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POLYCHAETE JAW APPARATUSES AND SCOLECODONTS FROM THE UPPER DEVONIAN OF POLAND

Abstract. — From Frasnian strata pierced by the Opole Lubelskie borehole in the south-eastern Poland, 10 polychaete jaw apparatuses are described. For these apparatuses, 7 new species and 3 new genera are proposed: *Multiprion opolensis* n.gen., n.sp., *Mochtyella kielanae* n.sp., *Xanioprion walliseri* n.sp., *Processoprion longiprocessus* n.gen., n.sp., *Polychaetaspis hindei* n.sp., *Kielanoprion elleri* n.sp., and *Hindeoprion basalaris* n.gen., n.sp. Moreover, 4 new species and 3 new genera of isolated polychaete jaws are described: *Langeites lublinensis* n.sp., *Trianguligenys* n.gen., *Uncinogenys uncinatus* n.gen., n.sp., *Serratula minutidentata* n.gen., n.sp., and *Serratula longidentata* n.sp. The problems of taxonomy of fossil polychaetes are discussed and necessity of further application of two independent systematics, one for scolecodonts and other for jaw apparatuses, is emphasized.

INTRODUCTION

Polychaete jaws are among the commonest microfossils in Paleozoic strata, and recent studies show that they are also common in Mesozoic ones. The polychaete jaws have been studied for over a century. A relative low biological-cognitive and stratigraphical value of isolated jaws resulted in the fact that little attention was paid to this material. However, a number of complete polychaete jaw apparatuses found rapidly increases nowadays, mainly due to improvement of extraction techniques. Moreover, recent detail studies on scolecodonts, based on the knowledge of fossil and recent apparatuses, showed that their stratigraphic value was underestimated (Kielan-Jaworowska, 1966; Taugourdeau, 1968; Szaniawski, 1970; Jansonius & Craig, 1971). These facts resulted in rapid increase of interest in scolecodonts.

Almost a half of literature devoted to isolated scolecodonts deals with scolecodonts extracted from Devonian strata in which they are particularly numerous. However, little is known about Devonian jaw apparatuses.

Joined jaws and apparatuses of the Devonian age were described in a limited number of papers (Eller, 1933, 1934*a*, *b*, 1936, 1955, 1963, 1964; Lange, 1949; Sylvester, 1959; Taugourdeau, 1968), but only one Devonian apparatus, *Paulinites paranensis* Lange, is sufficiently known. The remaining findings usually included single specimens of joined jaws or very poorly preserved apparatuses.

The present authors have used „wet" technique of extracting microfossils from residuum, described by Kielan-Jaworowska (1966). Frasnian limestones studied yielded very abundant scolecodont material as well as a number of more or less complete jaw apparatuses. Ten apparatuses hitherto unknown were found; for 7 of them new species are proposed, and the remaining 3 are specifically unidentifiable. Moreover, three new generic names are established for the apparatuses. Also, 4 new species and 3 new genera of isolated scolecodonts are described.

Ordovician and Silurian polychaete jaw apparatuses are relatively best known (Šnajdr, 1951; Kozłowski, 1956; Martinsson, 1960; Kielan-Jaworowska, 1961, 1962, 1966; Szaniawski, 1970). A few Permian and Triassic apparatuses were also found (Tash & Stude, 1965; Kozur, 1967; Szaniawski 1968; Zawidzka, 1971), whereas only one badly preserved apparatus is known from the Carboniferous (Hinde, 1892). In the Upper Devonian assemblage of the present authors there is a number of the genera already known from the Ordovician and Silurian, e.g., *Mochtyella* Kielan-Jaworowrowska, *Xanioprion* Kielan-Jaworowska, *Polychaetaspis* Kozłowski, *Paulinites* Lange, and *Skalenoprion* Kielan-Jaworowska. Also some new genera appear in this assemblage, e.g. *Kielanoprion* Szaniawski, *Multiprion* n.gen., *Processoprion* n.gen., and *Hindeoprion* n.gen. Genus *Atraktoprion* Kielan-Jaworowska seems to have the widest stratigraphical range, as it is known from the older Paleozoic, Devonian and Permian, and scolecodonts close to its MI are also known from the Mesozoic. There are some scolecodonts in the authors' collection, assigned to *Uncinogenys uncinatus* n.gen., n.sp., which are somewhat similar to MI of the genus *Atraktoprion*, but the differences are still remarkable and these forms are exclusively known from the Devonian. Stratigraphical range of genus *Skalenoprion* Kielan-Jaworowska seems to be as wide as that of genus *Atraktoprion*, but the former genus is markedly rarer. From the genera which appear for the first time in the Devonian, only the genus *Kielanoprion* Szaniawski was also recorded in the younger rocks. In general, the Devonian polychaete fauna appears to be differentiated and quite peculiar, which confirms once more its stratigraphical value. However, further detailed studies are necessary before polychaete material may be used as a reliable tool for stratigraphical purposes.

The collection here described is housed at the Palaeozoological Institute of the Polish Academy of Sciences, Warszawa (abbr. Z. Pal.).

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STRATIGRAPHY AND MATERIAL

The polychaete jaw appartuses described herein are extracted from core samples from the borehole Opole Lubelskie IG 1, located on the right bank of the Vistula river, south of Lublin. This borehole was made by the Geological Institute as one of a number of prospective-research boreholes located along south-western margin of the East-European Platform. The whole section of the Upper Devonian, pierced by this borehole, was systematically sampled. Out 235 samples taken for microfaunistic studies, only 110 dissolved in acetic or hydrochloric acid; the remaining ones underwent partial dissolution or appeared completely insoluble. Most abundant scolecodonts were found in samples taken at the depths from 1.202 to 1.212 m. Hence, this part of the profile was resampled, especially for scolecodont studies — 1 kg samples were taken in 0.5 m intervals; the resulting core material, ca. 30 kg in weight, yielded the whole polychaete material described herein. The polychaete-bearing strata represent upper part of so called „coral series", 330 m thick, assigned to the Frasnian (Miłaczewski & Żelichowski, 1970). Seven successive samples, taken 36 m above scolecodont-bearing limestones, yielded conodonts characteristic of the *Ancyrognathus triangularis* (to $I\gamma$) (cf. Szulczewski, 1972) of the Upper Frasnian.

Besides scolecodonts, also sphaerical algae of the genus *Tasmanites* Newton and filamentous remnants of some unidentifiable algae were found in the residuum.

The scolecodont-bearing limestones are dark-coloured, strongly bitominous, marly. In places, their structure becomes lumpy, which resulted from reversed density gradients. The limestones also yield innumerous corals and amphipores. In thin sections, very fine skeletal debris, foraminifers, calcareous algae, ostracods and gastropods are noted. It may be assumed that these organic remains were deposited in shallow-water environment, characterized by moderate hydrodynamic and high rate of clay-limy sedimentation.

Scolecodonts are quite well-preserved. Crushed or broken specimens are in minority. Particular elements in apparatuses are sometimes translocated in relation to one another. Usually, they are surrounded by aggregates of clay minerals, insoluble in hydrochloric acid and hardly soluble

in hydrofluoric acid. These coating prevented disruption of weak bounds between particular apparatus elements in the course of dissolution and scouring. Sometimes even strongly deformed apparatuses are almost completely preserved.

TAXONOMIC PROBLEMS

From the very beginning taxonomy raises crucial problems in the studies of fossil polychaete jaws. Hinde, who initiated scolecodont studies and proposed principles of scolecodont systematics, stated (1880, pp. 369—370) that he is „... thoroughly conscious of its (i.e., of systematics) tentative character, as serving for paleontological reference rather than as presenting exact zoological arrangement". Although remarkable progress in studies of fossil scolecodonts and complete jaw apparatuses has taken place, their systematics is still the subject of contention. This results from the fact that single scolecodonts are usually derived from jaw apparatuses composed of a number of different elements and that homological elements of quite different apparatuses can be very similar to one another. Moreover, some genera (as, e.g., *Arabellites* Hinde) were established for „... jaw of widely different form, which have a general resemblance to those of the existing genus *Arabella* Grube..." (Hinde, 1879, p. 377); whereas other genera were established for particular elements of the apparatuses, e.g., for MI; often left jaws were placed in one genus, and right ones — in another. Earlier authors have not chosen type species which resulted in subsequent allocation of highly different forms in a given genus what caused enormous confusion in the systematics of scolecodonts. Therefore, the authors having complete jaw apparatuses at their disposal considered the scolecodont systematics as parataxonomic and introduced a separate systematics for the apparatuses. These authors recognize the fact that the application of such double systematics is contradictory to the Rules of Zoological Nomenclature, but they cannot offer a better solution, as allocation of the apparatuses in the existing scolecodont systematics would make identification of both scolecodonts and apparatuses impossible (Lange, 1949; Kozłowski, 1956; Kielan-Jaworowska, 1966, 1968). Some authors (e.g. Eller, 1964; Tash and Stude, 1965) hold an opposite view. In their opinion the apparatuses should be included in the scolecodont systematics. However, they seem not to take into account the consequences of such procedure, which, as it has been shown (Lange, 1949; Kielan-Jaworowska, 1966, 1968), would result in allocation of quite different apparatuses and scolecodonts in one genus and thus make the knowledge of their biological relationship impossible. Eller seems to be inconsistent in giving these joined jaws a generic name of the earlier described

element and, at the same time, in not including in its synonymy the generic names of the remaining elements. In this ways jaw MII found in connection with MI was named *Nereidavus exploratus* (Eller, 1934*a*), whereas isolated MII, almost identical with it, was later described by the same author (Eller, 1934*b*) under the generic name used for MII jaws, *Leodicites declivis* Eller.

