposite mandible.

*Discussion.* — *Atraktoprion* n. gen. here described is represented in the author's collection by six or so species, most of which have to remain for the time being undescribed. The species recognized by the author differ mostly in the shape and arrangement of the anterior jaws (MII — MV), and only in some of them MI are also characteristic of a species. Often two species differing distinctly in shape of MII — MV, have MI almost identically shaped. Therefore, when isolated MI right and left of *Atraktoprion* usually allow an identification at the generic level only. Also the assemblages composed of MI, MII, basal plate and the carriers, are usually hardly enough to allow a specific identification. In addition to *A. cornutus* n. sp. — a type species, the present author describes here an assemblage recorded as *Atraktoprion* sp. *a*, as it is so far the only assemblage of this genus in the author's collection, in which the mandibles are preserved.

*Atraktoprion* is the only fossil apparatus of prionognatha type which is known in all details and well defined. Among fossil apparatuses described so far, only *Ildrantes* Eller, 1936, from the Upper Devonian of New York, seems to be of prionognatha type. *Ildrantes* is

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<sup>2</sup> There is some evidence that in one so far undescribed species of *Atraktoprion* MIII is paired.

however poorly known and reconstructed by Eller (1936, pl. 11) so that a more detailed comparison is impossible.

With regard to the detached jaws, the carriers described by Eisenack (1939) as *Orthopelta mucronata* Eisenack and *O. synclinalis* Eisenack are arrow-like, filiform, similar to those in *Atraktoprion*. Similarly shaped carriers are characteristic of numerous recent prionognatha genera and it seems evident that in prionognatha forms they cannot be regarded as a feature characteristic at generic level. One can state that the carriers of *Orthopelta mucronata* and *O. synclinalis* are of prionognatha type, but one cannot be sure whether they are congeneric with *Atraktoprion*.

Numerous detached MI similar to those of *Atraktoprion* were described by various authors as different species of the genera *Arabellites* Hinde, *Protarabellites* Stauffer and *Ildraites* Eller, and the detached MII as *Leodicites* Eller and *Eunicites* Ehlers (Hinde, 1879, 1880, 1882; Eller, 1934, 1935, 1943, 1945, 1955, 1961; Stauffer, 1939; Sylvester, 1959; Seidel, 1959; Walliser, 1960). Similarly, as in the case of the carriers, one can state that MI and MII above cited are of prionognatha type, but one cannot state with any certainty whether some of them are congeneric with *Atraktoprion*.

Comparisons with *Skalenoprion* n. gen. — see p. 307/308.

*Atraktoprion cornutus* n. sp.

(pl. I; text-fig. 3B)

*Type specimen*: Entire, slightly depressed jaw apparatus figured on pl. I, No. 0. 400/1.

*Type horizon and locality*: Probably lowermost part of the Upper Ordovician corresponding to the Rakvere stage (E) of Estonian division. Erratic boulder found in Mochty, Warsaw district.

*Derivation of name*: Lat. *cornu* — horn, *cornutus* — provided with horns, on account of large, horn-like denticles in MII — MIV.

*Diagnosis*. — Basal plate subtriangular, wider than long, with a base directed transversely. Hook in MI right occupying 1/3 of the jaw length, in MI left — a little more. MIII single. MII — MIV with large, transverse shanks, convex anteriorly and with the first denticles hook-like, distinctly larger and 3—4 times longer than the remaining ones. Pulp cavities in MII — MIV open. MV single teeth.

Denticles formula:

Basal plate	—	7?
MI	1+6	1+8
MII	1+5	1+5
MIII	1+3	—
MIV	1	1(or 2?)
MV	1	1

*Material.* — Type specimen only, being the entire jaw apparatus composed of the carriers, partly broken off and fastened obliquely along the dorsal side of the left MI, basal plate, right and left: MI and MII, single left: MIII, right and left: MIV and MV. In front of MV there are some indistinct traces of the anterior teeth. The right side of the apparatus is displaced forwards with respect to the left. The apparatus is slightly depressed, the jaws being strongly cemented by a siliceous material which covers large areas of the ventral side.

*Description.* — *Carriers*, imperfectly preserved, of the pattern characteristic of the genus. Their length seems to exceed that of the apparatus.

*Basal plate* subtriangular, wider than long, with 7(?) denticles. A very short (long.) interval between the anterior denticle and the next ones. Posterior margin directed transversely, at right angles to the dentary. Anterior margin runs from the dentary in an arch convex anteriorly, then obliquely postero-laterally and then nearly transversely, reaching the posterior margin at the right angle. Postero-lateral corner tapers into a narrow (long.), transverse, pointed process.

*MI right* — hook occupies a little more than  $1/3$  of the jaw length. 8 denticles or so in the dentary. Outer margin runs postero-laterally to the rounded posterior corner. Bight wider than long, its length occupying about  $1/3$  that of the jaw. In ventral view belt comparatively narrow (tr.), opening occupies more than half of the jaw length. Opposite the anterior part of the opening the jaw is delicate and more transparent, indicating the presence of rounded muscle scar, indistinct on account of the coating of silicate.

*MI left* — hook longer than in the right jaw, occupying nearly half of the jaw length, dentary shorter (long.) with about 6 denticles. Posterior margin transverse at first, then running antero-laterally, lateral margin directed postero-laterally. In ventral view: opening occupies more than half of the jaw length, belt wide (tr.), narrowing posteriorly. Muscle scar subcircular, following the outline of the opening in the anterior part, produced posteriorly into a tapering prolongation, directed postero-laterally.

*MII right* — set square shaped, provided with a wide (long.) and long (tr.) shank, forming an arch convex anteriorly. Length of shank equal to about  $2/3$  that of the jaw; 6(?) denticles extending the length of jaw, first one hook-like, more than 3 times longer than remaining ones.

*MII left* — similarly shaped, situated further backward than the right one.

*MIII*, single left jaw, with a wide (long.) and long (tr.) shank, nearly

as long (tr.) as the length of the jaw (long.). 4 denticles, the first hook-like, 4 times longer than the last one.

*MIV right* — sickle shaped jaw, with a large shank, convex anteriorly, as long (tr.) as the length of the jaw (long.). One very long, hook-like denticle, extending nearly the length of the jaw, the presence of the second one not certain.

*MIV left* — slightly larger than the right one, similarly shaped, situated a little further forward than the right one.

*MV right and left* — thin, long teeth, sharply pointed, with large bases, covering somewhat *MIV right* and *left* respectively from the dorsal side.

Attachment lamellae of *MII* — *MIV* incompletely preserved, produced anteriorly in front of *MV* into a long cone-like longitudinal projection, on which some poorly known anterior teeth are preserved.

### *Atraktoprion* sp. a

(pl. II)

*Type horizon and locality:* Middle Ordovician, corresponding to the Kukruse stage (CII) of Estonian division. Erratic boulder found in Mochty (prov. of Warsaw).

*Material.* — One specimen No. 0.182/1 consisting of carriers, basal plate, *MI right* and *left*, *MII left* only, and the mandibles.

Denticles formula:

Basal plate	—	7
<i>MI</i>	1 + 8	1 + 8
<i>MII</i>	6	unknown
<i>MIII</i> — <i>MV</i>	unknown	unknown

*Description.* — *Carriers* form two narrow (tr.) arrows, rounded anteriorly, tapering posteriorly. They are widest across the rounded anterior part. Length of the carriers seems to exceed that of the apparatus.

*Basal plate* is subtriangular, wider than long, with 7 denticles, first one being indistinctly larger than the others. Internal, denticulated margin directed posteriorly, posterior margin directed at first transversely, then antero-laterally. Anterior margin directed at first postero-laterally, then forming an arch and directed almost transversely, slightly antero-laterally. Distal part of the plate much shorter (long.) than the proximal, produced into a narrow (long.), elongated (tr.) shank. Ventral view: belt comparatively wide (tr.) anteriorly, narrowing posteriorly, its lateral margin forming an arch surrounding the large opening, occupying the remaining part of the jaw.

*MI right* — hook occupies about 1/3 of the jaw length, 8 denticles, the first one situated within the base of the hook, smaller than the others. Next 7 denticles arranged in a longitudinal row, sharply pointed,



diminishing in size posteriorly. Outer margin directed postero-laterally. Postero-lateral corner rounded. Bight wider than long, occupying less than one third of the jaw length. Ventral view: the opening occupies a little more than half the jaw length. Opposite the anterior part of the opening there is a rounded, large muscle scar.

*MI left* — hook a little longer than in the right jaw. 8 sharply pointed denticles, two posterior being somewhat smaller than others. Round wing along the outer margin. In ventral view the opening occupies about half the jaw length. Opposite the anterior part of the opening there is a large, rounded, muscle scar.

*MII left* — set square shaped, with 6 denticles, the first of which is perceptibly larger than the others. Shank directed transversely, at the distal end bent somewhat posteriorly. The inner margin produced into a large attachment lamella. The whole ventral side occupied by the opening.

*Mandibles* are in the shape of two set squares, touching each other anteriorly with transverse (shorter) branches. The length (long.) of the transverse anterior part is slightly more than one third of the mandible, the width (tr.) about twice as great as that of the longitudinal posterior branch. Longitudinal branches, directed posteriorly, run subparallel to each other, rounded at the posterior ends. Anterior edges are smooth and rounded. On the ventral side each mandible is provided with a semicircular, reticulated surface, occupying the majority of the transverse branch. The reticulated surfaces of two mandibles touch each other, forming a subcircular surface, situated in the middle of the anterior part.

### *Skalenoprion* n.gen.

*Type species: Skalenoprion alatus* n. sp.

*Occurrence:* Ordovician erratic boulders of Poland.

*Derivation of name:* Gr. *skalenos* — uneven, *prion* — saw, on account of the uneven surface of the right MI, provided with an additional ridge.

*Diagnosis.* — Jaw apparatus of prionognatha type. No basal plate. Right MI a compound jaw with a strong curved hook, occupying half or more of the jaw length, with a row of denticles (main ridge) and a short (long.) additional ridge, smooth or denticulated, parallel to the main ridge, situated close to it in the posterior part of the jaw. Left MI single jaw of similar outline, but without an additional ridge. MII symmetrical, elongated plate with a very narrow (long.) shank, perpendicular to the dentary. The carriers and MIII — MV unknown.

*Discussion.* — The material is incomplete (MI and MII only), but MI is so well characterized by the presence of an additional ridge which does not occur in any other known recent or fossil apparatuses of prio-

nognatha type, that the writer has decided to describe it as belonging to a separate genus. *Skalenoprion* is closely comparable with *Atraktoprion* n.gen. here described, and differs from it in the lack of the basal plate and consequently in the lack of bight in the posterior margin of MI, which is a compound jaw. The additional ridge in a compound MI is regarded here as homologous to the basal plate of *Atraktoprion*.

With regard to the detached jaws in *Skalenoprion*, it is possible to distinguish only right MI with any certainty. When isolated MI left of *Skalenoprion* appears similar to that in *Atraktoprion*, and neither this piece, nor the MII pieces allow a fresh identification at generic level. Numerous detached MI right and left of prionognatha type have been described by various authors, but in none of them, judging from the figures and description, was the additional ridge characteristic of the right MI in *Skalenoprion* present.

However in *Arabellites hamiltonensis* (Stauffer), described by Sylvester (1959), the right MI is provided with a postero-lateral wing and there is no bight along its posterior border. On the rather indistinct photograph of this jaw in dorsal view (l.c., pl. 5, fig. 36), there appears an indistinct transverse line in the posterior part of the jaw which, if it is really present on the object, could be interpreted as a line of fusion of two jaws. In the description the author does not mention its presence, nor the presence of any structure which could be compared with the additional ridge. The specimens recorded earlier as *A. hamiltonensis* (Stauffer, 1939, Eller, 1941) represent the left MI and could not throw any light on the question. Anyway the apparatus, to which the jaw in question, figured by Sylvester (1959), belonged, is of prionognatha type, the basal plate being lacking. In this respect it resembles our genus *Skalenoprion*, but without seeing the specimen it is impossible to decide whether it was congeneric or not. It should be noted that the discussed *Arabellites hamiltonensis* described by Stauffer occurs in the Upper Devonian and Lower Mississippian beds, much later than *Skalenoprion* described here.

*Skalenoprion alatus* n.sp.

(pl. III and IV)

*Type specimen:* The specimens No. 0.59/1 composed of MI right and left, and MII right and left, preserved together, figured in pl. III.

*Type horizon and locality:* Ordovician erratic boulder of unknown horizon, found in Władysławowo, prov. of Gdańsk.

*Derivation of name:* Lat. *ala* — wing, provided with wings in the postero-lateral corners of MI.

*Diagnosis.* — Additional ridge in the right MI smooth, occupying less than 1/3 of the length of the main ridge. Fusion furrow indistinct,

perpendicular to the main ridge. Distinct notches in the posterior parts of the external margins, producing the wings in the postero-lateral corners. MI right — 12 denticles, MI left — 8-9 denticles and 2-3 indistinct crenulations. MII symmetrical, elongated (long.), with 7-8 denticles, produced into a short spine at the posterior end, and anteriorly into the transverse shank, at right angles to the dentary.

*Material.* — Nc. 0.59/1 type specimen, described above, in which right and left sides became separated at the time the drawing was made; No. 0.159/3 left MI; No. 0.159/3 right MI; No. 0.159/4 right MI; No. 0.174/1 right MI; No. 0.301/1 right MI.

*Description.* — The arrangement of particular jaws is as follows: The main ridges of MI right and left situated opposite each other, in chewing position that of the left MI covering the right one somewhat dorsally, and posteriorly embraced by the right main ridge and the additional ridge. MII symmetrical, situated below the hooks of MI.

*MI right* — an elongated (long.) compound jaw, extending forwards into a stout, recurved hook. Length of the hook exceeds half the length of the jaw. Along the inner margin a row of 12-13 denticles, decreasing in size backwards. First 8 denticles conical, sharp and larger than the posterior 4-5, opposite the additional ridge, which are smaller, rounded, and in some specimens lacking. Additional ridge in dorsal view indistinct, with a slope on the left side only, the right slope being almost entirely flattened. In dorsal view it somewhat covers the main ridge. In left side view it is more prominent: a distinct rounded ridge, separated from the main ridge by a deep furrow. From the anterior corner of the additional ridge there runs transversely through half the jaw width an indistinct faint furrow. Posterior margin somewhat irregular, running obliquely from the end of the main ridge antero-laterally. External margin directed posteriorly, provided in the posterior part with a distinct angular notch, producing a characteristic wing in the postero-lateral corner of the jaw.

In ventral view, the opening of the pulp cavity occupies less than half the jaw length. Pulp cavity simple, provided with a shallow, curved furrow in the posterior part, associated with the additional ridge. Muscle scar rounded, large. Belt narrow (tr.), below it in the pulp cavity one can see a row of pits, corresponding to the denticles of the main ridge.