Recently, Kozur (1970) proposed combining scolecodont and apparatus systematics. At the same time he made an attempt to introduce order into scolecodont systematics by distinguishing type species for the genera not having them and by treating a number of unidentifiable (in his opinion) taxa as nomina dubia. This proposition was criticized by Jansonius and Craig (1971) as premature. The present authors support this opinion. According to them, because of comparatively poor knowledge of fossil apparatuses and the chaos in scolecodont systematics, connecting of these two systematics at present would lead to serious errors and would do much more harm than profit and make further research more difficult. Hence, both these systematics should be treated as tentative and their connection, at least up to the generic level, will most probably be possible in the future. However, in some families, such as Mochtyellidae Kielan-Jaworowska, where very similar jaws occur in entirely different apparatuses, unsurpassable difficulties may be encountered. Also in other families, some elements of the apparatuses, e.g., anterior jaws, or single teeth, will be very difficult to identify.

Kozur seems not to have much experience in studying Paleozoic scolecodonts and the apparatuses predominating among all the fossil polychaetes known. His proposition is mainly based on compilation; hence, its numerous errors. It is not the purpose of the present authors to give a detailed analysis of this proposal; only some of the errors noticed in the course of their own studies will be discussed.

Kozur considers the genera *Vistulella* Kielan-Jaworowska, 1961, and *Oxyprion* Szaniawski, 1969, to be the younger synonyms of the genus *Staurocephalites* Hinde, 1879. The type species of the genus *Staurocephalites* — *St. niagarensis* Hinde is an isolated MI from the family Mochtyellidae Kielan-Jaworowska, 1961; however, on its single illustration (Hinde, 1879, Pl. 20, Fig. 1) it is not even possible to state whether it is the left jaw seen from the inner lateral side, or the right jaw seen from the outer lateral side. All the flattened jaws from the family Mochtyellidae are similar to it in their outline. Neither there is any certainty whether this jaw did not have a basal ridge or second ridge, which may have been easily overlooked, as Hinde did not have any material freed from the rock at his disposal. The genus *Oxyprion* markedly differs from the genus *Vistulella* in the lack of the basal plate, of the right MIIb, and intercalary and laeointercalary teeth, as well as in entirely different shapes of all the jaws, and especially laeobasal plate coalesced with MI in case of the genus *Oxy-*

prion, and isolated in the case of the genus *Vistulella*. Kozur's statement of apparent incompleteness of the apparatus *Oxyprion compressus* Szaniawski, probably results from a misunderstanding caused by double meaning of the word „missing" (improper use of the word „missing" in place of „lacking") in the definition of this genus in regard to the basal plate and intercalary and laeointercalary teeth. The lack of these elements in the genus *Oxyprion* has been clearly stated when it was compared with the genus *Pistoprion* Kielan-Jaworowska (Szaniawski, 1968, p. 206). The genus *Oxyprion* is most closely related to the genus *Multiprion* n.gen., which has neither a basal plate, nor intercalary or laeointercalary teeth. It is also more closely related to the genus *Pistoprion* Kielan-Jaworowska, 1966, and *Mochtyella* Kielan-Jaworowska, 1961, than to the genus *Vistulella*. Therefore, allocation of the Silurian genus *Vistulella* and Permian genus *Oxyprion* in the synonymy of the genus *Staurocephalites* on the basis of the similarity of the outline of one jaw in side view is not justified.

The other systematic revisions made by Kozur also tend to allocate the forms highly differing in morphology into a single genus. Thus, for example, the genera *Atraktoprion* Kielan-Jaworowska, 1961, and *Xanthoprion* Kielan-Jaworowska, 1966, are included in the synonymy of the genus *Arabellites* Hinde, 1879. *Arabellites hamatus* Hinde, a left MI, has unfortunately been chosen as the type species of the genus *Arabellites*, because the left MI of the genus *Atraktoprion* hardly differs from the corresponding jaw of the genus *Skalenoprion*. Hence, on the base of these type species, also the genus *Skalenoprion* should be included in the synonymy of the genus *Arabellites*. However, the genus *Skalenoprion* has an entirely different structure of the right MI and does not have a basal plate. Moreover, *Arabellites hamatus* Hinde markedly differs from the left MI of all the hitherto known apparatuses of the genera *Atraktoprion* and *Xanthoprion* in being narrower, in having less bent hook and in a shorter, transversal posterior margin. Unfortunately, this species has been illustrated by Hinde (Hinde, 1879, Pl, 18, Fig. 12) only in dorsal view and thus it is not known how its pulp cavity opening is developed. It is highly probable that *A. hamatus* Hinde belonged to the apparatuses with the structural pattern markedly differing from that of the apparatuses of the genera *Atraktoprion* and *Xanthoprion*.

According to Kozur, the genera *Mülleriprion* Kozur, 1967, and *Kielanoprion* Szaniawski, 1968, should be included in the synonymy of the genus *Eunicites* Ehlers, 1868. However, the original diagnosis of the genus *Eunicites* was mainly based on the imprints of soft parts. Only unidentifiable fragments of the jaw apparatuses of the type species of this genus, *Eunicites avitus* Ehlers, as well as of other species included by Ehlers to this genus, were found. The new diagnosis of this genus, proposed by Kozur (1970), cannot be accepted because its part concerning the jaw apparatuses is

based on scolecodonts and apparatuses of the Permian and Triassic age, whose congenerity with Jurassic imprints of soft parts cannot be proved (see also p. 245).

Kozur considers the genera *Polychaetaspis* Kozłowski, 1956, and *Kozlowskiprion* Kielan-Jaworowska, 1966, as the synonyme of the genus *Protarabellites* Stauffer, 1933. The type species of the latter genus, *P. humilis* Stauffer, which is a left MI, markedly differs from the corresponding jaws of all the known apparatuses of the genera *Polychaetaspis* and *Kozlowskiprion* in rhomboidal shape and in being wider. Moreover, it should be noted that the diagnostic importance of the left jaw is much smaller than that of the right jaw, and that pulp cavity opening of the type species in question is unknown. Hence, it may be proved in the future that *P.humilis* Stauffer belongs to an apparatus highly differing from the apparatuses of the genera *Polychaetaspis* and *Kozlowskiprion* in structural pattern.

Kozur also assigned mandibles of the genus *Palaeosigma* Eisenack, 1939, which have nothing in common with the mandibles of the genus *Polychaetaspis*, to the genus *Protarabellites*.

Kozur considers the genus *Paulinites* Lange, 1949, as a younger synonym of the genus *Kettnerites* Žebera, 1935, the holotype of the type species of which is deformed (?) MII — *Kettnerites kosoviensis* Žebera. However, scolecodonts corresponding to the jaws MI of the apparatuses of the genus *Paulinites* have been previously described under the generic name *Nereidavus* Grinnel, 1877. Kozur considers the type species of the latter genus, *Nereidavus varians* Grinnel, as *nomen dubium*. According to the present authors, the MI jaw of the genus *Paulinites* seems to be more closely related to the type species of the genus *Nereidavus* than the MII jaw to the type species of the genus *Kettnerites*. However, both these type species are insufficiently preserved for a univocal statement whether or not they are congeneric with the forms of the genus *Paulinites*.

Acceptation of Kozur's proposition of combining the systematics would be harmful both to apparatuses and to scolecodonts systematics. Kozur considers majority of Paleozoic scolecodont genera as *nomina dubia*. According to him, some apparatus elements, including mandibles and basal plates are unidentifiable. In the case of mandibles, Kozur (1970, p. 40) holds that „Scolecodonten-Gattungen, die für Mdb aufgestellt wurden, werden daher im allgemeinen als nomina dubia bezeichnet"; whereas, mandibles are actually highly differentiated and are of undoubtful diagnostic importance, at least up to the generic rank. The fact that they were rarely used for diagnostic purposes is the result of their being seldom found in conjunction with apparatuses. Hence, description of isolated mandibles seems justified. Until recently 9 mandible genera are known (cf. Eisenack, 1970 and Jansosnius & Craig, 1971) and a new genus is described in the present paper.

The genus *Paleoenonites* Eller, 1942, grouping basal plates and including a number of well-defined species, is also considered by Kozur as *nomen dubium*. However, it should be noted that Kielan-Jaworowska (1966) found basal plates to be of great diagnostic importance for genera and even for species, as in the case of, e.g., the genus *Polychaetaspis*. Besides MI jaws, they are the apparatuses elements of highest diagnostic value. Recently, Jansonius & Craig (1971) have distinguished three new genera among basal plates previously described.

In turn, some other scolecodonts were allocated by Kozur in various systematic taxa, whereas they are actually different elements of a single apparatus. As it was shown by Zawidzka (1971), *Delosites raridentatus* Kozur, and *Palurites separatus* Kozur, allocated by Kozur (1970, 1971) not only in different species and different genera, but also in different families and superfamilies, actually represent MI and MII jaws of an apparatuses of one species.

The above examples do not allow to accept the combination of scolecodonts and apparatuses systematic suggested by Kozur (1970). However, such combination may be possible in the future, after the scolecodonts systematic has been put in order and the knowledge of fossil apparatuses has enriched. The initiative of Jansonius & Craig (1971) to introduce order into the systematic of scolecodonts is of great importance.

SYSTEMATIC DESCRIPTION

I. APPARATUSES

Family **Mochtyellidae** Kielan-Jaworowska, 1966

Discussion. — Genus *Multiprion* nov. gen., described below, is allocated by the present authors in the family Mochtyellidae Kielan-Jaworowska, although it comprises a higher number of jaws than it is defined by the diagnosis of this family. Therefore an emendate diagnosis of it is proposed as follows:

Asymmetrical jaw apparatuses of the placognatha type, consisting of jaws with gaping openings of the pulp cavities in the posterior part and two rows of teeth in the anterior part. As a rule, a series of lateral teeth forming two chains on both sides of the posterior part of the apparatuses are present (unknown in *Vistulella*). Carriers lacking. Basal and laeobasal plates are elongated jaws shorter than MI. Anterior jaws (MII and MIII), if present, are small, platelike and odd. Intercalary and laeointercalary teeth sometimes present. In *Mochtyella* and *Multiprion*, posterior part consists of compound jaws, whereas in *Vistulella* and *Pistoprion* of simple jaws

Isolated jaws belonging to apparatuses of this family were often recorded in Devonian strata but complete apparatuses of that age were hitherto unknown.

Genus *Multiprion* nov.

Type species: *Multiprion opolensis* n.sp.
Derivation of the name: Lat. *multus* — many, *prion* — saw.

Diagnosis. — Apparatus consisting of right and left MI with basal and laeobasal ridges, right and left MII, single right MIII, and unspecified number of anterior and lateral teeth. Second ridge lacking. Laeobasal ridge with separate pulp cavity. Jaws MII and MIII of the appearance of denticulated plates. Right MII somewhat smaller than left MII.

Occurrence. — Upper Frasnian of Poland.

Remarks. — The apparatus of genus *Multiprion* gen.nov. differs from all hitherto described apparatuses of the family Mochtyellidae Kielan-Jaw. primarily in occurrence of paired MII and single right MIII. These jaws markedly differ from anterior jaws of the apparatuses of the genera *Pistoprion* Kielan-Jaw. and *Vistulella* Kielan-Jaw. both in shape and size. Right MII of the apparatus of genus *Multiprion* nov. differs from the corresponding jaw of the *Oxyprion compressus* Szan. only in smaller number of teeth and almost rectilinear denticulated margin. MI of genus *Multiprion* nov. are the most similar to the corresponding jaws of genus *Mochtyella* Kielan,-Jaw and *Oxyprion* Szan. They primarily differ from those of the latter genus in the presence of basal ridge; in turn, they are most similar to the corresponding jaws of genus *Mochtyella Kielan-Jaw.* in the lack of the second ridge, differing from them in the laeobasal plate longer and coalescent with them, and in a clearly separated pulp cavity. Construction of the newly described apparatus seems to indicate that the apparatuses of genus *Oxyprion* Szan. also contained more anterior jaws that it is known. Therefore, it may appear that genus *Multiprion* nov. is still more similar or even congeneric to genus *Oxyprion* Szan. It may also be assumed that genus *Multiprion* nov. represents a form transitional between Ordovician and Permian genera of the family Mochtyellidae Kielan-Jaw.

Devonian scolecodonts similar to anterior jaws of the new genus were described under the names of *Anisocerasites* Eller, e.g., *A. aciedentatus* Eller, or *A. confertus* (Eller), and *Ungulites* Stauffer. In turn, the similarity of MI of this apparatus to scolecodonts hitherto described is the same as in the case of corresponding jaws of the genera *Mochtyella* Kielan-Jaw. and *Oxyprion* Szan., which was already discussed (vide Kielan-Jaworowska, 1966; and Szaniawski, 1968).

Multiprion opolensis n.sp.

(Pl. I, Figs 2, 3*a*—*b*)

Holotype: Almost complete apparatus consisting of right and left MI with basal ridges, right and left MII, single right MIII, and a few lateral or anterior teeth. Pl. I, Fig. 2, Z. Pal. No. Sc. II/1.

Type horizon and locality: Frasnian, Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Derivation of the name: *opolensis* — found nearly Opole Lubelskie.

Diagnosis. — Asymmetrical apparatus with right MI markedly shorter than left. Laeobasal ridge with separate opening of pulp cavity, finely-denticulated, with length equalling 0.75 of the total length of MIl jaw. Basal ridge distinct, with length equalling 0.2 of the total length of MIr jaw, crenulated or almost smooth. Both MI jaws strongly bent outwards in the anterior part. Right and left MII plate-like, convex from inner side, with margin denticulated, almost rectilinear or slightly bent, left MII, larger than right and almost equal to MI in height. MIII similar to MII, differing in a smaller size and a shallower pulp cavity; its internal wall passes into attachement lamella. Anterior teeth straight, smooth, spine-like. Lateral teeth wider than the anterior ones, somewhat bent and with wide opening of pulp cavity.

Denticle formula:

Laeobasal ridge	15—17	—
Basal ridge	—	indistinctly crenulated
MI	14—17	13—17
MII	7	5
MIII	—	4

Material. — Holotype and 15 incomplete apparatuses consisting of right and left MI; 4 apparatuses also comprise a few anterior or lateral teeth; moreover, left MI jaw joined with MII ones and a few hundred of isolated jaws, mainly right and left MI.

Description. — *Left MI* varying from 0.33 to 0.48 mm in length (0.33 mm long in the case of the holotype). Jaw width almost equal to its height, equalling 0.25 to 0.30 of the length. Anterior margin rounded. Inner margin almost straight or slightly convex. Outer margin irregular, slightly concave. Main ridge denticulated along its whole length, with anterior part curved outwards in such a degree that the first three denticles are, occasionally, almost transversally oriented; pits separating these denticles are shallower and smaller and these denticles are more straight and less regular than the remaining ones. Four subsequent denticles are more or less equal in size; whereas the rest ones gradually decrease in size and are inclined towards the posterior. Laeobasal ridge equalling ca. 0.75 length of MI, with a row of fine denticles, the first

of which are markedly smaller than the remaining ones. It is oriented parallelly to the posterior part of the main ridge and connected with the jaw by a thin wall, which usually undergoes breaking, beginning from its posterior part. Whole ventral side of the jaw occupied by wide opening of pulp cavity with distinctly separated cavity corresponding to laeobasal ridge.

Right MI generally resembling left MI, differing in markedly smaller size. Courses of margins similar to those from left MI; outer margin commonly irregular in result of poor preservation of the wall gradually thinning out towards its edge. The main ridge denticulated along its whole length, with anterior part bent outwards; its last denticle, knobby-like and obtuse, passing in short edge; all denticles more regular than in the left jaw, gradually decreasing in size and inclined posteriorly. Basal ridge narrow, equalling 0.2 of MI length, finely-crenulated or almost smooth. Pulp cavity opening occupying the whole ventral side of the jaw. Pulp cavity deep,

Left MII plate-like, denticulated, convex from inner side, equalling 0.26 of MI length, higher than long but lower than MI. Denticulated ridge almost straight. Denticles increasing in size and somewhat inclined posteriorly, fine, narrow. Margin of pulp cavity opening irregular due to deformation of the wall. Pulp cavity opening occupying whole ventral side. Pulp cavity very deep.

Right MII generally resembling left MII, differing in somewhat smaller size. Anterior and posterior denticles slightly smaller than medial ones, which results in a slight bent of denticulated margin.

Right MIII similar in shape to right MII, differing in smaller size and in more pronounced bent of denticulated margin. Pulp cavity shallow. Inner wall passing into attachment lamella.

Anterior teeth. A row of anterior teeth is represented by a few translocated, singular teeth; these are spine-like, smooth, with very thin, translucent walls.

Lateral teeth. Teeth with spine-like cusp and wide base, triangular in outline, slightly bent and laterally flattened; pulp cavity opening wide, ovate; walls very thin, translucent.

Mochtyella kielanae n.sp.

(Pl. I, Fig. 4)

1966. *Mochtyella* sp. b: Kielan-Jaworowska, pp. 56—57, Pl. 4, Fig. 2; Pl. 5, Fig. 4.

Holotype: incomplete apparatus consisting of right and left MI with basal ridges and second ridge. Pl. I, Fig. 4, Z. Pal. No. Sc. II/10.

Type horizon and locality: Frasnian, Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Derivation of the name: named in honour of Professor Zofia Kielan-Jaworowska, who was the first to describe a single jaw of this species.

Material. — Holotype and almost twenty isolated scolecodonts; the whole material derived from Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Diagnosis. — Both jaws equal in length. Laeobasal ridge denticulated, equalling ca. 0.75 length of MI. Second ridge undenticulated, equalling about 0.2 of MI. Basal ridge well-differentiated, short, weakly crenulated.

Description. — Both jaws equal in length, from 0.35 to 0.55 mm long.

Left MI subtrapezoidal in lateral view, with straight denticulated margin. In dorsal view laterally flattened, with steep slopes. Anterior margin rounded, whereas inner margin straight or slightly arched. Outer margin irregular, bent inside. Main ridge denticulated along its whole length, slightly bent outwards in its anterior part; along the remaining section denticles are arranged in a straight line. Denticles, 14 to 16 in number, regularly decrease in size posteriorly; however, those situated in the middle appear to be the most massive. Laeobasal ridge usually broken off or crushed, equalling ca 0.75 length of MI, with at least 10 denticles; it continues parallelly to and ends simultaneously with the main ridge, and is separated from it by a relatively wide furrow. Deep pulp cavity with separated cavity of laeobasal ridge observable from ventral side.

Right MI very similar to the left one, representing its mirror reflection. Main ridge denticulated almost along its whole length, occasionally with very short undenticulated section in the most posterior part. Denticles, 14 to 16 in number, regular, gradually decreasing in size and inclined posteriorly. Second ridge smooth or somewhat crenulated, equalling ca. 0.2 of MI length, developed in the form of small fold, situated between inner anterolateral jaw margin and main ridge, continuing parallely to the latter. Basal ridge slightly crenulated or smooth, equalling ca. 0.2 of MI length, clearly differentiated on jaw slope.

Mochtyella sp. A

(Pl. I, Figs 5a—b, 6)

Material. — Two incomplete apparatuses consisting of compound right and left MI and a few dozens of isolated jaws. The whole material derived from the Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Description. — Both jaws almost equal in length, 0.30 to 0.58 mm long. *Left MI* is of a regular trapezoidal outline in side view, becoming laterally inflatted in dorsal view; inclination of slopes varying. Anterior part of the jaw wider than the posterior one. Anterior margin rounded. Inner margin gently arched; outer margin irregular, bent inside. The main ridge almost rectilinear, except for its anterior section turned outside; the main ridge

is formed of 12 to 14 regularlyshaped denticles, gradually decreasing in size posteriorly. Laeobasal ridge never completely preserved because of its fragility; consisting of more than 10 denticles, narrow, fine, separated from the main ridge by a wide furrow. Pulp cavity markedly deep, with a wide opening, separated from laeobasal ridge cavity.