*MI left* — is nearly the mirror image of the right one. Main ridge is somewhat shorter, provided with 8-9 denticles and some indistinct crenulations in the posterior part. The main difference concerns the lack of an additional ridge in the left MI. In the place corresponding to the additional ridge there is a distinct, deep longitudinal furrow

that becomes shallow anteriorly. In the chewing position the additional ridge of the right MI comes into this furrow.

*MII right* — is a longitudinal narrow plate, with a row of 8 denticles. The longitudinal part of the jaw is produced posteriorly into a spine. In the anterior part the jaw is produced transversely into a shank, at right angles to the dentary. The shank is thin (long), tapering peripherally. The length (tr.) of the shank is less than a half of the jaw length (long.). Pulp cavity open, the entire ventral side being occupied by the opening. On the ventral side one can see a row of distinct pits, corresponding to the denticles.

*MII left* — is almost a mirror image of *MII right*, only being a little longer. The anterior part of the inner margins of both jaws are produced into the attachment lamellae which (as preserved in one specimen) are fused together. The attachment lamellae are irregular, large, directed perpendicularly to the jaw surface and standing out somewhat anteriorly.

### *Kalloprion* n.gen.

*Type species: Kalloprion ovalis* n.sp.

*Occurrence:* Ordovician erratic boulders of Poland.

*Derivation of name:* Gr. *kallos* — beautiful, *prion* — saw.

*Diagnosis.* — Asymmetrical jaw apparatus of labidognatha type. Carriers paired, arrow shaped, in length equal more or less to MI. Basal plate subtriangular, longer than wide. MI with first denticle somewhat stronger than the rest. Large bight along the posterior border of MI right. MII paired with rounded anterior part, produced externally into a short shank, directed posteriorly, and internally into an elongated part, provided with a ridge of denticles. MIII single, left, subtriangular with a concave posterior border, provided externally and internally with longitudinally directed short shanks. MIV poorly known with 4-5 denticles. MV — imperfectly known teeth.

*Discussion.* — *Kalloprion* n.gen. here described, though recorded above as a labidognath, displays some features characteristic of prionognaths, and is in some ways intermediate between these two types. In all known fossil and recent labidognaths, the carriers are comparatively short and wide, in prionognaths — on the contrary — they are arrow-like, elongated. In *Kalloprion* the carriers are arrow-like but not as long as is usually characteristic of prionognatha type. Otherwise the shape of MI and arrangement of MII — MIII is more like those in the labidognaths.

*Kalloprion* n.gen. differs from *Polychaetaspis* Kozłowski and *Polychaetura* Kozłowski mostly in having differently shaped carriers and in the shape of MI and the basal plate, which in the new genus are pro-

vided with wide, transverse bases, whereas in *Polychaetaspis* and *Polychaetura* they taper posteriorly. Moreover the openings of the pulp cavities in MI of *Kalloprion* are smaller and MII - MIII are differently shaped. Lateral teeth characteristic of *Polychaetura* and *Polychaetaspis* have not been found in *Kalloprion*.

From *Paulinites* Lange the new genus differs in having the carriers more elongated, the basal plate larger and subtriangular (whereas it is subrectangular in *Paulinites*), MI differently shaped with the first denticle not developed as a distinct hook and larger openings of the pulp cavity, and in having MII distinctly smaller and differently shaped. Similar differences concern *Kettneraspis* Žebera (see Žebera, 1935, and Šnajdr, 1951) which is a genus closely related to *Paulinites* Lange. A comparison with *Ramphoprion* n.gen. is given on p. 314/315.

With regard to the detached jaws, very few plates similar to those of *Kalloprion* have so far been described. The carriers described by Eisenack (1939) as *Orthopelta navis* Eisenack, are somewhat similar to those of *Kalloprion*, but they have different proportions being comparatively longer with regard to their width, and it is doubtful whether they are congeneric. *Protarabellites dubius* Stauffer (Stauffer, 1933) shows similarities to the right MI in *Kalloprion*, but differs in having the posterior prolongation of the denticulated ridge less thin and not bent outside, as is characteristic of *Kalloprion*. As the jaw was not figured in ventral view, it is difficult to decide how great are the similarities. The jaws described by Hinde (1879) as *Arabellites lunatus* and *A. cristatus*, show some similarities to MII (right and left) of *Kalloprion*, but they are too poorly known to venture an opinion, whether they could be regarded as congeneric. Much the same is true of *Leodicites acclivis* Eller (Eller, 1943) which shows similarities to the left MII in *Kalloprion*.

*Kalloprion ovalis* n.sp.

(pl. V—VII)

*Type specimen*: Nearly entire apparatus, No. 0.400/15 figured on pl. V.

*Type horizon and locality*: Probably lowermost part of the Upper Ordovician, corresponding to the Rakvere stage (E) of Estonian division. Erratic boulder of Mochty, Warsaw district.

*Stratigraphic range*: Middle Ordovician (Kukruse stage) — Upper Ordovician (Rakvere stage).

*Derivation of name*: Lat. *ovalis* — oval, from the suboval shape of MI right and left, when preserved together.

*Diagnosis*. — As for the genus.

*Material*. — No. 0.400/15 type specimen: carriers, basal plate, MI right and left, MII right and left, MIII single left, MIV right and left, and imperfectly preserved, uncertain MV; No. 0.400/229 basal plate

and MI right; No. 0.366/3 basal plate, MI right and left, MII right and left, MIII left; No. 0.366/43 MI left, MII left, MIII left; No. 0.182/39 MI left; No. 0.182/40 M left.

*Remark.* — In addition to the apparatuses cited above, two assemblages of *Kalloprion* were found in the sample from the boulder No. 0.398; these differ from *K. ovalis* n.sp. mostly in the shape of the basal plate, which is narrower and more elongated than in *K. ovalis*. It is probable that the specimens from the boulder No. 0.398 represent another species of *Kalloprion*, which will be elaborated later.

Denticles formula:

Basal plate	—	9—10
MI	1+10—13	1+11—13
MII	7—10	9
MIII	8—9	—
MIV	6	4?
MV	1?	1?

*Description.* — *Carriers* preserved in one specimen only (No. 0.400/15) are displaced from their normal position and situated obliquely nearly perpendicularly with respect to the length of the apparatus. They form two arrows rounded anteriorly, tapering posteriorly. They are widest across the anterior rounded part. Length to maximal width ratio of a single carrier is about 5.3. On the dorsal side there are indistinct, sublongitudinal thread-like lines, bent somewhat outside. Length of the carriers is more or less equal to that of MI.

*Basal plate* is subtriangular, longer than wide, usually with 9 denticles, the first of which is slightly larger than the rest. Posterior border is directed at first transversely, then antero-laterally. Anterior border directed postero-laterally, meeting the posterior border at the posterior end of the jaw. In one specimen No. 0.366/3 (cf. pl. VI) the basal plate is somewhat differently shaped, anterior and posterior borders meeting each other half way along the jaw. These differences are due to the fact that the distal, narrow (long.) part, which is thinner and more transparent than the rest of the jaw, may be easily broken off.

*MI right* — is elongated longitudinally, 2.5 times longer than wide. First denticle is somewhat stronger than the rest which are situated behind it without an interval. Most often 12 denticles decreasing in size posteriorly. Bight somewhat longer than wide, occupying more than one third of the jaw length. Internal margin directed posteriorly, the most posterior, narrow part of the jaw, opposite the bight bent postero-laterally. External margin directed postero-laterally, then posteriorly. The middle part of the jaw, behind the first denticle, somewhat concave. Along the external margin, in the prolongation of the first denticle, the jaw is slightly inflated, forming an indistinct border, pro-

duced into a short (long.) rounded shank, in the postero-lateral corner. Ventral view: the opening occupies  $\frac{4}{5}$  of the jaw length. Belt narrow, along it there run a deep furrow with a row of pits. In the middle part of the opening there is a subtriangular swelling, associated with the deepening on the dorsal side. Along the external margin the wall of the jaw is thicker. In some specimens at the internal margin a remnant of an attachment lamella is preserved.

*MI left* — is elongated longitudinally, 2.5 times longer than wide. First denticle somewhat larger than the others. Internal margin directed at first posteriorly, then postero-laterally. A row of about 12 denticles decreasing in size posteriorly. Posterior margin directed at first transversely, then bent and directed antero-laterally. External margin directed postero-laterally. Postero-lateral corner situated a quarter of the way along the jaw from behind. In the posterior part of the jaw a deep, longitudinal furrow, parallel to the dentary, situated close to it, running through one third of the jaw length. External border, in the prolongation of the first denticle, especially in the anterior part somewhat inflated. Ventral view: opening occupies  $\frac{4}{5}$  of the jaw length. Parallel to the internal margin, a row of pits, corresponding to the denticles, is distinctly seen. In the middle part of the opening there is a large subtriangular swelling.

*MII right* — anterior part of the jaw is subcircular, produced posteriorly into two shanks, internal one longer, directed posteriorly, with the row of denticles, and external one much shorter, directed somewhat postero-laterally. 9 denticles, 5 of which are larger and sharp, next smaller and rounded. Posterior margin between two shanks concave. Along the anterior and external margins, in the prolongation of the first denticle, there runs a somewhat swollen border, produced into the external shank. The wall of the jaw behind this border is somewhat concave. Ventral view: the opening occupies the majority of the jaw, the narrow belt of the jaw being preserved along the anterior and interior margins. In the middle of the opening there is an inflation on the jaw, associated with the concavity on the dorsal side. Along the internal margin, a more or less large attachment lamella is preserved.

*MII left* — is nearly a mirror image of *MII right*.

*MIII left* — is similar in shape to *MII left*, but smaller and with shorter (long.) shanks. Attachment lamella preserved.

*MIV right* — is imperfectly known, preserved in one specimen in abnormal position and somewhat damaged (see pl. V) with about 4 denticles.

*MIV left* — similarly imperfectly known, jaw rounded anteriorly with 6 denticles, the first one somewhat longer than the other, external margin produced into a short shank.

*MV right* — in front of MIV there is, preserved in one specimen only, an imperfectly known tooth which seems to be composed of a single tapering tooth, directed longitudinally, and a transverse, long (tr.) shank at its base, situated at right angles. The tooth is however very poorly known and the above description is tentative only.

*MV left* — only a remnant of it is preserved in one specimen, but it is too poorly known to be properly described.

*Anterior teeth* — there is some evidence based on the specimen. No. 0.400/15 that in front of MV there were some paragnaths, which are too poorly known to be discussed.

*Variation.* — The specimens recorded by the author within *Kalloprion ovalis* n. sp. differ in some details. The differences concern mostly the shape of the basal plate (see p. 312). Moreover, MI of the specimen No. 0.366/3 differ from the other specimens in having the first and second denticles in both right and left jaws of almost equal size, whereas in the remaining specimens the first denticle is distinctly larger (see pl. VI). Otherwise, the specimen No. 0.366/3 is almost identical with the others and it seems to the present writer that the above cited differences may be regarded as due to individual variation.

### *Ramphoprion* n. gen.

*Type species: Ramphoprion elongatus* n. sp.

*Occurrence:* Ordovician erratic boulders of Poland, Ordovician (Trenton) of Ontario, Quebec and New York, Upper Ordovician of United States (Minnesota).

*Derivation of name:* Gr. *ramphos* — beak, *prion* — saw, on account of the beak-like anterior denticle in MI.

*Diagnosis.* — Asymmetrical jaw apparatus of labidognatha type. Carriers very small, short (long.), equal to one third of MI length. Basal plate subtriangular, longer than wide. Strong right lateral tooth (left one so far never preserved). MI narrow, elongated jaws with strong first denticles and numerous small behind it. The opening occupying less than a half of the jaw length. MII paired jaws elongated longitudinally, with rounded anterior part, produced externally into a short shank and internally into an elongated part with a ridge of denticles. Left MII somewhat larger, situated further backwards than right MI. Openings in MII occupying less than half the length of the anterior part. MIII single left, distinctly smaller than MII, anterior margin rounded, posterior concave, opening small.

*Discussion.* — The new genus here described differs from all known fossil labidognatha genera in having very small, short (long.) carriers, and strongly elongated MI. Similarly shaped carriers occur in *Paulinites* Lange and *Kettnerites* Žebera, in *Ramphoprion* they are however shorter.



Moreover, the basal plate is in the new genus longer, the lateral tooth, lacking in *Paulinites* and *Kettnerites*, is here present, and lastly MII are in the new genus comparatively smaller and differently shaped. *Ramphoprion* differs from *Polychaetaspis* Kozłowski and *Polychaetura* Kozłowski in having differently shaped carriers, basal plate shorter in comparison with the length of MI, and in having pulp cavity of MI strongly enclosed, whereas in both *Polychaetura* and *Polychaetaspis* the openings are very large, the pulp cavities being slightly enclosed. The similarities between *Ramphoprion* and *Polychaetaspis* concern the presence of lateral teeth.

From *Kalloprion* n. gen. above described *Ramphoprion* n. gen. differs mostly in the shape of the carriers and the basal plate, which in *Kalloprion* is comparatively shorter and differently shaped, and in having differently shaped MI, with much smaller openings of the pulp cavities. MII and MIII are somewhat similar in both genera, but in *Kalloprion* they are distinctly concave on the dorsal side and ventrally provided with much larger openings of the pulp cavities than in *Ramphoprion*.

As *Ramphoprion* is comparatively poorly known, the assemblage of only one species being found so far, it is difficult to decide with any certainty what is the range of variability of particular jaws within this genus. The isolated MI right and left, which could be attributed to *Ramphoprion*, have been described and figured by various authors, and they are discussed below. The following list has, however, a tentative character only, showing that some isolated jaws are similar to those in *Ramphoprion*, without stating with certainty that they are congeneric.

*Protarabellites glenwoodensis* Stauffer (Stauffer, 1933) may represent left MI of *Ramphoprion* n.gen., *Nereidavus procurvus* Eller (Eller, 1943) — left MI, *Oeononites conterminus* Eller (Eller, l.c.) may represent left MI, but as the jaw is figured only in side view, it is possible that the similarities are here illusory. *Lumbriconereites longae* Eller and *L. angustifossus* Eller (Eller, 1945) may represent right MI. Lastly in the same paper Eller described some jaws, recorded by him as belonging to *Nereidavus* (e.g. *N. avinoffi* Eller and *N. alatus* Eller, cf. Eller, 1945), which though differing in details, show some similarities to MI left of *Ramphoprion*.

*Ramphoprion elongatus* n.sp.

(pl. VIII, IX, X; text — fig. 2B)

*Type specimen*: The apparatus composed of the carriers, basal plate, MI right and left, right lateral tooth, MII right and left, and MIII single, left, No. 0.398/1, figured on pl. VIII.