Right MI resembling the left one in overal outline but shorter. Main ridge consisting of 12 to 14 regularly shaped denticles, gradually decreasing in size towards the posterior part, occasionally with very short, undenticulated posterior section. Second ridge lacking. Basal ridge slightly crenulated, usually partly damaged or obliterated.

Lateral teeth. These teeth are thin-walled, with claw-like bend, spike-shaped, with smooth peak and wide base; their concave side is covered with fine denticles at the base.

Remarks. — The apparatus in question appears to be most similar to the apparatuses of *Mochtyella trapezoidea* Kielan, — Jaw. and *M. duplicidentata* Szan. It differs from the former species in longer laeobasal ridge, without any notch in posterior part of inner slope of right MI and in denticulation of anterior or lateral teeth. In turn, the apparatus in question differs from the latter species in right MI with basal ridge, without any noth in posterior part of inner slope, and with some outward bend of main ridge; moreover, it differs from the latter species in the lack of first pair of anterior teeth with double peaks; however, this lack may result from incompleteness of the specimen in question.

Family **Xanioprionidae** Kielan-Jaworowska, 1966

Emended diagnosis. — Symmetrical jaw apparatuses of placognatha type. Carriers lacking. MI longitudinally elongated. Laeobasal and basal plates strongly elongated adhering to outer margins of MI. MII arcuate, situated in front of MI. MIII small, situated in front of MII. Anterior teeth (or MIV) situated in front of MIII. Lateral teeth situated in front of laeobasal and basal plates, forming rows running parallely to outer margin of MII.

Discussion. — The apparatus of *Xanioprion walliseri* n.sp. found in the Opole Lubelskie borehole enabled description of MIII jaw, hitherto unknown in the apparatuses of that genus. Comparative studies of material extracted from Ordovician and Silurian erratic blocks from Northern Poland and described by Kielan-Jaworowska (1962, 1966) enabled finding of these MIII jaws among isolated elements as well as in the holotype apparatus of the *Xanioprion borealis* Kielan-Jaw. These jaws are of great diagnostic value, hence emendation of both generic and family diagnoses

appear necessary. Former diagnoses were based on a single species, *Xanioprion borealis* Kielan-Jaw.

Both in the material of the present authors and in material of Kielan-Jaworowska (1962, 1966)anterior teeth are commonly connected with MIII jaw. Always only simple paired anterior, right and left teeth were found. Shape and arrangement of these teeth in the apparatus implicate that they may have been actually the only anterior teeth of the apparatuses hitherto found. If this is the case, then these teeth may be considered as jaws (MIV), similarly as in the apparatuses of the labidognatha and prionognatha types.

Devonian apparatuses of the *Xanioprion walliseri* n.sp., are characterized by well-separated laeobasal and basal plates; in case of Ordovician and Silurian apparatuses of *X. borealis* Kielan-Jaw. these plates are coalescent with lateral teeth, which inclined Kielan-Jaworowska (1966) to treat lateral teeth as "anterior part of laeobasal or basal plates" rather than distinguish them as separate elements.

Genus *Xanioprion* Kielan-Jaworowska, 1966

Type species: Xanioprion borealis Kielan-Jaworowska, 1962.

Emended diagnosis. — Nearly symmetrical jaw apparatuses consisting of three jaws, some lateral teeth and one or more anterior teeth on each side. MI straight, subrectangular. MII arcuate, larger than MI and arranged in front of them. Laeobasal and basal plates finely denticulated with denticles decreasing posterioly in size. Pulp cavity of laeobasal and basal plates narrowly open. MIII subtriangular, finely denticulated. Lateral teeth arcuate, long, sharply pointed. Anterior teeth (or MIV) arranged in front of MIII, subtriangular in outline.

Xanioprion walliseri n.sp.

(Pl. I, Fig. 1; Pl. II, Figs 1-6; Pl. III, Fig. 7)

Holotype: Almost complete apparatus consisting of right and left MI, laeobasal and basal plates, right and left MII, left MIII, and lateral teeth, Z. Pal. No. Sc. II/40, Pl. I, Fig. 1a-d.

Type horizon and locality: Upper Frasnian, the Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Derivation of the name: Named in honour of Professor O. H. Walliser of the University of Göttingen, who described isolated elements of the apparatus of this genus for the first time.

Diagnosis. — MI strongly elongated, with denticulated ridge becoming smooth in the posterior part and finally passing into narrow posterior pro-

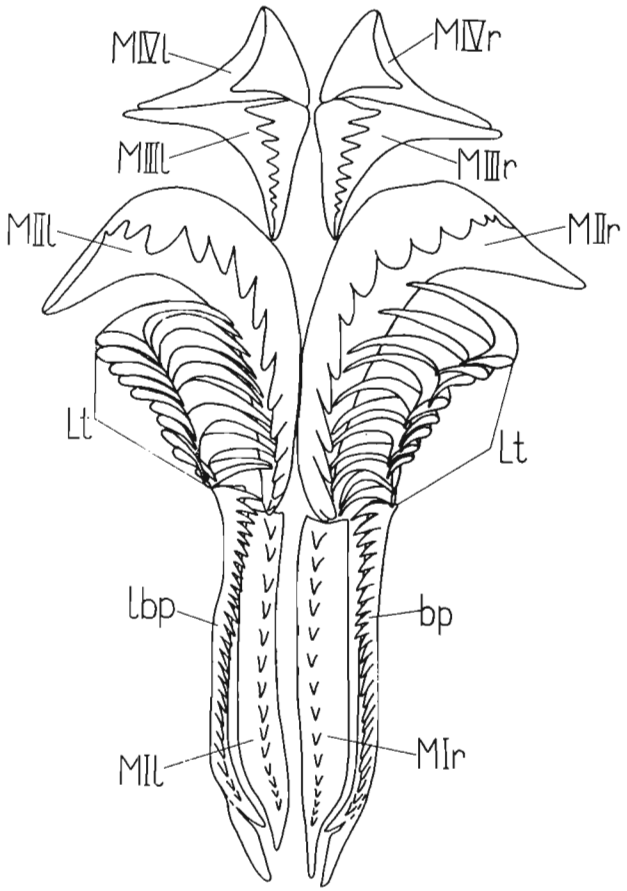

Fig. 1. Diagram of jaw apparatus of *Xanioprion walliseri* n.sp.

jection. MII more massive than MI, and almost equal in length; largest denticle situated at the center of jaw bent; 2 or 3 anterior denticles adjoining it are markedly smaller; the remaining anterior part of ridge completely smooth. Basal and laeobasal plates with distinct lateral slopes, pulp cavity opening gaping, and with anterior margin well-differentiated, transversally oriented. Rows of lateral teeth comprise up to 11 single teeth. MIII — denticulated jaws with right-angled triangle outline, resulting from lateral extension of transversal branch in anterior jaw part. MIV (or anterior teeth) single, spine-like teeth with large base, triangular in outline.

Denticle formula:

Laeobasal and basal plates	18—24	18—25
MI	12—15	12—15
MII	10—13	10—14
MIII	8	9
M IV	1	1

Material. — Incomplete apparatus, a few dozens of isolated MI and MII jaws, laeobasal and basal plates and lateral teeth. Among these isolated elements, connections of MI with laeobasal or basal plate, MII with lateral teeth, laeobasal or basal plate with 2—3 lateral teeth are the most common. There is also one right MIII joined with MIV (or anterior tooth).

Description. — *MI* 0.40—0.75 mm long (posterior ends of MI of the holotype are broken-off). Right MI represents mirror image of the left one. MI strongly elongated, with moderately steep lateral slopes. Denticulated ridge straight, becoming slightly posteromedially bent in the posterior part (equalling a third of jaw length) and finally undenticulated along most posterior section, equalling 1/7 of jaw length. Anterior margin transversal, straight. Inner margin almost straight. Outer margin posteromedially bent in the posterior part, equalling a third of jaw length. Posterior jaw end extended in a form of narrow posterior projection variable in length, commonly ca. 1/7 of jaw length. Pulp cavity gaping.

MII. Right MII representing mirror image of the left one. Massive jaws 0.45 to 0.95 mm long; the holotype — ca. 0.45 mm long. Anterior part, equalling a third of jaw length, bent outwards, and pointed laterally. Denticulated ridge completely smooth along its anterior section of transversal branch. Two or three anterior denticles small, being followed by the largest denticle and a row of denticles gradually posteriorly decreasing in size; denticles laterally flattened, low, inclined towards the outside and posteriorly. Inner slope of the jaw steep, slightly convex, covered with fine furrows running from inter-denticle pits towards the margin. Outer slope concave. Anterior jaw end sharper than posterior.

Basal and laeobasal plates very similar to each other, almost straight, narrow jaws, usually somewhat longer than MI, 0.45 to 0.80 long, with posteromedial bend of posterior part. Lateral slopes steep, with well-differentiated margins. Anterior margin transversal, straight. At the bent of outer margin of the plates, there begins a posteriorly directed pellicular projection variable in shape and length, commonly attaining ca. 0.2 of jaw length, straight or bent to the inside; however, it is usually partly or completely broken off. Two anterior denticles larger than the remaining ones, which gradually posteriorly decrease in size. Anterior denticles markedly individualized, whereas the remaining ones are progressively stronger coalesced to one another forming distinct ridge, finally passing into almost smooth edge. Pulp cavity gaping, somewhat expanded close to anterior margin.