*Type horizon and locality:* Middle Ordovician, corresponding to the Keila stage (DII) of Estonian division. Erratic boulder found in Mochty, prov. of Warsaw.

*Diagnosis:* As for the genus.

*Derivation of name:* Lat. *elongatus* — on account of the strongly elongated MI.

*Material.* — No. 0.398/1 — type specimen; 0.398/2 — basal plate, MI right, and right lateral tooth; 0.398/12 — MI right; 0.398/14 — MII left; 0.398/15 — MI left, strongly depressed.

Denticles formula:

Basal plate	—	13
MI	24—26	18—20
MII	12	?
MIII	?	—
MIV, MV	unknown	unknown

*Description.* — *Carriers* small, equal to about one third the length of MI. Each carrier is subtriangular, widest anteriorly, tapering posteriorly, width to length ratio being about one to four. Carriers touch each other along three quarters of their length.

*Basal plate* subtriangular in outline, longer than wide, with 13 denticles of nearly equal size. Anterior margin directed at first posterolaterally, then transversely. Posterior margin short (tr.) directed transversely. Outer margin directed at first (from behind) anteriorly, then antero-laterally. Proximal part of the plate much longer (long). than the distal one, which is distinctly triangular. In ventral view the belt is comparatively narrow, wider anteriorly, narrowing posteriorly.

*Lateral tooth* is a strong tooth, bent anteriorly, terminating with a sharp point, equal to more than one third the length of MI. Opening at the base, occupies a little less than one third of the tooth length. In specimen No. 0.398/1 the tooth comes close to MI dorsally, its opening being on the dorsal side. In specimen No. 0.398/2 the tooth is outturned, fastened to the right MI laterally, the opening being situated ventrally, the point directed outside. By analogy with numerous, so far undescribed specimens of *Polychaetaspis*, in which lateral teeth are preserved close to MI, with the openings arranged dorsally, it seems that the position of the tooth in specimen No. 0.398/1 is natural.

*MI right* — elongated jaw, bottle shaped in dorsal view, about 3 times longer than wide, with 18—20 denticles. First denticle distinctly larger than the other, situated outside the prolongation of the dentary. First 6—7 denticles comparatively small, increasing in size posteriorly, next 6—8 larger, conical, directed backwards, most posterior 6—7 denticles smaller, decreasing again in size posteriorly, rounded. Bight occupying one third of the jaw length, longer than wide, its anterior border directed transversely. Outer margin runs from the first denticle at first posteriorly, then postero-laterally to the triangular postero-lateral

corner, then transversely, surrounding the bight and postero-medially to the rounded end of the jaw. The internal margin runs at first posteriorly, then forms an arch convex externally and runs postero-medially. The maximal width of the jaw is in front of the bight, across the postero-lateral corner. The left slope, steep anteriorly, becomes flattened half way along the jaw, where the jaw is at its widest. The right slope is moderately steep anteriorly, becomes very steep in front of the bight and also opposite the bight, where there is a deep subtriangular depression in the dorsal wall of the jaw.

In left lateral view the jaw is narrow, five times longer than wide, first denticle distinctly larger than the remaining, directed at right angles to the length of the dentary. The differences in the size of denticles are plainly visible in this view. In the middle of the jaw length, the posterior part of the opening is visible.

In right lateral view, first denticle is similarly prominent. Proportions are like those in the left view. Posteriorly a large part of the opening is visible and one can see that the ventral side of the postero-lateral corner, occupied by the opening, is distinctly convex.

In ventral view, more than half of the jaw length is occupied by the opening. In the middle of the opening there is a distinct subtriangular inflation, corresponding to the subtriangular depression on the dorsal side. This swelling is surrounded on the right side by a deep longitudinal furrow with a row of pits at the bottom, corresponding to the denticles, and on the left side by the obliquely directed furrow, running from the middle anterior part of the opening to the end of the postero-lateral corner. The anterior part of the postero-lateral corner in front of the furrow forms a distinct, elongated swelling.

*MI left* — is bottle shaped in dorsal view, three and a half times longer than wide, with about 24 denticles. First denticle distinctly larger than the rest, situated outside the prolongation of the dentary. As in the right jaw, the denticles are largest in the middle of the jaw, decreasing in size both anteriorly and posteriorly. The outer margin is directed at first postero-laterally, then forms an arch convex externally and directed postero-medially, to the transverse, short posterior margin. The interior margin runs in the anterior part quite close to the dentary, so that the anterior part of the right slope is not visible in dorsal view, then it turns outwards and runs postero-laterally to the corner, situated a quarter of the way along the jaw from behind, turns once more and runs postero-medially to the transversal posterior margin. The left slope, comparatively flattened anteriorly, becomes very steep in the posterior part. The right slope is also steep posteriorly, where the dentary is elevated. From the posterior margin there runs anteriorly a very deep, distinct furrow, situated close to the dentary on its left side,

through about a quarter of the jaw length. Outside this furrow, parallel to it, there is a longitudinal inflation. In both right and left lateral views the jaw is very narrow, first denticle arranged at right angles to the dentary, denticles well visible. In ventral view the opening is somewhat shorter (long.) than in MI right, occupying less than half the jaw length. Along the opening, on the left side, there runs a very deep, longitudinal furrow, with deep pits, corresponding to the denticles.

*MII left* is a jaw rounded anteriorly, with a concave dorsal wall and a row of 12 denticles along the internal margin, decreasing in size posteriorly. In both specimens: No. 0.398/1 (where MII is preserved in an assemblage) and No. 0.398/14 (representing detached MII) the denticles are large and flat, distinctly worn out. The outer margin of the jaw extends into a short, longitudinally directed pointed shank. Posterior margin, enclosed between the shank and the ridge of denticles, is concave. In ventral view the opening covers the shank, the interior prolongation with pits corresponding to the denticles and one third of the anterior part of the jaw. Along the elongated part with pits, a part of the dorsal wall of the jaw is visible on the left side. It is produced into an imperfectly preserved attachment lamella.

*MII right* — is shaped similarly to MII left, somewhat shorter (long.). As it is preserved only in an assemblage (No. 0.398/1), hidden somewhat under MI right, it is difficult to estimate the exact number of denticles and to describe it in detail.

*MIII left* — is a subtriangular jaw, produced externally into a short, posterolaterally directed shank and internally into a short prolongation with denticles. Its anterior margin is convex, the posterior one concave. The opening occupies about one third or more of the jaw length. As in MII right, the exact number of denticles is difficult to ascertain.

### *Xanioprion* n.gen.

*Type species: Xanioprion borealis* n.sp.

*Occurrence:* Ordovician erratic boulders of Poland.

*Derivation of name:* Gr. *xanion* — comb, *prion* — saw, on account of the comb-like structure of M<sub>2</sub>.

*Diagnosis.* — Nearly symmetrical jaw apparatus, consisting of three jaws on each side and some imperfectly known anterior teeth. Carriers unknown. M<sub>1</sub> elongated jaw, arranged internally, M<sub>3</sub> in its anterior prolongation, anteriorly bent outwards. M<sub>2</sub> narrowly open jaw, parallel to M<sub>1</sub> and to the longitudinal part M<sub>3</sub>, covering them somewhat dorsally, in the anterior part bent outwards, following the course of M<sub>3</sub>.

*Discussion.* — Among the fossil and recent eunicid apparatuses, only *Vistulella* Kielan-Jaworowska invites comparison (see fig. 4).

*Xanioprion* and *Vistulella* are alike in the presence, in the posterior part of the apparatus, of two parallel jaws on each side, the external one somewhat covering the internal one dorsally. The main difference concerns the fact that the apparatus of *Vistulella* is strongly asymmetrical, whereas it is almost entirely symmetrical in *Xanioprion*.

The right side of *Xanioprion* recalls the right side of *Vistulella* in the arrangement of  $M_1$ , which in both genera are elongated, with open pulp cavities. However  $M_1$  is in *Xanioprion* much shorter (long.), occupying a half or less of the apparatus, whereas in *Vistulella* it occupies nearly three quarters of the apparatus.  $M_2$  in both forms is similarly situated, covering  $M_1$  somewhat dorsally, however in *Xanioprion* the denticles of  $M_2$  are more distinctly separated from each other, particularly so in the anterior part, whereas in *Xanioprion* they are very large, each provided with its own pulp cavity. The main differences concern the remaining jaws, as in *Xanioprion* in front of  $M_1$  there is one jaw, called here  $M_3$ , situated in the prolongation of  $M_1$ , whereas in *Vistulella* there are two jaws in front of  $M_1$ , both bent somewhat outside anteriorly, but it would be beyond the scope of the present paper to discuss whether one of them should be regarded as homologous with  $M_3$  in *Xanioprion*.

With regard to the left side of *Vistulella*, the similarities are still closer. This side in *Xanioprion* consists of three jaws, but only two in *Vistulella*. However, in the place occupied by  $M_1$  and  $M_3$  in *Xanioprion*, *Vistulella* has an elongated jaw, anteriorly bent outwards, very similar in shape and arrangement to  $M_1$  and  $M_3$  of *Xanioprion*, if these were fused together. The arrangement of  $M_2$  is in both genera identical.

With regard to the detached jaws, so far described, only *Leodicites sublunatus* Walliser, from the Ludlovian of the Canadian Arctic Archipelago shows similarities to  $M_3$  in *Xanioprion*. Walliser (1960), describing *Leodicites sublunatus*, compared it with several species (see Walliser, 1960, p. 24). All the jaws cited by him, have a denticulated ridge, straight or bent somewhat anteriorly, in none however does the ridge extend onto the shank, to the lateral corner of the jaw. In  $M_2$  of *Xanioprion* the denticulated ridge follows the curvature of the jaw, extending as a crenulated ridge to the lateral extremity of the jaw. Judging from the illustration of *Leodicites sublunatus* (Walliser, 1950, pl. 5, fig. 4 a, b), the ridge (smooth or slightly crenulated) reaches the lateral extremity of the jaw, as is characteristic of *Xanioprion*. Otherwise, as far as the writer knows, no jaws which could be regarded as congeneric with particular jaws in *Xanioprion* have ever been described.

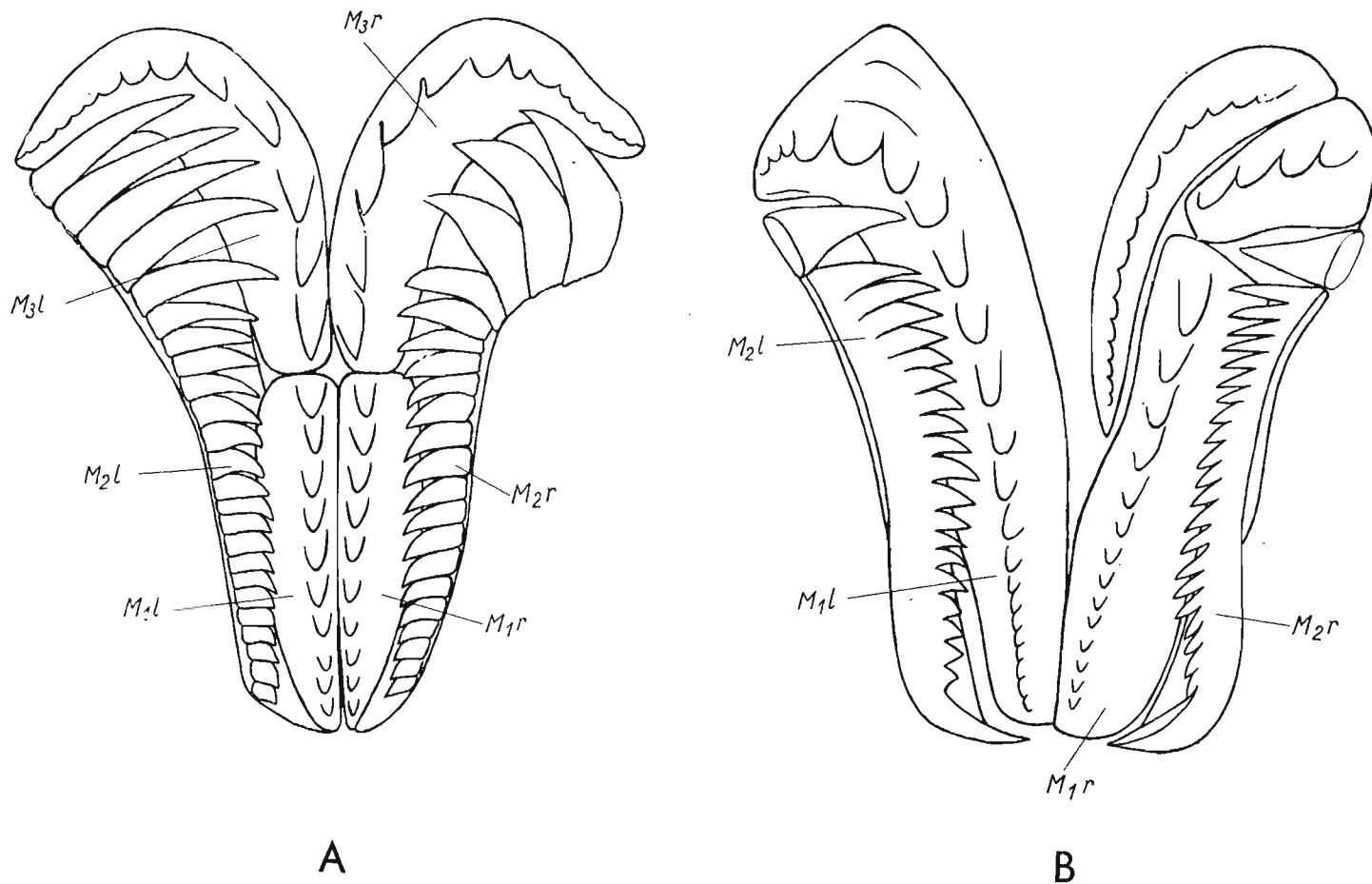


Fig. 4. — Diagrammatic sketches of the jaw apparatuses: A *Xanioprion borealis* n. gen., n. sp., B *Vistulella kozlowskii* Kielan-Jaworowska. Both species from the Ordovician erratic boulders of Poland. Anterior jaws on the right side in *Vistulella* not numbered, as their homology with those of *Xanioprion* is not clear.

*Xanioprion borealis* n. sp.

(text-fig. 4; pl. XI, XII, XIII)

*Type specimen:* The apparatus No. 0.400/140 figured on pl. XI.

*Type horizon and locality:* Probably lowermost part of the Upper Ordovician, corresponding to the Rakvere stage (E) of Estonian division; erratic boulder found in Mochty, prov. of Warsaw.

*Stratigraphic range:* Middle Ordovician (Kukruse stage) — Upper Ordovician (Rakvere stage).

*Derivation of name:* Lat. *boreas* — north wind, *borealis* — coming from the north.

*Diagnosis.* — As for the genus.

*Material.* — No. 0.400/140 — type specimen, consisting of right and left  $M_1$ ,  $M_2$  and  $M_3$ , and two left anterior teeth; No. 0.142/2 — right  $M_2$  and  $M_3$ ; No. 400/140 — right  $M_1$  and  $M_2$ ; No. 0.279/3 — right  $M_2$ .

*Description.* — Right side.  $M_1$  right elongated jaw, tapering posteriorly. Anterior margin directed transversely, pulp cavity open. 9—11 sharp denticles decreasing in size posteriorly. Right and left slopes comparatively steep. On the left slope there are indistinct furrows, being the prolongations of the boundaries between the denticles, which do not reach the margin of the jaw.

$M_2$  right — elongated jaw, compressed laterally with pulp cavity narrowly open, consisting of 15–21 small denticles in the posterior part and 6 larger teeth anteriorly. Anterior part of jaw, consisting of individual teeth, which are provided with separate pulp cavities, is much wider (tr.) than the posterior. As however, even in the detached  $M_2$ , they are always preserved together with the posterior part of the jaw, it seems reasonable to the present writer to describe both anterior and posterior parts together, as one jaw. The posterior part is arranged longitudinally, the anterior one may be bent somehow outwards, following the bow of  $M_3$ , which covers it partly dorsally. In the dorsal view of the apparatus, the ridge of denticles forms the left margin of the jaw. The particular teeth of the anterior part of the jaw are distinctly separated from each other, sometimes one partly covering another. First and second teeth are usually smaller than the third and fourth, which are the largest. Next two teeth are smaller again, especially the sixth, which is slightly larger than the first denticles of the posterior part of the jaw. The size of teeth in particular jaws may vary. Teeth are long (tr.) and sharply pointed, each provided with a rectangular opening into the pulp cavity, arranged laterally, best seen in side view. In ventral view a part of the openings is seen. Anteriorly the jaw is produced into a longitudinal, pointed prolongation, running from the base of the first denticle anteriorly. In cross section it is convex dorsally, concave ventrally. The points of the teeth are bent upwards,

following the right slope of  $M_3$ . The largest teeth of the anterior part of the jaw are about three times longer (tr.) than the denticles of the posterior part. In the posterior part the denticles are directed transversely, their tips being bent posteriorly. On both right and left slopes the boundaries between the denticles are visible and reach the margin of the jaw. The left slope comparatively narrow anteriorly, widens posteriorly, causing the somewhat curved course of the posterior part of the denticulated ridge. The posterior margin of the jaw forms an undenticulated ridge, directed transversely, somewhat postero-medially. The right slope is somewhat wider than the left one. At the base of denticles it extends into a thin pellicle, often broken off. Posteriorly this pellicle separates from the jaw as a longitudinal thin ridge, running parallelly to the jaw and following its course in the posterior part, bent postero-medially behind the jaw, reaching the middle posterior point of the apparatus, where  $M_1$  and  $M_2$  right and left meet each other. The pulp cavity in the posterior part of  $M_2$  is best seen in lateral view and is divided into several large pits, associated with particular denticles, fused however into one compound pulp cavity.

*M<sub>3</sub> right* — a jaw in the form of an arch, with a row of 12—16 denticles and with a gaped pulp cavity. The posterior part of the jaw, arranged in the prolongation of  $M_1$ , is directed longitudinally; the anterior, subtransversal part forms an arch convex anteriorly, its distal, tapering part being bent postero-laterally. The denticles are compressed laterally and are the largest in the longitudinal part, where they are sharply pointed, directed posteriorly. Anteriorly, the denticles decrease in size somewhat, but in the transversal part they are still comparatively large. Laterally, in the tapering distal part, the denticles decrease in size significantly, forming only more or less distinct crenulations along the ridge. The number of larger denticles varies between 8 and 11, the number of crenulations between 5 and 8. The denticulated ridge divides the jaw between the concave right and convex left slopes. The denticles directed posteriorly overhang the right slope. On the left slope there are furrows forming the prolongations of the boundaries between the denticles. They are more distinct in the longitudinal part of the jaw, where they reach the base of the jaw. In the anterior transversal part they may disappear.

Left side — is more or less a mirror image of the right side. In one specimen (No. 0.400/140), where right and left sides are preserved together, there are some differences in the shape of particular teeth and in the number of denticles of right and left  $M_2$ , as well as in the shape of right and left  $M_3$ . The differences between the right and left sides in this specimen are not, however, greater than between the parti-



cular specimens of the right side, and they range within the individual variation. In specimen No. 0.400/140, the differences between the right and left sides are partly due to the state of preservation (e. g. right  $M_3$  is slightly compressed).

*Anterior teeth* — in specimen No. 0. 400/140 there are two anterior teeth, preserved in front of the left  $M_3$ . The first, smaller one, is a jaw consisting of two pointed branches, at right angles to each other. One shorter is directed longitudinally, slightly bent and covers  $M_3$  dorsally with its pointed end. The transversal branch is directed along the anterior margin of  $M_3$ . Anteriorly a remnant of the attachment lamella is seen. The ventral side is poorly known, as it is covered by the next tooth. The second tooth is larger than the first one, situated below and in front of it. Its posteriorly directed branch is narrow and curved, touching  $M_3$  with its point. The transversal branch is subtriangular, directed transversely, and provided on the ventral side with the opening of the pulp cavity. An imperfectly preserved attachment lamella embraces the anterior edge of the tooth.

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Warszawa, March 1962*

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ZOFIA KIELAN-JAWOROWSKA

NOWE RODZAJE ORDOWICKICH APARATÓW SZCZĘKOWYCH  
WIELOSZCZETÓW (ANNELIDA, POLYCHAETA)

*Streszczenie*

W roku 1960 autorka przystąpiła do opracowywania kolekcji aparatów szczękowych wieloszczetów z ordowickich głazów narzutowych Polski. Część tej kolekcji została opracowana przez Kozłowskiego (1956), który opisał 3 gatunki, należące do rodzajów *Polychaetaspis* Kozłowski i *Polychaetura* Kozłowski, oraz przez Kielan-Jaworowską (1961), która opisała dwa gatunki, należące do rodzajów *Mochtyella* Kielan-Jaworowska i *Vistulella* Kielan-Jaworowska. W roku 1961, opisując rodzaje *Vistulella* i *Mochtyella*, autorka nadmieniła, że kolekcja aparatów szczękowych wieloszczetów z głazów narzutowych, przekazana jej do opracowania przez Profesora Romana Kozłowskiego, obejmuje wiele tysięcy izolowanych szczęk oraz kilkadziesiąt aparatów szczękowych. Ponieważ od tego czasu głazy narzutowe były nadal zbierane przez Prof. Kozłowskiego, Doc. Urbanika i autorkę oraz systematycznie rozpuszczane w kwasach solnym i octowym w Zakładzie Paleozoologii PAN w Warszawie, opracowywana kolekcja wzrosła znacznie, tak że obejmuje ona obecnie ponad 400 mniej lub bardziej kompletnych aparatów szczękowych wieloszczetów. Ponieważ opracowanie całej kolekcji musi zająć dłuższy okres czasu, autorka zdecydowała się opublikować osobno opisy pięciu nowych rodzajów, wyróżnionych dotychczas w toku badań.

Wszystkie opisane tu rodzaje zaliczone są do nadrodziny Eunicea. Ustalenie mniejszych jednostek systematycznych takich, jak rodziny i podrodziny, w obrębie kopalnych Eunicea zostanie dokonane później. Wśród wyróżnionych tu 5 rodzajów, dwa: *Atraktoprion* n. gen. i *Skalenoprion* n. gen. są typu prionognatycznego. Znalezienie ich jest interesujące z tego względu, że prionognatyczne aparaty szczękowe nie były dotychczas znane w stanie kopalnym. Tylko pojedyncze szczęki, opisywane pod nazwami rodzajowymi *Arabellites* Hinde, *Protarabellites* Stauffer i *Ildraites* Eller, wydają się przedstawiać maxille pierwszej pary (MI) aparatów prionognatycznych. Rodzaj *Atraktoprion* stanowi aparat szczękowy,

złożony z długich, parzystych podpór, nieparzystej prawej płytki bazalnej, parzystych MI, opatrzonych dużymi, zagiętymi kolcami przednimi, parzystych MII w formie kątownicy, nieparzystej lewej MIII, niewielkich trójkątnych parzystych MIV oraz parzystych MV, stanowiących u opisanego tu *Atraktoprion cornutus* n.sp. pojedyncze zęby. Jeżeli porównać aparat szczękowy *A. cornutus* n.sp. z aparatem szczękowym dzisiejszych wieloszczetów o szczękach prionognatycznych takich, jak np. *Aglaurides fulgida* Savigny, *Halla parthenopeia* (Delle Chiaje) i innymi (por. fig. 2), to podobieństwo dotyczące liczby, kształtu i układu poszczególnych płytek w aparatach jest tak uderzające, że wydaje się, iż są wszelkie podstawy, aby poszczególne szczęki u dzisiejszych prionognatycznych aparatów numerować w sposób wykazany na fig. 2. W interpretacji tej, pierwsza płytka szczękowa z prawej strony uznana jest za homologiczną płytce bazalnej i nie jest numerowana, natomiast umieszczona przed nią duża płytka (druga), podobna kształtem i wielkością do pierwszej płytki z lewej strony, uznana jest za MI — za parę pierwszej szczęki z lewej strony. Następnie otrzymamy u form dzisiejszych, podobnie jak u kopalnych, parzyste MII, nieparzystą MIII oraz parzyste MIV i MV. Przyjęcie tej interpretacji pozwoli na oznaczanie w jednolity sposób kopalnych i dzisiejszych szczęk, i to zarówno w typie prionognatycznym, jak i labidognatycznym, wskazując, że różnice między dzisiejszymi prionognatycznymi i labidognatycznymi aparatami są znacznie mniejsze, niż przyjmowano dotychczas, i polegają na zaniku płytki bazalnej u dzisiejszych form labidognatycznych (por. fig. 3), płytki, która występuje jednak u kopalnych aparatów tego typu.

*Skalenoprion* n.gen. — drugi z opisanych w niniejszej pracy aparatów prionognatycznych, jest mniej poznany; najbardziej kompletny zespół składa się z MI prawej i lewej oraz MII prawej i lewej. U rodzaju tego nie występuje płytka bazalna i obie szczęki MI są prawie symetryczne, jednak w prawej szczęce MI na dole występuje dodatkowy rząd ząbków (który niekiedy, jak np. u opisanego tu *Skalenoprion alatus*, może być gładki i tworzyć tylko wypukłą listewkę). Autorka uważa, że dodatkowy rząd ząbków u *Skalenoprion* można uznawać za homologiczny płytce bazalnej *Atraktoprion* i innych aparatów prionognatycznych.

*Kallopriion* n.gen. i *Ramphoprion* n.gen. przedstawiają aparaty typu labidognatycznego. *Kallopriion*, mimo że zaliczony do typu labidognatycznego, wykazuje pewne cechy charakterystyczne dla aparatów prionognatycznych, mianowicie obecność długich podpór, zbliżonych do tych, jakie występują u kopalnych i dzisiejszych form prionognatycznych. U *Kallopriion* jednak podpory te są stosunkowo krótsze i szersze, niż w typie prionognatycznym. Poza tym aparat ten składa się z płytki bazalnej, parzystych MI i MII, pojedynczej MIII oraz parzystych, stosunkowo słabo poznanych MIV i MV.

*Ramphoprion* przedstawia aparat prionognatyczny charakteryzujący się obecnością bardzo krótkich, trójkątnych podpór i bardzo długich MI. Układ szczęk jest tu typowy dla form labidognatycznych. Cechą charakterystyczną rodzaju *Ramphoprion* jest występowanie zęba lateralnego, którego obecność została stwierdzona przez Kozłowskiego (1956) u *Polychaetaspis warkae* Kozłowski.

U *P. warkae* zęby lateralne występują symetrycznie, umieszczone skośnie w przednich częściach MI, przykrywając je od strony grzbietowej. U *Ramphoprion* stwierdzono obecność tylko jednego (prawego) zęba lateralnego, sądząc jednak z podobieństwa do *P. warkae* można przypuścić, że i w tym rodzaju występowały dwa parzyste zęby.

*Xanioprion* n.gen. przedstawia typ budowy aparatu szczękowego który nie może być zaliczony ani do typu prionognatycznego, ani do labidognatycznego. Zdaniem autorki, również i dzisiejszy rodzaj *Dorvillea* Parfitt przedstawia typ budowy odmienny, niż wymienione tu typy, i powinien być wyeliminowany z typu prionognatycznego, do którego był dotychczas zaliczany. Opisując rodzaje *Mochtyella* i *Vistulella*, Kielan-Jaworowska (1961) stwierdziła również, że nie mogą być one zaliczone do typu prionognatycznego, bądź labidognatycznego. W materiale opracowywanym przez autorkę istnieje więcej zbliżonych typów aparatów, które zostaną opisane później i wówczas będą utworzone nazwy dla typów budowy, charakteryzujących *Xanioprion* i inne wymienione tu rodzaje. Rodzaj *Xanioprion* zbliża się najbardziej do rodzaju *Vistulella*, od którego różni się tym, że ma aparat prawie całkowicie symetryczny, gdy tymczasem *Vistulella* charakteryzuje się silnie asymetrycznym aparatem szczękowym (por. fig. 4). Cechą wspólną obu typów aparatów jest obecność dwóch podłużnych, równoległych szczęk z każdej strony, przy czym zewnętrzna przykrywa nieco wewnętrzną od strony grzbietowej, oraz zagięcie szczęk wewnętrznych w przedniej części aparatu na zewnątrz, tworzących charakterystyczne luki.

Zdaniem autorki, nie można w obecnym stanie wiedzy przeprowadzić homologii szczęk w aparatach *Vistulella* czy *Xanioprion* ze szczękami typu prionognatycznego i labidognatycznego. Dlatego też autorka zastosowała numerowanie szczęk u rodzaju *Xanioprion* cyframi arabskimi, zamiast rzymskich, przyjętych dla kopalnych i dzisiejszych aparatów prionognatycznych i labidognatycznych, aby uniknąć sugestii o homologii.

#### OBJAŚNIENIA DO ILUSTRACJI

Fig. 1 (p. 296)

A *Atraktoprion*, prawa MI, od strony brzusznej; B *Skalenoprion*, prawa MI, od strony grzbietowej; C *Atraktoprion*, lewa MII, od strony grzbietowej; *tr* kierunek poprzeczny, *long.* kierunek podłużny, *l* długość zatoki, *w* szerokość zatoki *b* pas, *ms* odcisk mięśniowy, *mr* główny grzebień, *ar* dodatkowy grzebień.