MIII. Right MIII representing mirror image of the left one. Jaw of the outline of right-angled triangle tapering posteriorly, with width equalling length, attaining ca. 0.3 length of MI. Denticulated ridge slightly arched, covered with straight denticles gradually posteriorly decreasing in size. Anterior margin transversal, straight. Outer margin bent to the inside,

forming a long shank in anterior part of jaw. Slopes steep; outer slope concave. Pulp cavity deep, gaping.

MIV or *anterior teeth* paired: right MIV representing mirror image of the left one; they are spike-shaped, with pulp cavity widely open and triangular in outline. MIV commonly strongly adhering to MIII, and diametrally differing from lateral teeth.

Lateral teeth usually crescent, claw-like, long, very sharply pointed, very closely adjoining one another, arranged in a series. Pulp cavity, separate for each tooth, deep, with wide rectangular opening. Teeth varying in length; teeth situated in the middle of the series usually predominating in size. Posterior teeth of the series commonly strongly pressed to anterior margin of laeobasal or basal plates, hence they are often found together with those plates. Lateral teeth series run parallely to outer margins of MII and partly cover these jaws in dorsal view.

Remarks. — Elements of apparatuses from Opole Lubelskie borehole are more massive and larger than the corresponding elements of the species *X. borealis* Kielan-Jaw. described by Kielan-Jaworowska (1962) from the erratic blocks and by Szaniawski (1970) from the Ordovician of the Mielnik borehole. MI of the apparatuses of *X. walliseri* n.sp. differs from MI of the apparatuses of *X. borealis* Kielan-Jaw. in more numerous denticles, longer and sharper posterior end. In turn, MII of the new species differs from the corresponding one of *X. borealis* Kielan-Jaw. in development of smooth edge in anterior part of denticulated ridge and in both anterior and posterior ends sharp. Moreover, apparatuses of *X. walliseri* n.sp. differ from the apparatuses of *X. borealis* Kielan-Jaw. in well-separated laeobasal and basal plates, and in series of lateral teeth comprising 11 teeth on each side of the apparatus, in comparison with 5—6 teeth of the latter species. Moreover, MIII of the new species have right-angled triangle outline in comparison with isoceles-triangle outline of the corresponding jaw of *X. borealis* Kielan-Jaw.

Single MII of this genus were described as scolecodonts from the Silurian of Canada (Walliser, 1960; see also Kielan-Jaworowska, 1962).

Genus *Processoprion* nov.

Type species: Processoprion longiprocessus n.sp.

Derivation of the name: Lat. *processus* — process, from antero-lateral projections on all jaws, gr. *prion* — saw.

Diagnosis. — Jaw apparatus consisting of paried and almost symmetrical MI and MII and series of lateral teeth. Antero-lateral corners of all jaws strongly elongated onwards in the form of thin projections. Right MI with denticulated main ridge and, occasionally, with basal ridge. MII jaws

markedly shorter than MI, situated in front of them. Pulp cavity openings of all jaws widely open.

Remarks. — The new genus differs from all known representatives of the family Mochtyellidae Kielan-Jaworowska, 1966, primarily in almost symmetrical left and right sides. This feature brings it closer to the family Tetraprionidae Kielan-Jaworowska, 1966, from representatives of which it differs in the lack of separate basal and laeobasal plates and MIII, as well as in markedly different shape of all jaws. Moreover, the new species differs from all hitherto described in long antero-lateral projections developed on all jaws. If more specimens with such characteristics are found in the future, perhaps introduction of a new family for them will be necessary.

Processoprion longiprocessus n.sp.
(Pl. IV, Fig. 8a-b)

Holotype: Jaw apparatus Z. Pal. No. Sc. II/50, Pl. III, Fig. 8a-b.

Type horizon and locality: Frasnian, the Opole Lubelskie borehole, depth of 1.212 m.

Derivation of the name: Lat. *longus* — long, *processus* — process; from long antero lateral projections on all jaws.

Diagnosis. — MI long, with main ridge denticulated along the whole jaw length. Basal ridge smooth, weakly projected. Lateral walls very thin. Antero-lateral projections long, narrow. MII placed between MI projections, triangular in outline, equalling ca. 0.3 length of MI, with a few, relatively large teeth. Length of antero-lateral projections somewhat exceeds a half of jaw length. Lateral teeth sharp, triangular, wide at the base, arranged in long series.

Denticle formula:	MI	16—14
	MII	4— 4

Material. — A single apparatus.

Description. — MI, together with projections, 0.31 mm long; width in dorsal view equal 0.23 of the length without projections. MII placed between antero-lateral projections of MI.

Right MI. Lateral margins straight, directed posteriorly, converging on the posterior end. Anterior margin straight, transversal. Main ridge denticulated along its whole length, continuing along inner margin turning outwards in the most anterior part. Denticles shapr, poorly differentiated in size, oriented towards the posterior with some deviation to the outside. Basal ridge smooth, weakly projected, situated close to outer margin, and equalling ca. 0.2 of main ridge. Inner slope almost vertical; outer slope steep; walls of both slopes very thin, translucent, partly damaged. Antero-lateral corner of jaw strongly extended forward in the form of narrow

projection, equalling a third of the length of proper jaw. Anteromedial jaw corner extended forward in the form of attachment lamellae, entering between right and left MI.

Left MI almost symmetrical to right one, except for the lack of basal ridge. Its antero-lateral projection is somewhot shorter, but this may result from breaking out. Antero-medial jaw corner extended in the form of attachment lamella entering beneath right MI.

Right MII triangular, plate-like, becoming narrower towards the posterior, equalling 0.28 length of MI (without projections); jaw widest in anterior part, equalling ca. 0.5 of its length. Anterior margin transversal; lateral margins postero-medially oriented, converging at the posterior. Almost whole dorsal side occupied by four sharp denticles, posteriorly inclined; medial denticle predominates. Antero-lateral projection broken off. Inner slope passing into attachment lamella, connected with a series of lateral teeth on ventral side. Pulp cavity opening on ventral side gaping.

Left MII symmetrical to right one. Antero-lateral projection extending forward and equalling ca. two-thirds of jaw length.

Lateral teeth triangular, wide at the base and with sharp point, arranged in long series. Original position of these series remains unknown. In the case of the holotype, right teeth series is almost complete and situated in MI pulp cavity and along MII attachment lamella, whereas left series, represented by a few teeth, is irregularly scattered along ventral side of both MII.

Family **Polychaetaspidae** Kielan-Jaworowska, 1966

Genus *Polychaetaspis* Kozłowski, 1965

Polychaetaspis hindei n.sp.

(Pl. III, Figs 1-6)

Holotype: Joined right and left MI, Z. Pal. No. Sc. II/51, Pl. III, Fig. 1*a-b*.

Type horizon and locality: Frasnian, the Opole Lubelskie borehole, depth 1.212 m.

Derivation of the name: Named in honour of George Jennings Hinde, who described scolecodonts resembling jaws belonging to this genus for the first time in 1879.

Diagnosis. — Basal plate triangular, with maximal width equalling 0.45 of its length, tapering anteriorly and posteriorly. MI narrow, maximally wide (one-third of their length) in the middle. First denticle postero-laterally oriented. Ligament scar invisible. Right MI with bight occupying a half of its length and with wide shank. Left MI somewhat narrower than right, with prominent proturberance in the half of its length. Inner wing attaining 0.7 of jaw length, tapering anteriorly. MII with long shank. In-

tercalary tooth lacking? Lateral teeth poorly known, narrow. Carriers unknown.

Denticle formula:			
Basal plate	—	9—12
MI	13—19	12—17
MII	?	9—10
MIII	?	—
MIV	?	8
MV	?	1

Material. — In addition to the holotype, complete right side of the apparatus, a number of joint jaws, and a few tens of isolated elements, mainly MI and basal plates.

Description. — MI varying from 0.25 to 1.2 mm in length.

Basal plate triangular in outline, tapering posteriorly and anteriorly, with maximal width equalling ca. 0.45 of its length, and situated at a variable height, normally at one-third from the front. Anterior margin straight or slightly sinusoidal, concave close to outer margin, postero-laterally oriented. Inner margin straight, denticulated almost along its whole length. First denticle predominating, bent; the remaining denticles similar in length, and becoming markedly slender towards the anterior. In ventral view, a belt wide in anterior part, becoming narrower towards the posterior in result of a torsion of the plate.

Right MI approximately three times longer than wide, the widest in the mid-length. Outer margin almost rectilinear, posteriorly oriented in anterior part, later turning abruptly laterally, and arcuately bent towards the posterior, forming prominent shank in its middle part; shank (in longitudinal direction) equalling ca. 1/5 of jaw length; its outer margin almost straight to slightly convex, posteriorly oriented with some lateral deviation. Longitudinal impression marked on the shank, at the extension of outer margin of the anterior jaw part. Bight of the basal plate, equalling approximately a half of jaw length, formed by posterior part of outer margin of the jaw. Inner margin anteriorly arcuate, postero-medially oriented, later becoming straight, posteriorly oriented, turning slightly in the lateral direction in the most posterior part of the jaw. Inner slope moderately steep. Row of 12—17 denticles, triangular in shape and decreasing in size towards the posterior, almost reaching the posterior end; denticles poorly differentiated in size, except for the first one, markedly longer, strongly incurved upwards and postero-laterally inclined. Posterior denticles inclined outside. Ligament scar invisible. On the ventral side opening of the pulp cavity occupies ca. 0.8 of jaw length. Denticle pits well-marked. Muscle scar poorly marked. Belt lacking.