Fig. 2 (p. 298)

Schematyczne rysunki dzisiejszych i kopalnych aparatów labidognatycznych: A *Onuphis eremita* Audouin & Milne-Edwards, dzisiejszy; B *Ramphoprion elongatus* n.gen., n.sp., ordowicki; Cr podpory, Bp płytką bazalną, Lt ząb boczny, MI-MV poszczególne szczęki, prawa i lewa (MIV i MV u *Ramphoprion* nieznanne).

Fig. 3 (p. 301)

Schematyczne rysunki dzisiejszych i kopalnych aparatów prionognatycznych: A *Aglaurides fulgida* (Savigny), dzisiejszy; B *Atraktoprion cornutus* n.gen., n.sp.

ordowicki: *Cr* podpory, *Bp* płytką bazalną, *MI-MV* poszczególne szczęki, prawa i lewa.

Fig. 4 (p. 320)

Schematyczne rysunki aparatów szczękowych: *A Xanioprion borealis* n.gen., n.sp.; *B Vistulella kozłowski* Kielan-Jaworowska. Oba rodzaje z ordowickich głazów narzutowych Polski. Przednie szczęki z prawej strony aparatu u *Vistulella* nie numerowane, gdyż ich homologia ze szczękami u *Xanioprion* jest niejasna.

Pl. I

*Atraktoprion cornutus* n.sp. — holotyp, No. 0.400/1, głaz narzutowy z Mocht (woj. warsz.), przypuszczalnie wieku górnio-ordowickiego (piętro Rakvere). *A* od strony grzbietowej, *B* od strony brzusznej. Prawie kompletny, nieco spłaszczony okaz, którego prawa strona przesunięta jest ku przodowi w stosunku do lewej. Podpory częściowo ułamane i przytwierdzone skośnie wzdłuż grzbietowej strony *MI*. Strona brzuszna częściowo pokryta osadem krzemionkowym.

Pl. II

*Atraktoprion* sp. *a*, No. 0.182/1, głaz narzutowy z Mocht (woj. warsz.), wieku środkowo-ordowickiego (piętro Kukruse). *A* tylna część aparatu od strony grzbietowej, z zachowanymi mandibulami; *B* ten sam okaz od strony brzusznej; *C* lewa strona tegoż aparatu (odizolowana po wykonaniu rysunków *A* i *B*), widziana bardziej z boku, w znacznym powiększeniu; *D* izolowana płytką bazalną tego samego aparatu, od strony grzbietowej i brzusznej, w tymże powiększeniu, co fig. *C*.

Pl. III

*Skalenoprion alatus* n.sp. — holotyp, No. 0.59/1, głaz narzutowy z Władysławowa (woj. gdańskie), nieznanego wieku. Okaz złożony z *MI* i *MII* (prawych i lewych), *A* od strony grzbietowej, *B* od strony brzusznej.

Pl. IV

*Skalenoprion alatus* n. sp. *A* lewa *MI* No. 0.59/3, głaz narzutowy z Władysławowa (woj. gdańskie), nieznanego wieku; *A*<sub>1</sub> od strony grzbietowej, *A*<sub>2</sub> od strony brzusznej. *B* prawa *MI*, No. 0.174/4, głaz narzutowy z Wyszogrodu-Zakroczyimia (woj. warsz.), nieznanego wieku; *B*<sub>1</sub> od strony grzbietowej, *B*<sub>2</sub> z boku, z lewej strony, *C* od strony brzusznej.

Pl. V

*Kallopriion ovalis* n.sp. — holotyp No. 0.400/15, miejscowość i poziom jak dla pl. I. Prawie kompletny okaz, z podporami umieszczonymi skośnie i z przednimi szczękami nieco spłaszczonymi i ruszonymi z normalnego położenia. *A* od strony grzbietowej, *B* od strony brzusznej, *C* z boku, z lewej strony, *D* prawa strona aparatu (oddzielona po wykonaniu rysunków *A-C*), z boku z lewej strony nieco skośnie od strony brzusznej, *E* lewa *MIV* tegoż okazu, *F* lewa *MIII* tegoż okazu.

Pl. VI

*Kallopriion ovalis* n.sp. niekompletny aparat złożony z 6 szczęk, No. 0.366/3, głaz narzutowy z Zakroczyimia (woj. warsz.), wieku środkowo-ordowickiego (piętro Kukruse lub Idavere). *A* od strony grzbietowej, *B* od strony brzusznej, *C* z boku z prawej strony, *D* z boku z lewej strony, *E* i *F* oddzielone: lewa *MIII* i prawa *MII* tego samego aparatu, w znacznym powiększeniu, w dwu położeniach.

Pl. VII

*Kallopriion ovalis* n.sp., *A* okaz złożony z 3 szczęk, które rozpadły się podczas rysowania; No. 0.366/43, miejscowość i poziom jak dla pl. VI. *A*<sub>1</sub> oddzielona lewa *MII*, od strony grzbietowej, *A*<sub>2</sub> oddzielona, nieco spłaszczona lewa *MIII* tegoż okazu, *A*<sub>3</sub> oddzielona lewa *MI* tegoż okazu, z prawej strony z boku, lewa strona

szczęki nieco ułamana; *B* prawa MI z płytką bazalną, od strony grzbietowej, przednia część MI ułamana i zagięta; No. 0.400/229, miejscowość i poziom — jak dla pl. I; *C* lewa MI, widziana z czterech stron, No. 0.182/39, poziom i miejscowość — jak dla pl. II.

## Pl. VIII

*Ramphoprion elongatus* n.sp. — holotyp, prawie kompletny okaz, złożony z podpór i 6 szczęk, No. 0.398/1, głaz narzutowy z Mocht (woj. warsz.), wieku środkowo-ordowickiego (piętro Keila). Podpory, przesunięte ku przodowi, przykrywają nieco lewą MI i płytkę bazalną od strony grzbietowej, przednia część płytki bazalnej i przednia część prawej MI nieco pokryte osadem krzemionkowym, *A* od strony grzbietowej, *B* z boku z lewej strony, *C* od strony brzusznej, *D* z boku z prawej strony.

## Pl. IX

*Ramphoprion elongatus* n.sp., prawa MI, No. 0.398/12, poziom i miejscowość — jak dla pl. VIII. *A* od strony grzbietowej, *B* od strony brzusznej, *C* z prawej strony z boku, *D* z lewej strony z boku.

## Pl. X

*Ramphoprion elongatus* n.sp., poziom i miejscowość — jak dla pl. VIII. *A*<sub>1</sub> lewa MII — od strony grzbietowej, *A*<sub>2</sub> ten sam okaz od strony brzusznej, No.0.398/14; *B* zespół, złożony z prawej MI, płytki bazalnej i zęba bocznego, który został wyruszony ze swego normalnego położenia, *B*<sub>1</sub> od strony grzbietowej, *B*<sub>2</sub> od strony brzusznej; No. 0.398/2.

## Pl. XI

*Xanioprion borealis* n.sp. — holotyp, złożony z 6 szczęk, No. 0.400/140, miejscowość i poziom — jak dla pl. I. *A* od strony grzbietowej, *B* od strony brzusznej.

## Pl. XII

*Xanioprion borealis* n.sp., *A*<sub>1</sub> prawa M<sub>2</sub> i M<sub>3</sub> od strony grzbietowej, *A*<sub>2</sub> ten sam okaz od strony brzusznej, No. 0.142/2, głaz narzutowy z Wyszogrodu-Zakroczymia (woj. warsz.), wieku środkowo-ordowickiego (piętro Kukruse); *B*<sub>1</sub> oddzielona prawa M<sub>2</sub> — od strony grzbietowej, *B*<sub>2</sub> tenże okaz od strony brzusznej (nieco z boku), No. 0.379/3, głaz narzutowy z Mocht (woj. warsz.), wiek głazu nieznany.

## Pl. XIII

*Xanioprion borealis* n.sp., okaz złożony z prawej M<sub>2</sub> i M<sub>3</sub>, No. 0.400/145, miejscowość i poziom — jak dla pl. I; *A* od strony brzusznej, *B* z boku z lewej strony, *C* od strony grzbietowej.

## Skróty używane na rysunkach plansz

*C*r podpory,

*MI-MV* poszczególne szczęki aparatów w typie prionognatycznym i labidognatycznym

*M*<sub>1</sub>-*M*<sub>3</sub> poszczególne szczęki aparatu u *Xanioprion borealis* n.sp.

*r* prawy, *l* lewy,

*B*p płytka bazalna, *pc* jama miękiszowa, *M*d mandibule, *al* blaszka łącząca, *ar* dodatkowy grzebień, *at* przedni ząb, *lt* boczny ząb.

ЗОФИЯ КЕЛЯН-ЯВОРОВСКА

НОВЫЕ РОДЫ ОРДОВИКСКИХ ЧЕЛЮСТНЫХ АППАРАТОВ  
МНОГОЩЕТИНКОВЫХ КОЛЬЦЕЦОВ

## Резюме

В 1960 году автор приступил к обработке коллекции челюстных аппаратов многощетинковых кольцецов из ордовикских валунов Польши. Часть этой коллекции обработана проф. Козловским (1956), который описал 3 вида относящиеся к родам *Polychaetaspis* Kozłowski и *Polychaetura* Kozłowski, а также Келян-Яворовской (1961), которая описала два вида относящиеся к родам *Mochtyella* Kielan-Jaworowska и *Vistulella* Kielan-Jaworowska. В 1961 году, описывая роды *Vistulella* и *Mochtyella*, автор упомянул, что коллекция челюстных аппаратов многощетинковых кольцецов, переданная ей для обработки проф. Козловским, включает много тысяч изолированных челюстей и несколько десятков челюстных аппаратов. Ввиду того, что с этого времени валуны подвергались дальнейшему сбору проф. Козловским, доц. Урбанком и автором, и растворению в соляной и уксусной кислотах в Отделении Палеозоологии Польской Академии Наук в Варшаве, обрабатываемая коллекция сильно увеличилась так, что сейчас содержит свыше 400 более или менее полных челюстных аппаратов многощетинковых кольцецов. Имея в виду, что обработка всей коллекции потребует более продолжительного времени, автор решил опубликовать отдельно описание пяти новых родов, выделенных пока во время обработки.

Все описанные тут роды отнесены к надсемейству *Eunicea*. Установление более мелких систематических единиц таких, как семейства и подсемейства, в пределах ископаемых *Eunicea*, будет совершено позднее. Из выделенных тут 5 родов, два — *Atraktoprion* n. gen. и *Skalenoprion* n. gen. — являются прионогнатического типа. находка их интересна ввиду того, что прионогнатические челюстные аппараты не были до сих пор известны в ископаемом состоянии. Только отдельные челюсти, описываемые под родовыми названиями *Arabellites* Hinde, *Protarabellites* Stauffer и *Ildraitites* Eller, представляют повидимому максиллы первой пары (M1) прионогнатических аппаратов. Род *Atraktoprion* представляет челюстной аппарат, состоящий из длинных, парных подпорок, непарной правой базальной пластинки, парных M1 снабженных большими загнутыми передними шипами, парных MII в виде наугольника, непарной левой MIII, небольших треугольных парных MIV и парных MV, представляющих у описанного тут *Atraktoprion cornutus* n.sp. отдельные зубы. Если сравнить челюстные аппараты *A. cornutus* n. sp. и современных многощетинковых кольцецов с прионогнатическими челюстями таких, как например *Aglaurides fulgida* Savigny, *Halla parthenopeia* (Delle Chiaje) и других (см. фиг. 2), то сходство в отношении числа, формы и расположения отдельных пластинок в аппаратах столь поразительно, что имеются все основания для нумерации отдельных челюстей в современных челюстных аппаратах способом приведенным на фиг. 2. Согласно такой интер-



претации, первая челюстная пластинка с правой стороны признана как гомологическая базальной пластинке и не нумерована, а расположенная впереди большая (вторая) пластинка, сходная по форме и величине с первой пластинкой с левой стороны, рассматривается как MI — т.е. как пара первой челюсти с левой стороны. У современных форм получим сходные соотношения, как у ископаемых — парные MII, непарную MIII и парные MIV и MV. Принятие такой интерпретации позволит обозначать одним и тем же способом современные и ископаемые челюсти, так прионогнатического как и лабидогнатического типа, показывая, что различия между современными прионогнатическими и лабидогнатическими аппаратами гораздо меньшие, чем это было принято считать до сих пор. Различия эти заключаются в исчезновении у современных лабидогнатических форм (см. фиг. 3) базальной пластинки, которая имеется однако в ископаемых аппаратах этого типа.

*Skalenoprion* n. gen. — второй из описанных в настоящем труде прионогнатических аппаратов, полный состав неизвестный; в наиболее полных образцах состоит из правых и левых MI и MII. У этого рода нет базальной пластинки, а обе челюсти MI почти симметричны, однако внизу правой челюсти MI находится добавочный ряд зубчиков, который иногда, как у описанного тут *Skalenoprion alatus*, является гладким и образует выпуклую планочку. Автор считает, что добавочный ряд зубчиков можно толковать как гомологичный базальной пластинке *Atraktoprion* и других прионогнатических аппаратов.

*Kallopriion* n. gen. и *Ramphoprion* n. gen. представляют аппараты лабидогнатического типа, хотя первая из упомянутых форм обнаруживает одновременно некоторые свойства характерные для прионогнатических аппаратов, а именно наличие длинных подпорок близких тем, какие имеются у ископаемых и современных прионогнатических форм. Однако у *Kallopriion* подпорки эти относительно короче и шире чем в прионогнатическом типе. Кроме того, этот аппарат состоит из базальной пластинки, парных MI и MII, единичной MIII и парных, сравнительно слабо изученных MIV и MV.

*Ramphoprion* представляет прионогнатический аппарат, отличающийся присутствием очень коротких треугольных подпорок и очень длинных MI. Расположение челюстей типичное для форм лабидогнатических. Характерной чертой рода *Ramphoprion* является присутствие латерального зуба, наличие которого установлено Козловским (1956) у *Polychaetaspis warkae* Kozlowski. У *P. warkae* латеральные зубы выступают симметрично, косо расположенные в передних частях MI, прикрывая их со спинной стороны. У *Ramphoprion* установлено наличие только одного (правого) латерального зуба. Судя однако по подобию на *P. warkae* можно допустить, что и у этого рода имелись два парных зуба.

*Xanioprion* n. gen. представляет тип строения челюстного аппарата, который не может быть отнесен ни к прионогнатическому, ни к лабидогнатическому типу. По мнению автора, также и современный род *Dorvillea* Parfitt представляет иной тип строения, чем указанные выше, и должен быть исключен из прионогнатического типа, к которому его до сих пор причисляли. Описывая роды *Mochtyella*

и *Vistulella*, Келян-Яворовска (1961) установила тоже, что и эти формы не могут быть отнесены к прионогнатическому или лабидогнатическому типу. В обрабатываемом автором материале имеется большее число аппаратов подобного типа, которых описание будет дано в будущем, и тогда будут установлены названия для типов строения свойственного *Xanioprion* и другим перечисленным тут родам. Род *Xanioprion* более всего приближается к роду *Vistulella*, от которого отличается тем, что его аппарат почти полностью симметричный, в то время как у *Vistulella* челюстной аппарат полностью асимметричный (ср. фиг. 4). Общим свойством аппаратов обоих типов является наличие двух продольных параллельных челюстей с каждой стороны, при чем наружная прикрывает несколько внутреннюю со спинной стороны, а также изгиб наружу в передней части аппарата внутренних челюстей, образующих характерные дуги.

По мнению автора, при современном состоянии знания, нет возможности провести гомологию челюстей в аппаратах *Vistulella* или *Xanioprion* и челюстей прионогнатического и лабидогнатического типа. Поэтому то автор, во избежание внушения о гомологии, применил обозначение челюстей у рода *Xanioprion* арабскими цифрами вместо римских, принятых для ископаемых и современных прионогнатических и лабидогнатических аппаратов.

— — — — —

## PLATES

### Abbreviations used:

*Cr* carriers

*MI* — *MV* particular jaws of the apparatuses in labidognatha and prionognatha types

*M*<sub>1</sub> — *M*<sub>3</sub> particular jaws of the apparatus in *Xanioprion borealis* n. sp.

*r* right

*l* left

*Bp* basal plate

*pc* pulp cavity

*Md* mandibles

*al* attachment lamella

*ar* additional ridge

*at* anterior tooth

*lt* lateral tooth

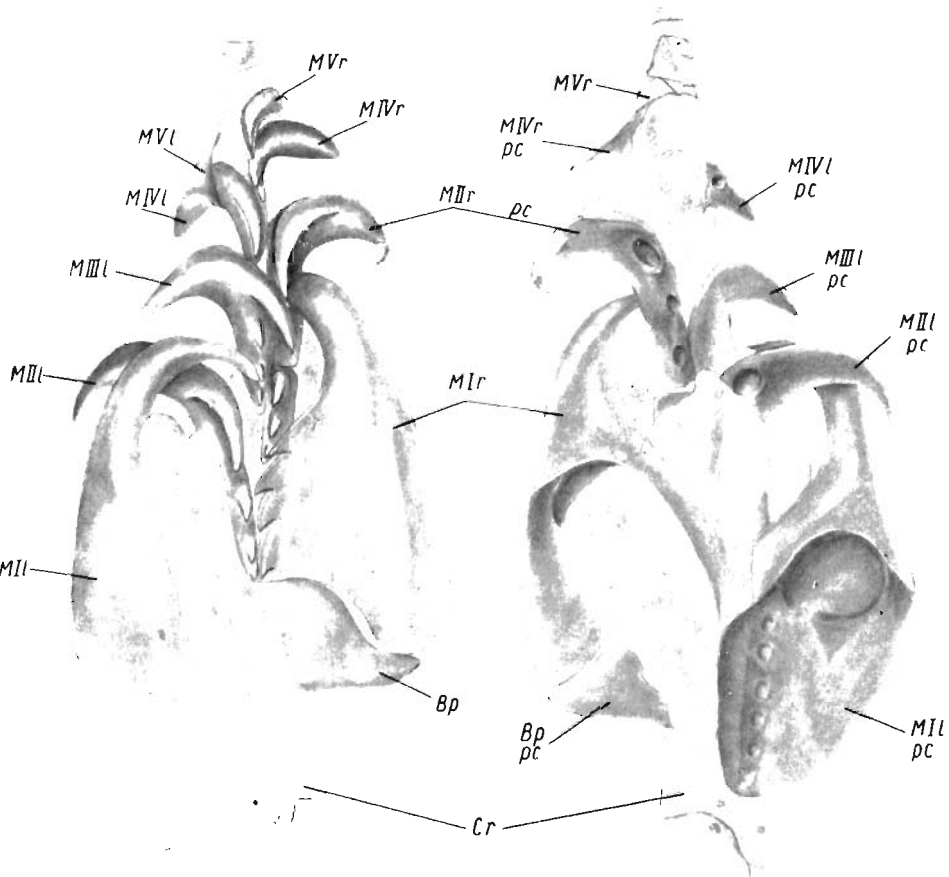
Pl. I

*Atraktoprion cornutus* n. sp.

Type specimen, No. 0.400/1, erratic boulder from Mochty (prov. of Warsaw), probably of Upper Ordovician age (Rakvere stage). Nearly entire, slightly depressed specimen, with right side moved forward with regard to the left one. Carriers partly broken off and fastened obliquely along the dorsal side of MI. Ventral side partly covered by siliceous material.

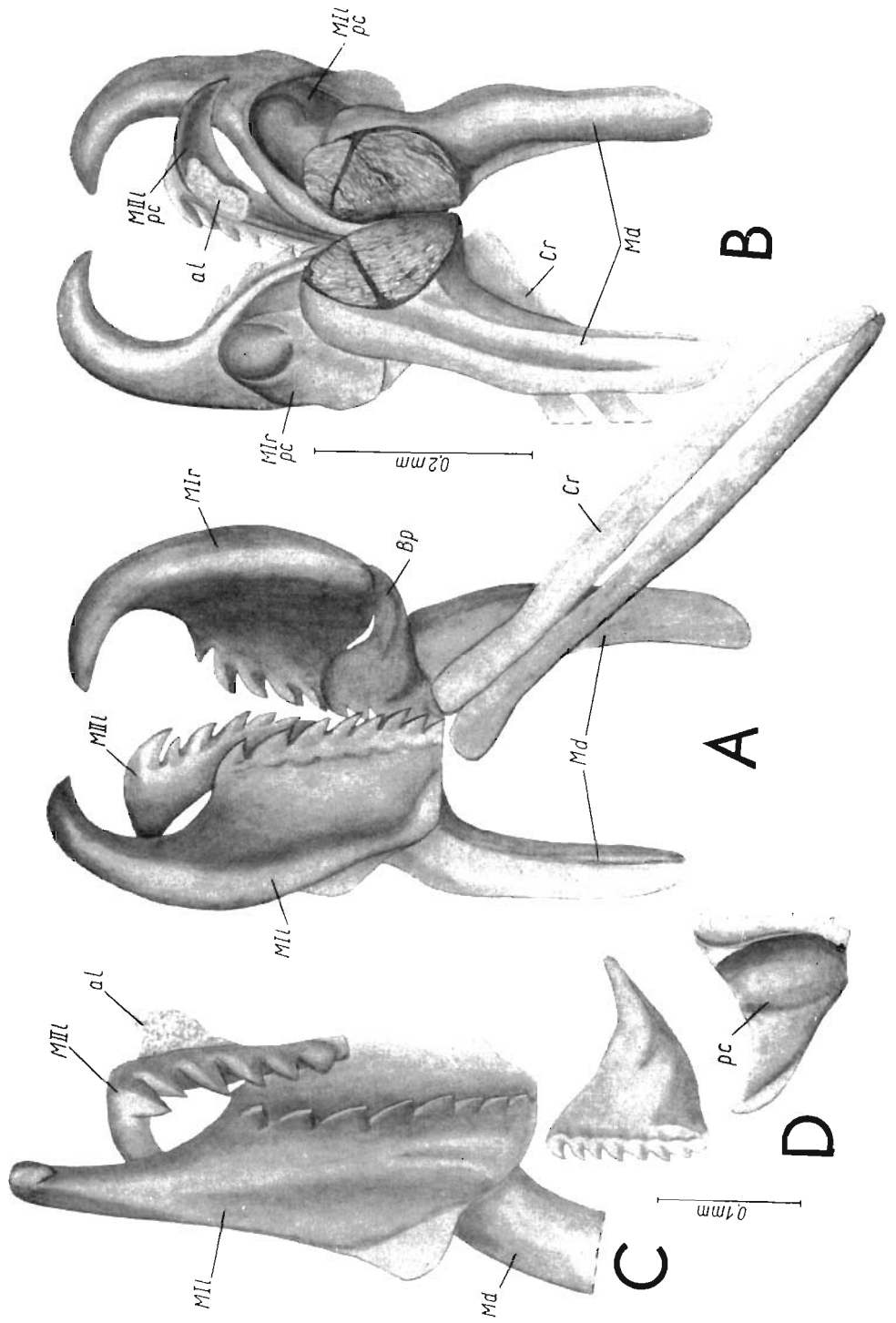
A dorsal view,

B ventral view.



A

B



Pl. II

*Atraktoprion* sp. *a*

Specimen No. 0.182/1, erratic boulder from Mochty (prov. of Warsaw), of Middle Ordovician age (Kukruse stage):

*A* posterior part of the apparatus, in dorsal view, preserving the mandibles,

*B* the same, in ventral view,

*C* left side of the same apparatus (isolated when the drawings *A* and *B* were made), in more lateral view, in greater enlargement,

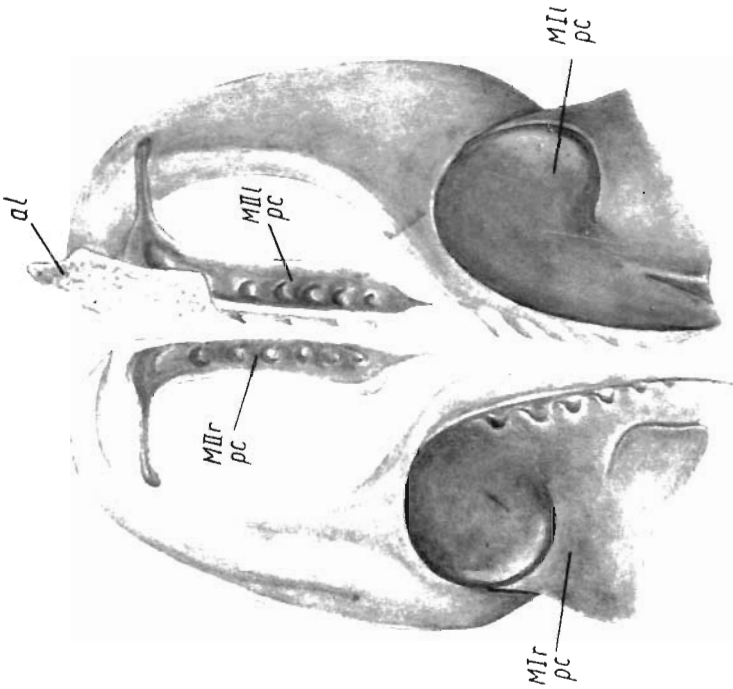
*D* isolated basal plate of the apparatus in dorsal and ventral views, the same enlargement as fig. *C*.

Pl. III

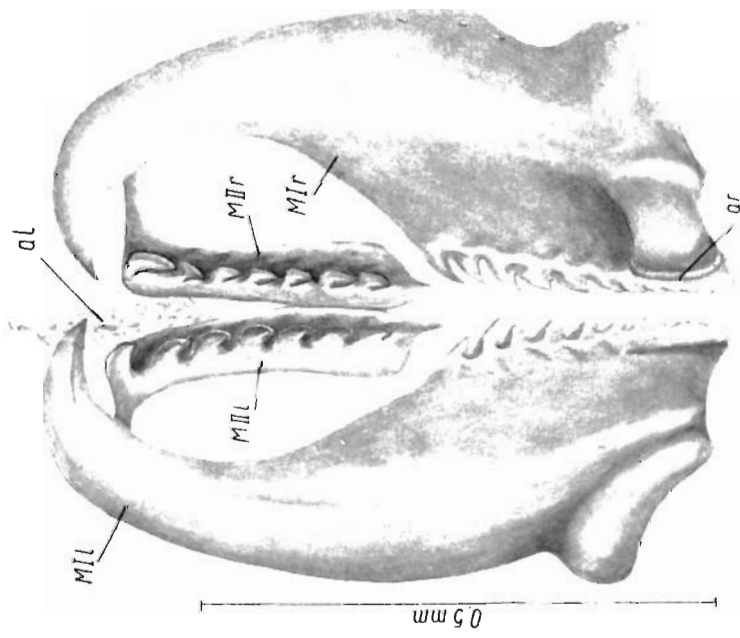
*Skalenoprion alatus* n. sp.

Specimen No. 0. 59/1, erratic boulder from Władysławowo (prov. of Gdańsk), of unknown age. Type specimen consisting of MI and MII (both right and left)  
A dorsal view,  
B ventral view.

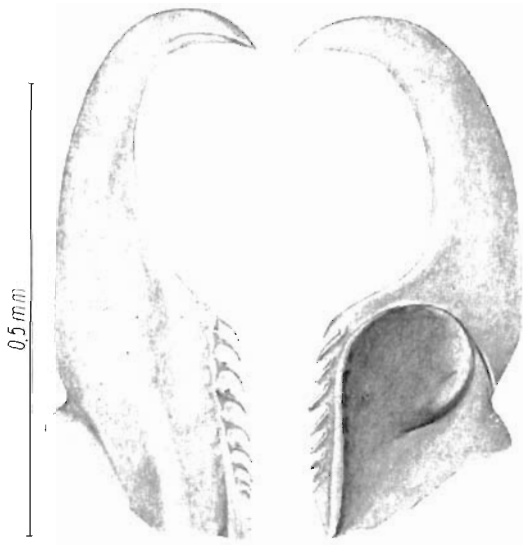




B



A



A<sub>1</sub>

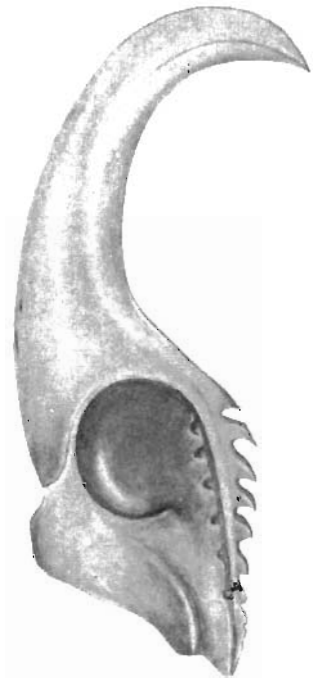
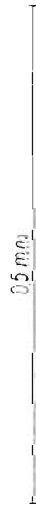
A<sub>2</sub>



B<sub>1</sub>



B<sub>2</sub>



B<sub>3</sub>

Pl. IV

*Skalenoprion alatus* n. sp.