Left MI narrow, about 3.3 times longer than wide, widest just above the mid-length. Outer margin continuing posteriorly with some lateral deviation through the anterior part, becoming strongly swelled to the

outside in the mid-length, and finally straight, postero-medially oriented in the posterior part. Inner margin arcuate, postero-medially oriented in the anterior part, becoming later straight, posteriorly oriented. Denticulation the same as in the case of the right jaw, except for the number of denticles, greater by two, on the average. Inner wing attaining 0.7 of jaw length, relatively narrow, widest in the middle, wedging out towards the anterior and becoming somewhat narrower towards the posterior. Ligament scar invisible. In ventral view pulp cavity opening occupies almost 0.8 of jaw length.

Right MII bevel square-shaped jaw, strongly tapering posteriorly. Outer margin arcuate, denticulated along its whole length. Shank long, sharply pointed, with anterior margin straight, postero-laterally oriented.

Right MIV similar in shape to MII, differing in smaller size and relatively longer shank.

Right MV single teeth, similar to the corresponding ones in other species of this genus.

Lateral teeth poorly known, long, slender.

Carriers and *left MII-MV* unknown.

Remarks. — The new species most closely resembles Ordovician *Polychaetaspis warkae* Kozłowski, 1956, differing primarly in basal plate which is longer and more triangular in outline, in narrower MI jaws, longer bight of right MI and in different denticle formula.

Polychaetaspis sp. A

(Pl. V, Figs 2-7)

Material. — Three right MI connected with basal plates, joined MI and lateral tooth, and approximately 300 isolated elements, mainly MI and basal plates. The collection also comprised two almost complete apparatuses, which underwent desintegration in the course of studies.

Description. — MI varying from 0.4 to 1.5 mm in length.

Basal plate subtriangular in shape, tapering anteriorly and posteriorly, 2.5 times longer than wide, the widest somewhat above the mid-length. Anterior margin postero-laterally oriented, convex, except for concave section adjoining outer margin. Outer margin slightly longer than the anterior one, straight, postero-medially oriented. Row of 8—12 denticles running along inner margin, straight, posteriorly oriented. First denticle predominantes; among the remaining denticles, median denticles predominate in size and anterior ones are more slender than the posterior. Posterior section of inner margin, corresponding to 0.2 of its total length, undenticulated arcuately bent in postero-lateral direction. In ventral view the belt markedly wider than the pulp cavity opening in anterior

part, becoming narrower towards the posterior in result of torsion of the plate.

Right MI about 2.7 times longer than wide, the widest just above the mid-length. Outer margin almost straight, posteriorly oriented with some lateral deviation along its anterior section, later turning more strongly in lateral direction, forming shank. Shank triangular, narrow, extending in postero-lateral direction. Bight occupying approximately a half of jaw length. Longitudinal ligament scar, usually reaching the base of the second denticle, marked along the most posterior section of left slope. Inner margin arcuate in the anterior part, postero-medially oriented, becoming later straight, posteriorly oriented. Row of 12—14 denticles continuing along 0.85 length of inner margin. First two denticles somewhat larger than the remaining ones, incurved upwards and posteriorly; the remaining denticles slightly differentiated in size; among them median denticles commonly predominate in size, and anterior ones are more slender than the posterior. On ventral side pulp cavity opening occupying approximately 0.8 of jaw length. Furrow with denticle pits well-marked.

Left MI about 3 times longer than wide, the widest just above the mid-length. Outer margin almost straight along the anterior section, posteriorly oriented with some lateral deviation, becoming bent outwards in the form of wide shank in the middle, and becoming finally straight, postero-medially oriented in the posterior part. Shank sharply delineated from the rear by a margin almost transversal in its course. Inner margin and denticulated ridge continuing similarly as the corresponding ones of the right jaw. Denticles, 12—15 in number. Inner wing attaining ca. 0.65 of jaw length, almost uniform in width and truncated in front by a margin postero-laterally oriented which can be seen in well-preserved specimens. Ligament scar, distinctly marked, rhomboidal in shape and usually reaching the height of the base of the second denticle. Pulp cavity opening occupying approximately 0.8 of jaw length.

Lateral teeth relatively large, with a thin apex bent upwards and a wide base with long shank set perpendicularly to tooth axis.

The remaining elements of the apparatus are unknown.

Remarks. — The elements described above belong to a hitherto unknown apparatus. However, the lack of joined MI in the collection prevents the authors from establishing a new species. These elements undoubtedly belong to the same species because in the collection, apart from the elements belonging to the species *Polychaetaspis hindei* n.sp., there is only one type of MI jaws and basal plates from the genus *Polychaetaspis*. Moreover, the authors have previously had at their disposal complete apparatuses of this species; unfortunately, these apparatuses desintegrated in the course of the studies.

Polychaetaspis sp. A seems to be most closely related to the species *Polychaetaspis aequilateralis* Kielan-Jaworowska, 1966, known from the (?) Silurian erratic blocks from Poland, differing in markedly narrower left MI with longer inner wing, in somewhat shorter bight of the right MI, and in convex anterior margin and markedly larger first denticle of the basal plate. Moreover, *Polychaetaspis* sp. A probably does not have intercalary tooth.

Eller (1964) described, from the Devonian of Ontario, joined MIl with MIIl jaws, and MIr with MIIr jaws under the generic name *Lumbriconereites* Ehlers, usually applied to isolated scolecodonts, and under common specific name, *L. jugosus* Eller. Left MI of this species appears to be very similar to the corresponding jaw of *Polychaetaspis* sp. A, whereas right MI allocated by Ehlers in the same species, *Lumbriconereites jugosus*, is more closely related to the right MI of the species *Polychaetaspis hindei* n.sp. Thus, it seems probable that the right and left jaws described as *L. jugosus* by Ehlers are not conspecific.

Family **Kielanoprionidae** Szaniawski, 1968

Remarks. — The family comprises genus *Kielanoprion* Szaniawski, as well as the apparatus *Delosites raridendatus* Kozur emend. Zawidzka, described by Zawidzka (1971) from the Triassic of Poland. The latter generic name was originally proposed (Kozur 1967) for isolated right MI; however, if separate systematics are consistently used for scolecodonts and apparatuses, a new generic name should be given to the apparatus *Delosites raridentatus* Kozur emend. Zawidzka.

Genus *Kielanoprion* Szaniawski, 1968

Remarks. — Kozur (1970, 1971) treats genera *Mülleriprion* Kozur, 1967, and *Kielanoprion* Szaniawski, 1968, as younger synonyms of genus *Eunicites* Ehlers, 1868. However, genus *Eunicites* cannot be taken into account in the systematics based on the structure of jaw apparatuses, because jaw apparatuses of its type species, *Eunicites avitus* Ehlers, is preserved in the form of unidentifiable fragments. This species is represented by a single imprint of the whole body, found in lithographic limestones of the Malm from Solenhofen. The diagnosis of genus *Eunicites* is as follows: "Elongate body with numerous groups of aciculae; jaws as in the extant *Eunicea labidognatha*, tentaculata" (Ehlers, 1869 in Jansonius & Craig, 1971), which shows that Ehlers interpreted this genus in a very broad way. The superfamily Eunicea Grube comprises a number of Recent genera with labidognathic jaw apparatuses. However, none of them is similar to Permian *Kiela-*

noprion. Kozur (1970) gave emended diagnosis of the genus *Eunicites*, in which the description of jaw apparatus was based on Permian and Triassic material. However, the way in which Kozur identified imprints of Jurassic polychaetes and jaw apparatuses of Permian and Triassic polychaetes remains mysterious. Although one of the specimens assigned by Ehlers (1869) to this genus, *Eunicites dentatus* Ehlers, has MI jaws (see Kozur 1970, Pl. III, Fig. 3); they are so badly preserved that Ehlers himself regarded them as mandibles. Moreover, as these indentifications were primarily based on comparisons of imprints of soft parts, it is highly probable that jaw apparatus of *E. dentatus* is essentially different from the apparatus of the type species, *E. avitus* Ehlers. Kozur (1971) allocated a few species of genus *Eunicites*, described by Ehlers (1868, 1869), and the species *Lumbriconereis deperditus* Ehlers in the synonymy of the species *Eunicites proavus* (Germar), what accordingly to the present writers is insufficiently based. Recently Jansonius and Craig (1971) have also shown uselessness of genus *Eunicites* in scolecodont systematic and invalidity of emendation of its diagnosis by Kozur (1970).

The genus *Müllerіprion* Kozur, 1967, has to be considered as nomen dubium, as the only known apparatus of this genus (see Kozur, 1967, Textfig. 1) is insufficiently preserved for identification. Kozur (1967) also described a number of species of isolated scolecodonts under this generic name. Some of these isolated scolecodonts are actually very similar to corresponding elements of the apparatus of genus *Kielanoprion*. However, these isolated elements should be described under older generic names, applied in parataxonomic scolecodont systematics. These are Triassic scolecodonts and it is not certain whether or not the apparatus comprising them was similar to Permian apparatus of the genus *Kielanoprion*.

Kielanoprion elleri n.sp.

(Pl. IV, Figs 2-6; Pl. V Fig. 1)

Holotype: Apparatus without carriers and MV, Pl. IV, Fig. 3a-b, Z. Pal. No. Sc. II/76.

Type horizon and locality: Frasnian, the Opole Lubelskie borehole, depth from 1.202 to 1.212 m.

Derivation of the name: In honour of Dr. E. R. Eller of the Carnegie Museum, who for the first time described scolecodonts resembling elements of the apparatus in question.

Diagnosis. — MI symmetrical, with large fang and postero-lateral spur. Inner margin denticulated along a section corresponding to ca. 0.6 of its length. Pulp cavity opening rounded, occupying ca. a third of jaw length. No traces of basal plate found on right MI. MII long, narrow, with transversal branch equalling ca. 0.45 of jaw length. Shank narrow, sharp, postero-laterally oriented. MIII short, with arcuate, denticulated inner

margin and with transversal shank longer than a half of jaw length. MIV — small, plate-like, with denticulated, arcuate inner margin and large attachment lamella. MV represented by single, long teeth. Carriers and mandibles unknown.