- A* specimen No. 0. 59/3, erratic boulder from Władysławowo (prov. of Gdańsk),  
of unknown age
- A*<sub>1</sub> left MI, in dorsal view,  
*A*<sub>2</sub> the same, in ventral view,
- B* right MI, No. 0. 174/4, erratic boulder from Wyszogród-Zakroczym (prov. of  
Warsaw), of unknown age,
- B*<sub>1</sub> in dorsal view,  
*B*<sub>2</sub> in left side view,  
*B*<sub>3</sub> in ventral view.

Pl. V

*Kalloprion ovalis* n. sp.

Type specimen No. 0.400/15, erratic boulder from Mochty (prov. of Warsaw), probably of Upper Ordovician age (Rakvere stage). Nearly entire specimen with carriers preserved obliquely and anterior jaws somewhat compressed and removed from their natural position

*A* dorsal view,

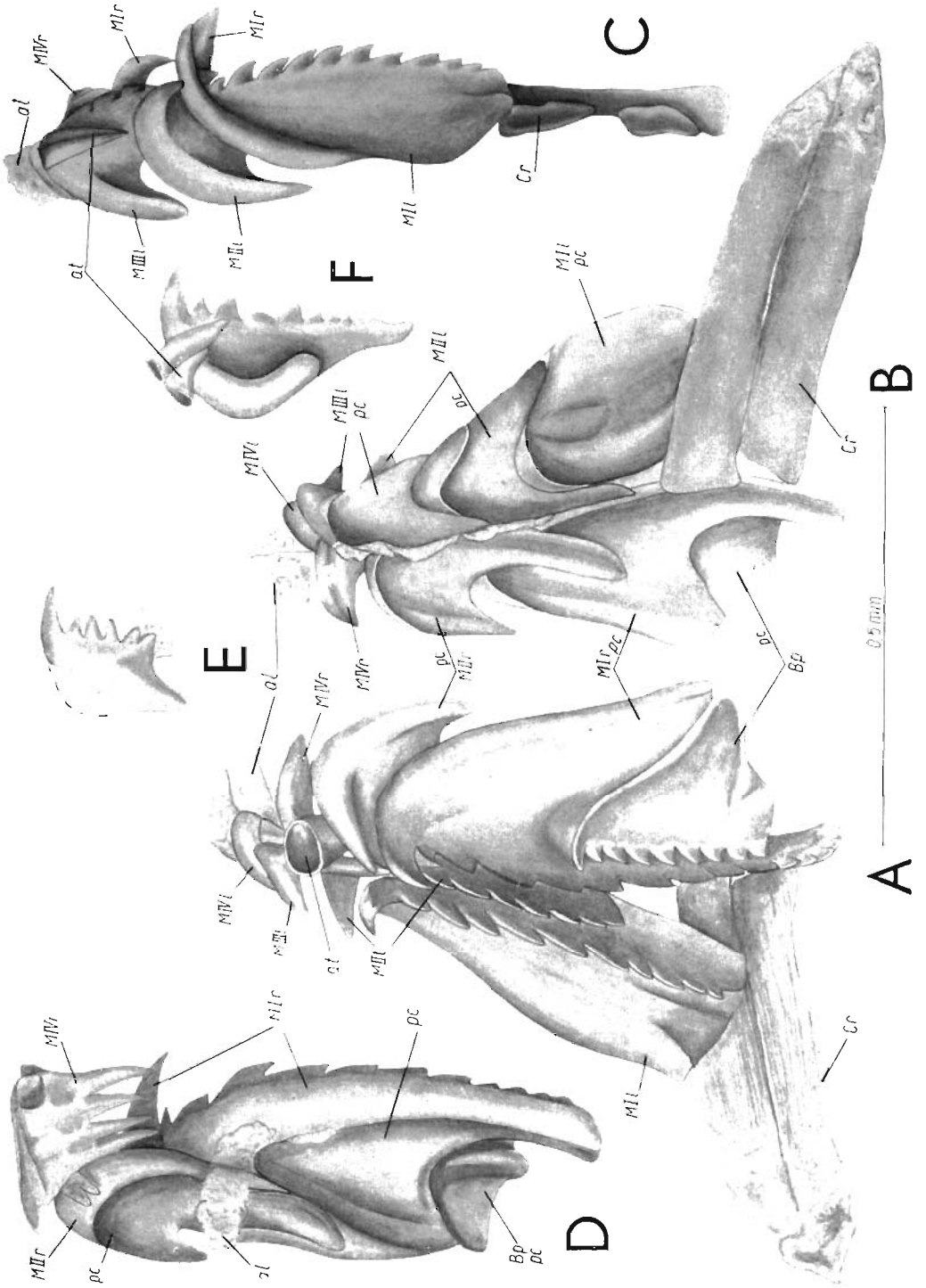
*B* the same, ventral view,

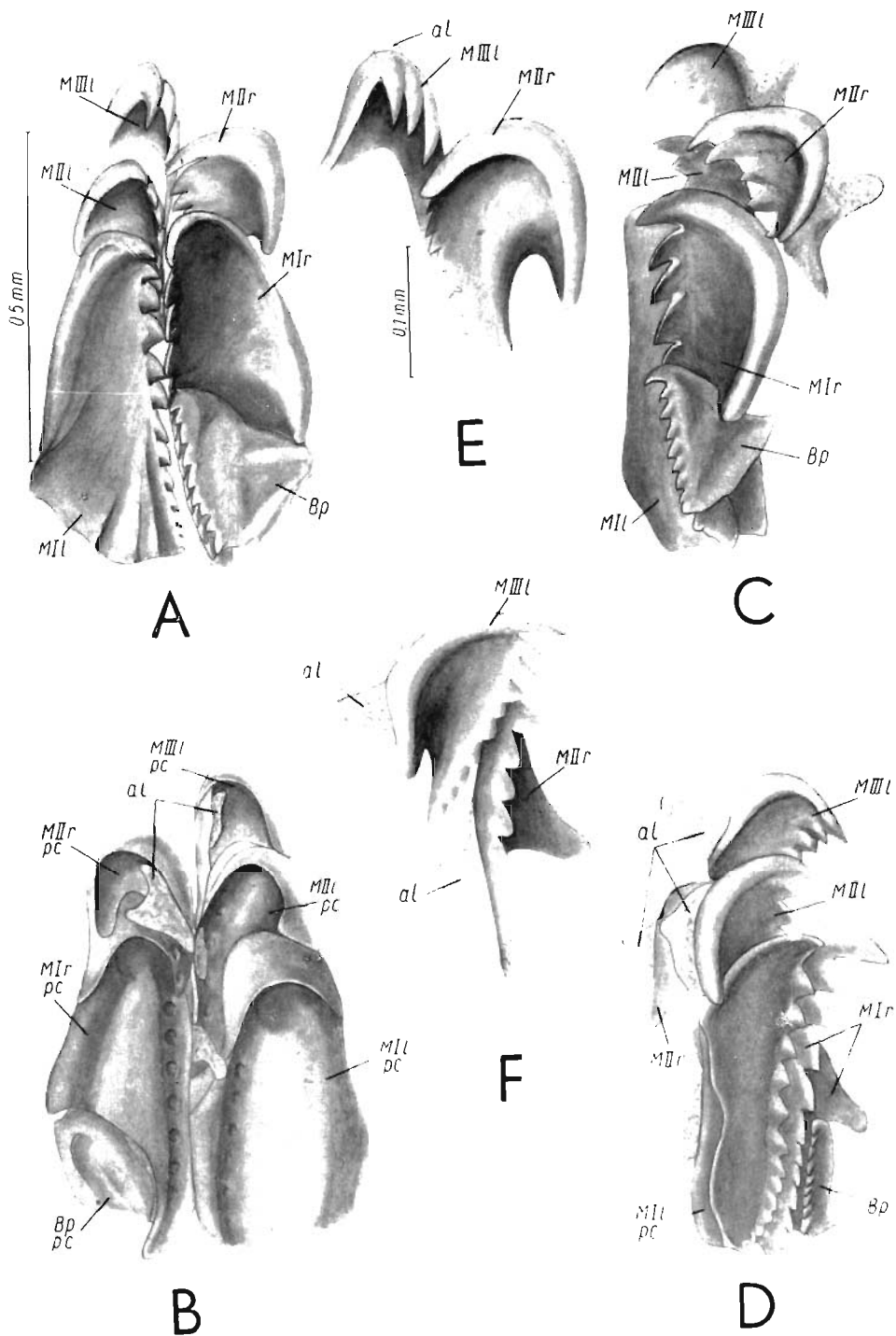
*C* the same, in left side view,

*D* right side of the apparatus (isolated when the drawings *A—C* were made)  
in left side, somewhat ventral view,

*E* isolated MIV left of the same specimen,

*F* isolated MIII left of the same specimen.





Pl. VI

*Kalloprion ovalis* n. sp.

Incomplete apparatus consisting of six jaws, No. 0.366/3, erratic boulder from Zakroczym (prov. of Warsaw), of Middle Ordovician age (Kukruse stage or Idavere stage)

*A* the assemblage in dorsal view,

*B* the same, in ventral view,

*C* the same, in right side view,

*D* the same, in left side view,

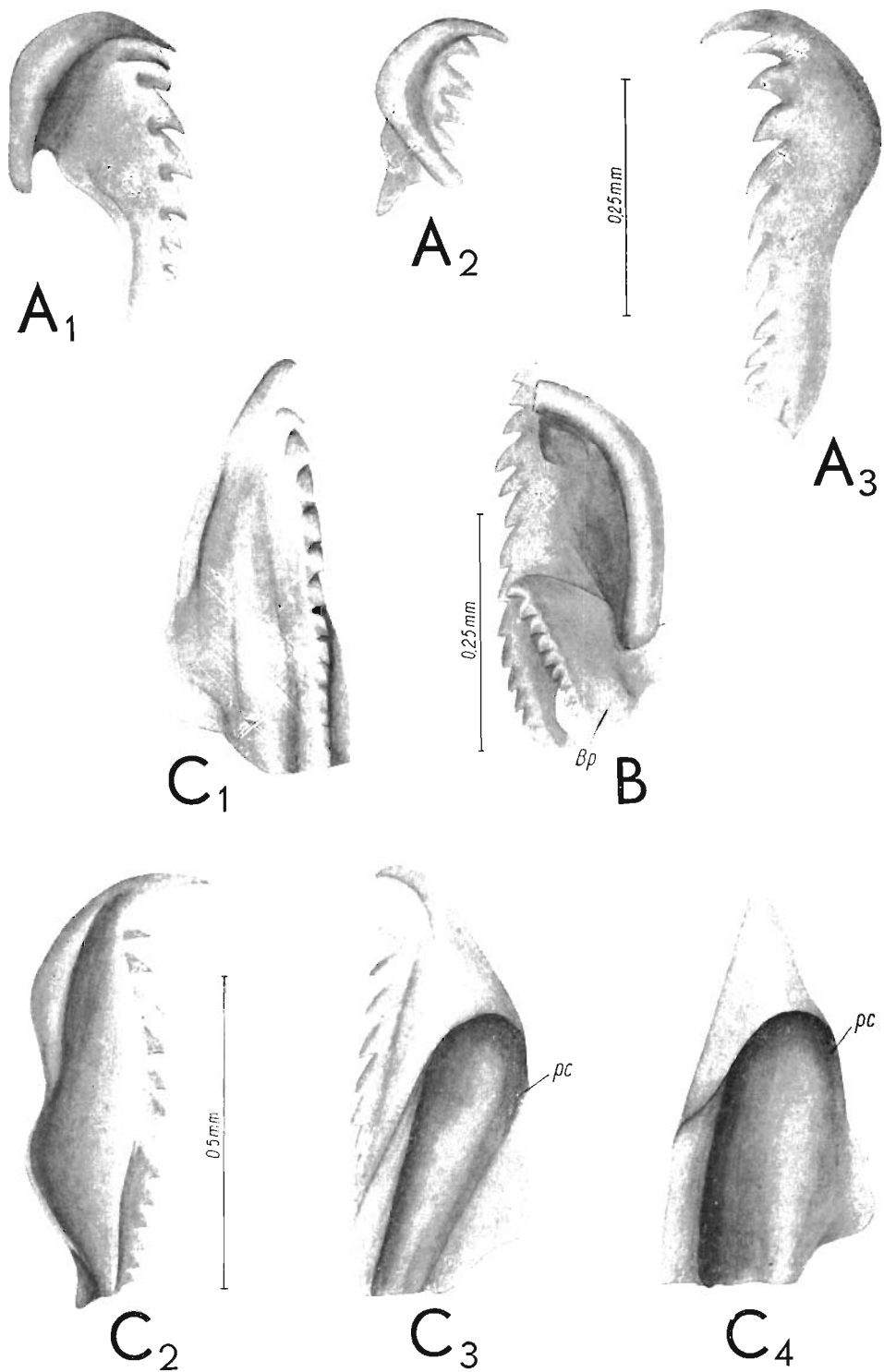
*E, F* isolated MIII left and MII right of the same apparatus in greater enlargement, in two views.

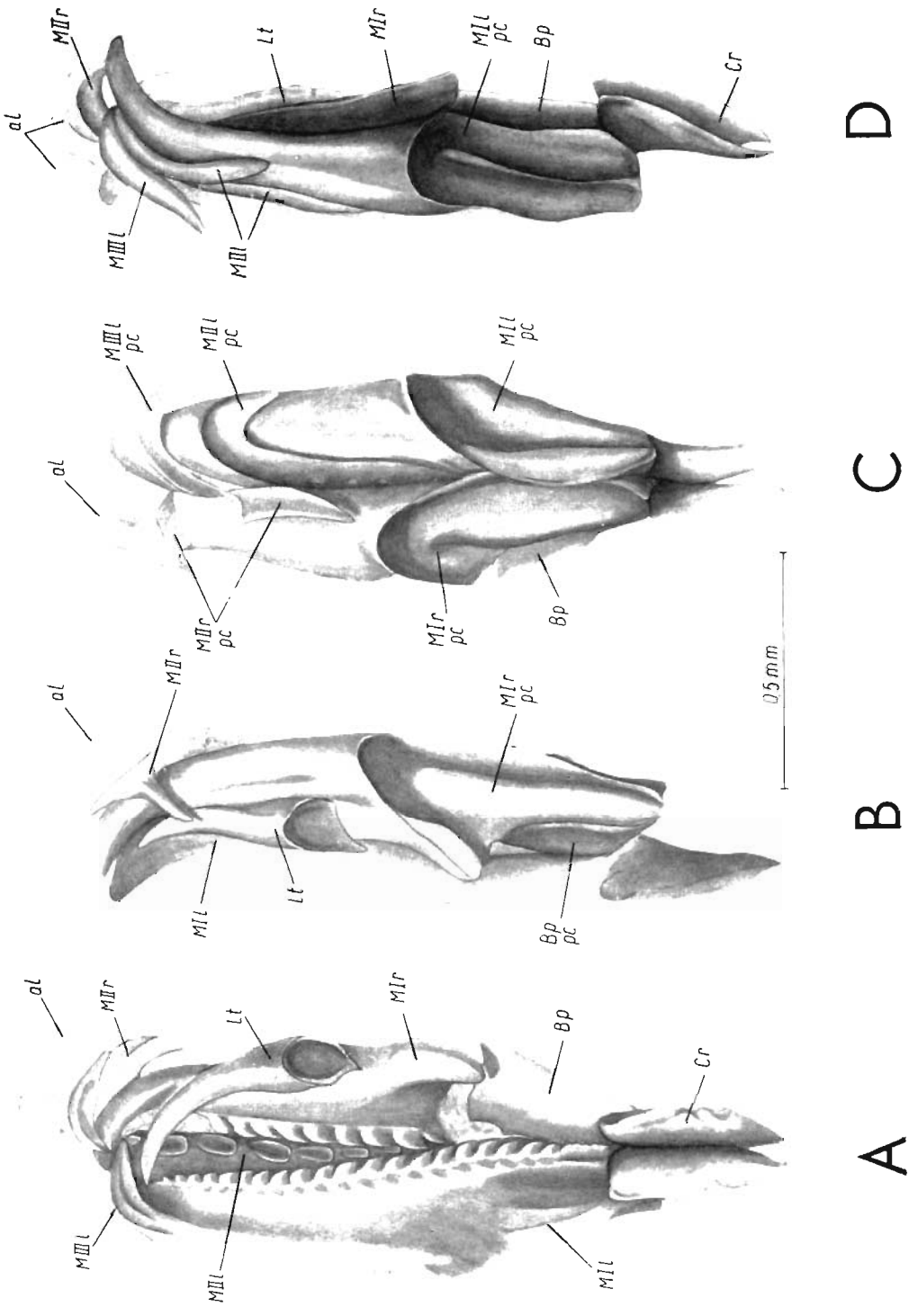
Pl. VII

*Kalloprion ovalis* n. sp.