Denticle formula:			
	MI	8—13	8—12
	MII	9—15	9—16
	MIII	6—10	—
	MIV	4— 6	5— 8
	MV	1	1

Material. — Eight more or less complete apparatuses, 12 specimens consisting of 2 or 3 connected jaws, and a few hundred isolated elements, mainly MI and MII. All specimens from the Opole Lubelskie borehole — depth from 1.202 to 1.212 m.

Description. — MI jaws 0.27 to 0.78 mm long; width equalling ca. a third of length.

Right MI subtriangular in shape. Fang markedly larger than remaining denticles, equalling ca. 0.13 of jaw length, slightly arcuate and bent upwards in relation to jaw surface. Outer margin arcuate, with long, sharp spur at the posterior and, Inner margin almost straight, denticulated except for its posterior part. Denticles, except for a few most anterior ones, generally decrease in size towards the posterior. Posterior, smooth and sharp section of margin equals 0.38 to 0.48 of jaw length. Small longitudinal inner wing found in majority of specimens. Posterior margin postero-medially oriented, somewhat bent in the middle of its length. Pulp cavity opening rounded, occupying about a third of jaw length. No traces of basal plate were found on the jaw.

Left MI almost symmetrical to right one, usually differing in larger, trapezoidal inner wing.

Right MII slightly shorter than MI. Inner margin straight, directed posteriorly, except for the anterior part where it is bent to the outside, denticulated along its whole length. The second or third denticle predominated, being followed by a relatively small denticle and by a row of medium-sized denticles, gradually decreasing in size towards the posterior. Outer margin inwardly, bent in the anterior part in the form of arch, which results in the formation of shank; the remaining part of the margin straight, posteriorly directed. At the posterior, both margins converge, forming an acutuniss. Anterior margin postero-laterally oriented. Transversal branch equalling ca. 0.45 of jaw length. Shank long, sharp-pointed, postero-laterally oriented. Outer and inner slopes very steep and high. Pulp cavity opening situated on ventral side, open except for its most anterior part.

Left MII almost completely symmetrical to right one, being only slightly shorter and less sharp on posterior end.

Left MIII. Inner margin gently arcuate, denticulated except for its most posterior section; central denticles predominate, whereas the remaining ones gradually decrease in size towards the anterior and posterior, respectively. Outer margin inwardly bend in the form of crescent. Anterior margin postero-laterally oriented. Transversal branch markedly exceeding a half of jaw length. Right and left slopes very high. Inner slope usually passing into attachment lamella.

Right and left MIV small, plate-like, with relatively large, blunt denticles distributed along arcuate inner margin. Inner slope vertical, very high, usually passing into attachment lamella. Right jaw slightly larger than left one.

Right and left MV single, narrow, long teeth, slightly bent, with small pulp cavity openings at posterior ends.

Carriers and *mandibles* unknown.

Remarks. — The new species seems close to *Kielanoprion pomeranensis* Szaniawski, primarily differing in the lack of basal ridge on the right MI, occurrence of large fang and postero-lateral spur on both MI, and in longer and thinner shank developed on MII, as well as in smaller overall size.

Occurrence or lack of basal plate or basal ridge in a given apparatus is considered (Kielan-Jaworowska 1966) to be a generic diagnostic feature. „Basal ridge" developed on right MI of the species *Kielanoprion pomeranensis* Szaniawski is very small or even imperceptible on some specimens and it is not certain whether or not it is homologous to basal plate. According to the present authors, establishment of a separate genus on the basis of so subtle difference seems pointless.

There are some forms among Devonian scolecodonts, which appear similar to particular elements of the apparatus described herein. Among them, *Arabellites comis* Eller of the Middle and Late Devonian age, corresponding to the right MI of the apparatus in question, predominates (Eller, 1938, 1941, 1964; Staufer 1939; Sylwester 1959; Taugourdeau 1968, 1970, 1971). It seems that not all of those forms are conspecific. Scolecodonts resembling MII were described under the names of *Lumbriconereites cooperi* Eller, *Leodicites crassimarginatus* Eller, *Leodicites finitimus* Eller, *Arabellites falciformis* Staufer and *A. cultriformis* Staufer. Scolecodonts resembling MIII and MIV were described under the name of *Eunicites seamani* Eller, *E. placidus* Staufer, *Paleoenonites auctificus* Eller, *P. deltoides* Eller, *P. descrescens* Taugourdeau, and *Leodicites obtusidentatus* Taugourdeau.

In the authors' collection, besides isolated MI undoubtedly belonging to the apparatus in question, there is one scarer form of MI, differing from the former in shorter undenticulated section of inner margin and in postero-lateral spur and inner wing bent on the ventral side in such a

degree that they are almost invisible from the dorsal side. Some of isolated MII are characterized by markedly shorter shank. It is possible that these jaws belong to the apparatus of a different species.

No carriers were connected with jaws of the new species. However, numerous carriers resembling those of the species *Kielanoprion pomeranensis* Szaniawski were found among isolated scolecodonts, which most probably belong to the species in question.

Family **Atraktoprionidae** Kielan-Jaworowska, 1966
Genus *Skalenoprion* Kielan-Jaworowska, 1962
Skalenoprion sp.

(Pl. V, Fig. 10a-b)

Material. — Joined left MI, right MII and left MII, from the Opole Lubelskie, depth of 1.212 m.

Description. — MI jaw 0.51 mm long; jaw width equalling 0.35 of length.

Left MI. Hook equalling 0.57 length of jaw, slightly bent except for medially incurved peak. Inner margin straight beneath the hook, denticulated along two-thirds of its length; denticles, 9 in number, sharp, inclined towards the posterior, insignificantly differentiated in size. Posterior section of inner margin smooth, sharp-edged. Outer margin gently arcuate, becoming somewhat inwardly bent close to the posterior. Posterior margin postero-medially oriented, with one-third of its length, starting from inner margin, somewhat bent to the posterior. This bend corresponds to swelling of dorsal surface. Furrow longitudinally oriented and becoming shallower towards the anterior runs between that swelling and undenticulated section of inner margin. Ventral side flat. Pulp cavity opening occupying 0.42 length of jaw. Muscle scar large, circular. Belt uniform in width along its whole lenth.

Right MII equalling 0.47 of MI length and almost uniform in width equalling 1/6 of the length. Lateral margins straight, parallel, oriented towards the posterior. Anterior and posterior margins rounded. Posterior part with narrow spike. Denticulated ridge marked along inner margins; denticles, 8 in number, sharp-pointed, strongly incurved towards the posterior. Inner slope vertical; outer slope very steep. Shank completely lacking. Pulp cavity opening, completely gaping.

Left MII is almost symmetrical to the right, somewhat longer. Inner slope passing into attachment lamella, through which it is connected with right MII and left MI. A separate lamella unites left MI hook with anterior part of left MII; however, this lamella is not coalescent with any jaw, but is only adhering to them.

Remarks. — Left MI of the newly described form closely resembles the corresponding jaw of *Skalenoprion alatus* Kielan-Jaworowska, 1962, differing in relatively lower width to length ratio and smaller curvature of hook; however, its MII jaws essentially differ from corresponding jaws of the latter species in the lack of shank. Therefore, the form in question undoubtedly represents a new species, but the lack of right MI precludes its definition. This species, similarly as other species of the genus *Skalenoprion* Kielan-Jaworowska, 1962, is very rare, and no its isolated elements were found in the collection.

In the scolecodont literature, Sylvester (1959) described under the name of *Arabellites hamiltonensis* (Stauffer) connected right and left MI, the left of which is very similar to the above described one, and the right one is symmetrical to it. It is highly probably that these forms are conspecific; however, the lack of right MI in the collection of the present authors, and MII in the material described by Sylvester preclude unequivocal answer. Sylvester (*l.c.*) does not mention occurrence of basal ridge on right MI and this ridge cannot be noted on the photograph enclosed in his paper (Sylvester 1959, Pl. 5, Fig. 36). However, it is possible that this ridge is present but hardly discernible, similarly as in the case of *Skalenoprion bugensis* Szaniawski. *Arabellites hamiltonensis* (Stauffer), described by Sylvester (*l.c.*) from the Upper Devonian and Lower Mississipian is not conspecific with Middle Devonian left MI described earlier under that name (Stauffer 1939, Eller 1941), according to the present authors Upper Devonian forms differ from the latter in a shorter hook, longer pulp cavity opening and large inner wing. It is very probable that these Middle Devonian left MI actually belonged to the apparatuses of the genus *Atraktoprion* Kielan-Jaworowska, 1962.

Familia incerta

Genus *Hindeoprion* nov.

Type species: Hindeoprion basalaris n.sp.

Derivation of the name: In honour of G. J. Hinde (1839—1918), the first student of scolecodonts.

Diagnosis. — Right and left MI symmetrical, with hook, denticulated inner margin and slightly enclosed pulp cavity. Base, heavily twisted in relation to dorsal surface, formed of extended postero-inner parts of jaws. No traces of basal plate on right MI.

Occurrence. — Upper Devonian of Poland.

Remarks. — Although only a single specimen consisting of connected right and left MI is represented in the collection, these two jaws differ

from all the others hitherto known, so that it appears necessary to allocate them in a separate genus. They differ from MI of the genera *Atraktoprion* Kielan-Jaworowska, 1961, and *Skalenoprion* Kielan-Jaworowska, 1962, in the lack of basal plate or basal ridge and in overall shape of MI. They differ from the genus *Kielanoprion* Szaniawski, 1968, in the development of hook and in more exposed pulp cavity. The jaws in question differ from the corresponding ones of these three genera in well-differentiated bases. Bases somewhat similar to those of the newly described forms are found in the case of MI of the Recent genus *Ophryotracha* Claparède Metschnikov, 1869. Bases of MI of these Recent forms are twisted in plane perpendicular to jaw surface, closely adhere to each other and substitute carriers. MI of the new genus were also joined by their bases, which were most probably also replacing carriers. Jaws of the new genus differ from MI of the genus *Ophryotrocha* markedly in shape and by possession denticles.