- A incomplete apparatus consisting of three jaws isolated during the drawing;  
No. 0.366/3, erratic boulder from Zakroczym (prov. of Warsaw), of Middle Ordovician age (Kukruse stage or Idavere stage)
- A<sub>1</sub> isolated left MII in dorsal view,
- A<sub>2</sub> isolated, somewhat compressed left MIII of the same specimen,
- A<sub>3</sub> isolated left MI of the same specimen. in right side view, left slope of the jaw somewhat broken off,
- B right MI with basal plate, in dorsal view, anterior part of MI partly broken off: No. 0.400/229, erratic boulder from Mochty (prov. of Warsaw), probably of Upper Ordovician age (Rakvere stage),
- C isolated left MI in four views: No. 0.182/39, erratic boulder from Mochty (prov. of Warsaw), of Middle Ordovician age (Kukruse stage)







Pl. VIII

*Ramphoprion elongatus* n. sp.

Type specimen, consisting of the carriers and six jaws; No. 0.398/1, erratic boulder from Mochty (prov. of Warsaw), of Middle Ordovician age (Keila stage). The carriers are moved forward, covering MI left and basal plate somewhat dorsally, anterior part of the basal plate and anterior part of the right MI are covered somewhat by a siliceous material

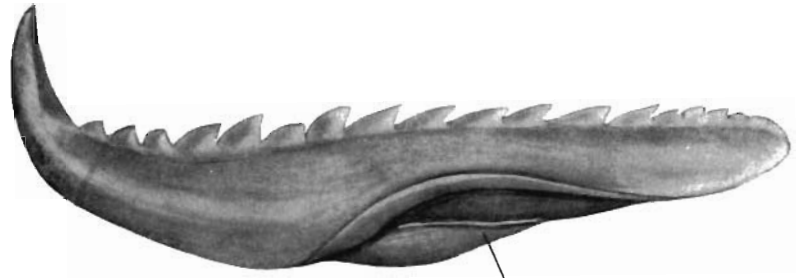
- A dorsal view,
- B left side view,
- C ventral view,
- D right side view.

Pl. IX

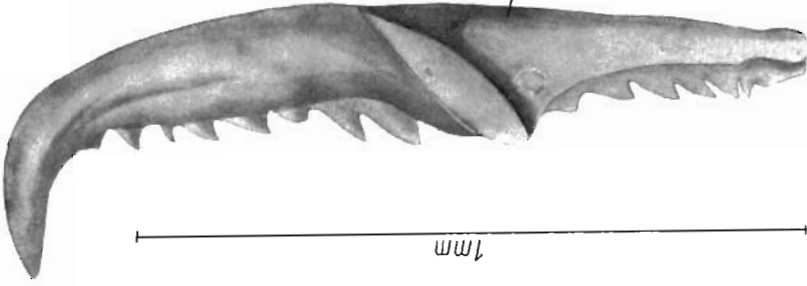
*Ramphoprion elongatus* n. sp.

Isolated right MI; No. 0.398/12, erratic boulder from Mochty (prov. of Warsaw),  
of Middle Ordovician age (Keila stage)

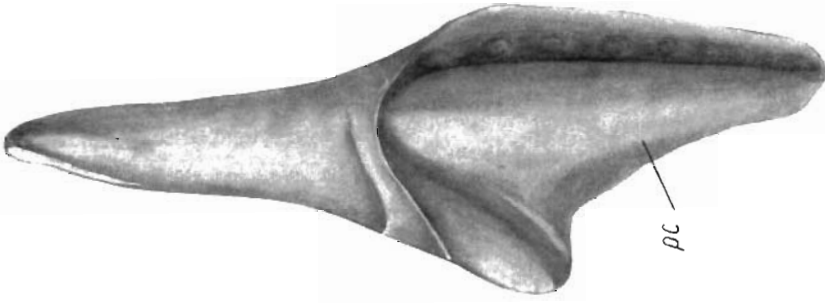
- A dorsal view,
- B ventral view,
- C right side view,
- D left side view.



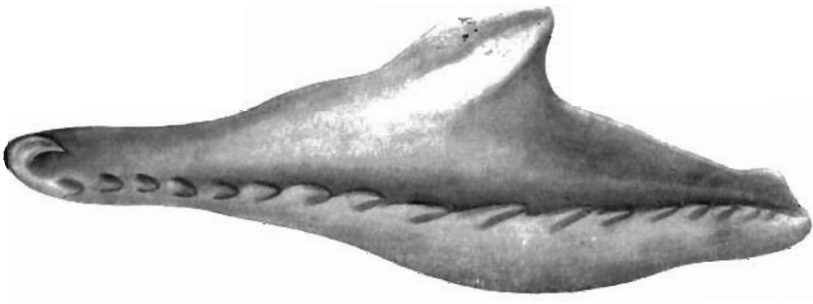
D



C



B



A

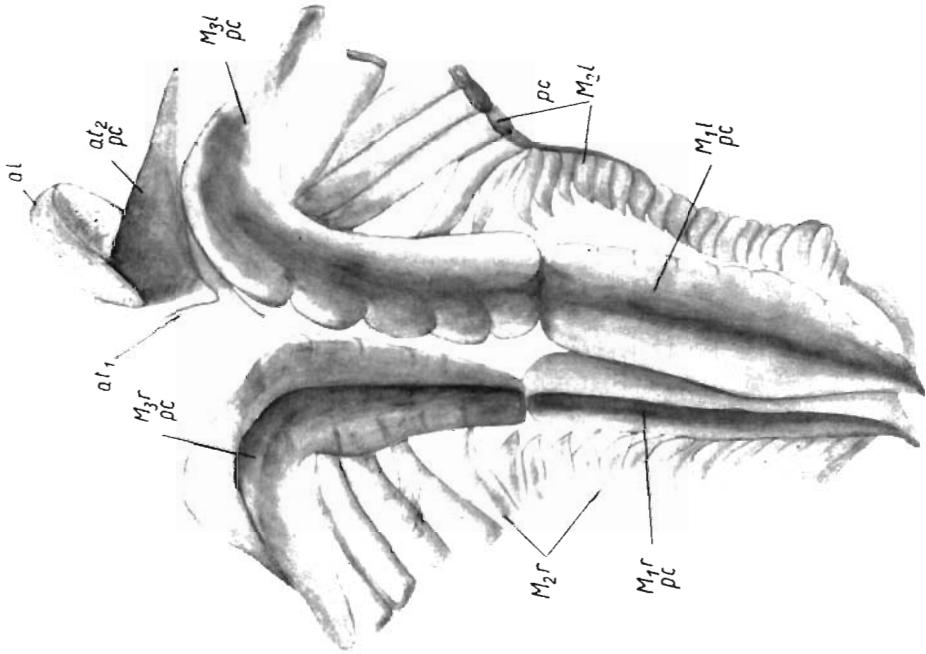
Pl. XI

*Xanioprion borealis* n. sp.

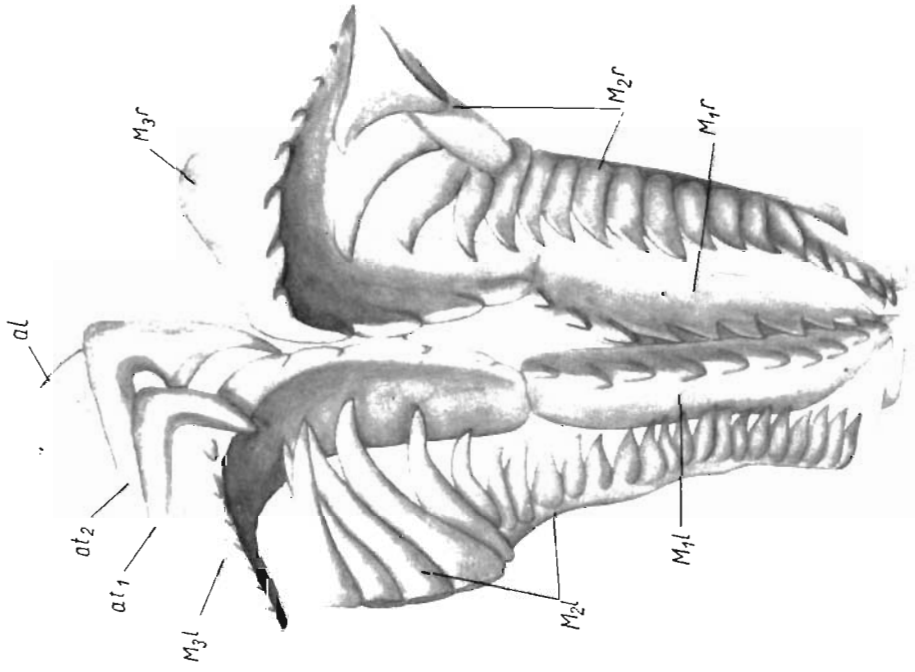
Type specimen, consisting of six jaws; No. 0.400/140, erratic boulder from Mochty (prov. of Warsaw), probably of Upper Ordovician age (Rakvere stage)

*A* dorsal view,

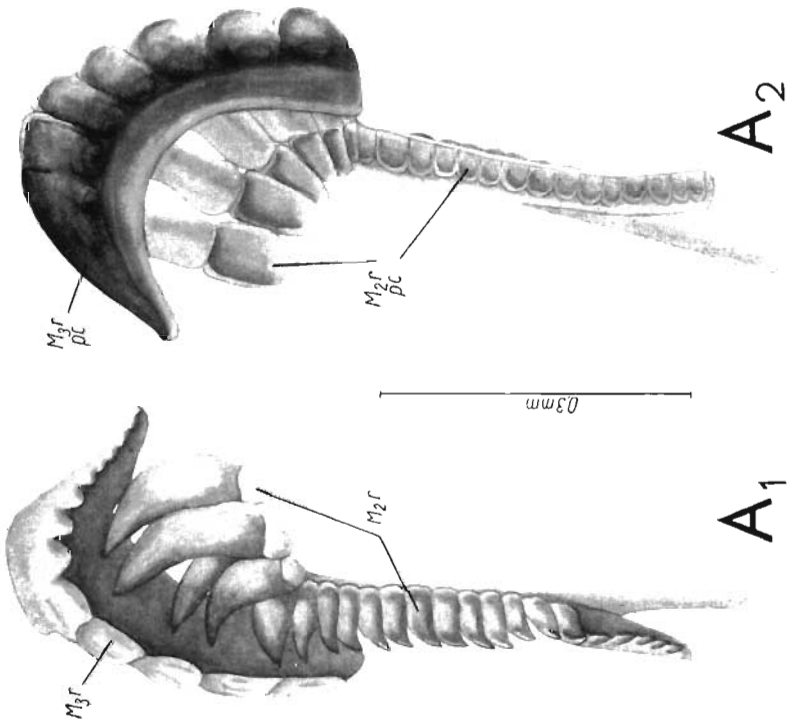
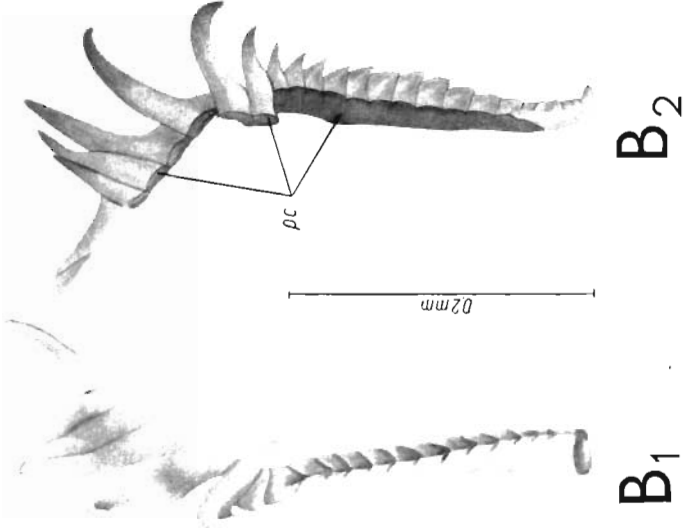
*B* ventral view.



B



A





Pl. XII

*Xanioprion borealis* n. sp.

Specimen No. 0.142/2, erratic boulder from Wyszogród-Zakroczym (prov. of Warsaw), of Middle Ordovician age (Kukruse stage)

$A_1$  right  $M_2$  and  $M_3$ , in dorsal view,

$A_2$  the same, in ventral view.

Specimen No. 0.279/3, erratic boulder from Mochty (prov. of Warsaw), age of the boulder unknown

$B_1$  isolated right  $M_2$ , in dorsal view,

$B_2$  the same, in ventral view (somewhat laterally).

Pl. XIII

*Xanioprion borealis* n. sp.

Right  $M_2$  and  $M_3$ ; No. 0. 400/145, erratic boulder from Mochty (prov. of Warsaw), probably of Upper Ordovician age (Rakvere stage)

*A* ventral view,

*B* left side view,

*C* dorsal view.