Hindeoprion basalaris n.sp.

(Pl. IV, Fig. 1)

Holotype: Joined right and left MI, Z. Pal. No. Sc. II/114, Pl. IV, Fig. 1.

Type horizon and locality: Upper Frasnian, the Opole Lubelskie borehole, depth of 1.208 m.

Derivation of the name: Lat. *basis* — base, *ala* — wing; from MI bases connected with inner wing.

Diagnosis. — MI symmetrical, widening towards the posterior. Hook strongly bent backwards, and to the dorsal side, extending for ca. 0.28 of the jaw length. Inner margin denticulated almost along the whole section extending down from hook. Base ca. 0.3 of jaw length. Pulp opening ca. 2/3 of jaw length (without base).

Material. — Joined right and left MI.

Description. — MI (with base) 0.37 mm long, 0.14 mm wide.

Right MI gradually widening towards the posterior. Hook strongly (circulary) curved and bent upwards. Inner margin somewhat convex, denticulated almost along its whole section extending down of hook. Denticles, except for the first, small one, decreasing gradually in size towards the posterior; differences in sizes of anterior and posterior denticles very large; 10 denticles discernible; posterior section of the margin indistinctly crenulated. Inner wing narrow, long, continuing from the middle of the jaw to the base with which it is connected. Outer margin slightly convex, posterolaterally oriented. Posterior margin somewhat sinusoidally bent, posteromedially oriented. Postero-inner jaw part strongly extended towards the posterior, forming a base. Base twisted in a plane perpendicular to jaw surface, extending for ca. 0.3 of the jaw length; base lateral margins

straight, directed posteriorly; posterior margin strongly convex. Base differing from proper jaw in lighter colouring and in thinner walls. On the ventral side, pulp cavity opening, extending for 0.68 of the jaw length (without base) and occupying its whole width.

Left MI almost completely symmetrical to the right one. Number of denticles smaller by two. Left MI base is not fully known, as it was damaged in the course of preparation: its fragment is attached to the base of right MI.

II. SCOLECODONTS

Genus ?*Langeites* Kielan-Jaworowska, 1966

Remarks. — The genus *Langetites* was established on the basis of detached right and left MI, which are undoubtedly conspecific; however, all other elements of this apparatus are unknown, which inclines the present authors to consider the status of this genus as being of parataxonomic nature.

?*Langeites lublinensis* n.sp.

(Pl. V, Figs 8a-b, 9a-b)

Holotype: Right MI, Z. Pal. No. Sc II/125, Pl. V, Fig. 9a, b.

Type horizon and locality: Upper Frasnian, borehole Opole Lubelskie, depth of 1.202 — 1.212 m, Pl. V, Fig. 9; Z. Pal. Sc. II/125.

Derivation of the name: lublinensis — found in the Lublin region.

Material. — Twelve right and ten left MI found in the borehole Opole Lubelskie at the depth of 1.202 — 1.212 m.

Diagnosis. — MI jaws with big hook representing about a half of jaw length. Left jaw smooth, right occasionally with a few of rudimentary denticles. Bight corresponding to basal plate, almost as long as wide. Basal cavity opening equall to ca 0.2 of the jaw length.

Description. — MI varying from 0.6 to 1.1. mm in length, width equal to 0.25 of the length.

Right MI. Strong hook representing almost a half of jaw length. Hook point bent upwards in relation to jaw surface. Behind of the hook, inner margin almost rectilinear, inclined backwards, completely smooth or with a few of rudimentary denticles at the hook base. Inner wing trapezoidal, equalling ca. a quarter of jaw length. Outer margin convex in anterior part surrounding hook, and becoming slightly concave in the posterior part. Spur small, triangular, occasionally turn on the ventral side and thus obscured. Posterior margin sinusoidal, with general postero-medial direction. Bight corresponding to basal plate rounded, almost as long as wide,

equalling 0.14 of total jaw length. Basal cavity openning on ventral side, equalling 0.22 of total jaw length.

Left MI differs from the right MI in relatively longer hook, representing almost two-third of total jaw length, and the lack of both rudimentary denticles on inner margin and bight corresponding to basal plate. Its posterior margin is postero-medially directed along the section from outer margin to the half of its length, later rapidly becoming almost transversally oriented. Depression extending in postero-medial direction is distinctly marked in postero-internal corner of the left jaw.

Remarks. — The new form differs from genus *Langeites* in hook distinctly separated from posterior par of jaw and in denticles lacking on left MI and differently situated on right MI. Therefore this form is allocated in the genus *Langeites* with reservation.

The right and left MI described above were not found in conjunction, but they are undoubtedly conscpecific as they are very similar to one another and there are no other scolecodonts in the collection, which could be their counterparts.

In the literature, somewhat similar scolecodonts were described under the names of *Nereidavus giganteus* Sylvester, *Nereidavus nudus* Taugourdeau, and *Drilonereisites paucidentatus* Taugourdeau. The newly described forms differ from the first of the above species in mode of hook development and much weaker dentation, from the second species — in distinct separation of the hook and basal part, and from the third species — in much shorter opening of pulp cavity and development of bight on the right MI.

The newly described jaws cannot be allocated in genus *Nereidavus* Grinnel, 1887, because they essentially differ from the type species of that genus. Nor can they be assigned to genus *Drillonereisites*, as the right MI jaws of that genus are devoided of bight corresponding to basal plate.

Genus *Trianguligenys* nov.

Type species: Trianguligenys lacinatus (Eller, 1964).
Derivation of the name: Lat. triangulum — triangle, *genys* — jaw.

Diagnosis. — Jaws MII, MIII and ? MIV arcuate, convex from inner side, in dorsal view, and triangular, tapering posteriorly in side view. A row of upward-oriented denticles arcuately continuing along the whole or almost the whole length of jaw. Both slopes high and steep. Inner slope usually passing into attachment lamella. Shank not developed; anterolateral end of jaw obliquely truncated. Pulp cavity gaping; its opening forms a sinus extending towards the first denticle in the anterior part.

Species assigned: Oenonites alpenaensis Eller, *O. abnormis* E., *Paleoenonites clinatus* E., *P. davisae* E., *P. angiportus* E., *P. armigerus* E., *P. du-*

bius Sylvester, *P. curtilobus* E., *P. informis* E., *P. incurvus* E., *P. lacinatus* E., *P. hexadactylus* E., *P. flexuosus* E. Moreover, there is a number of species which most probably belong to this new genus, but their descriptions or illustrations are insufficient for unequivocal answer; these include: *Oenonites dubius* Eller, *Paleoenonites curvilineatus* E., *P. cippus* E., *P. exsertus* E., *P. latidorosatus* E., *P. latissimus* E., *P. hiulcus* E., *P. lacertosus* E., *P. flaccidus* E., *P. latimarginatus* E., *P. geometricus* E., *P. inops* E., *P. insperatus* E., *P. limulurus* E.

Occurrence. — ?Ordovician — Silurian — Devonian of the North America and Europe.

Remarks. — Eller (1942) considered forms allocated in his genus, *Paleoenonites*, as MII jaws. However, all forms assigned in that paper to this genus, including the genotype, *Paleoenonites accuratus* Eller, actually represent basal plates. In his subsequent papers Eller (Eller 1945, 1955, 1963, 1964) described under this generic name a number of forms, which actually represent MII, MIII and MIV jaws and essentially differ from basal plate in their construction. Some MII — MIV jaws without shank were also allocated in this genus by Sylvester (1959) and Taugourdeau (1968). In turn, Kozur (1970) considers the genus *Paleoenonites* Eller, 1942, as *nomen dubium* (see also p. 230). Jansonius and Craig (1971) assigned some representatives of the genus *Paleoenonites* to their three new genera, *Basogenys, Colpogenys* and *Porrhogenys*, which, maybe with the exception of the first one, also represent basal plates. Kozur 1970), as well as Jansonius and Craig (1971) correctly recognized the fact that genus *Paleoenonites* represents basal plates, but they did not note a number of MII jaws described under this name. The majority of MII jaws allocated in this genus essentially differ from all the genera comprising such elements; thus establishment of a new genus appears necessary.

Jaws of the genus *Trianguligenys* differ from basal plates of the genera *Paleoenonites, Basogenys* and *Colpogenys* in arcuate outline, in dorsal view, achieving triangular outline (typical of dorsal view of the latter genera) in side view. Jaws of *Trianguligenys* are in dorsal view high, whereas the basal plates are flat. Moreover, denticles are set upwards on jaws, wheres in the case of basal plates they are commonly arranged in the plane of jaw. The jaws also differ from these basal plates in characteristic sinus of pulp cavity opening.

The jaws of the genus *Trianguligenys* differ from MII jaws commonly asigned to the genera *Lumbriconereites* Ehlers, 1869, *Leodicites* Eller, 1940, and *Menogenys* Jansonius & Craig, 1971, in the lack of any distinct well-separated shank, but truncation of antero-lateral corner of jaw and in development of sinus of pulp cavity opening.

The jaws of the new genus are elements of the apparatuses of the family Polychaetaspidae Kielan-Jaworowska, 1966. However, all hitherto

known Ordovician apparatuses of this family have MII with shank, and elements resembling jaws of this new genus were only recorded in the case of ?Silurian species, *Polychaetaspis inconstans* Kielan-Jaworowska. From Devonian strata Eller (1964) described under the name of *Lumbriconereites jugosus* Eller a left MII, here assigned to the genus, connected with a left MI undoubtedly belonging to the apparatus of the family Polychaetaspidae, A right MII connected with a right MI, allocated by Eller (1964) in the same species, has shank and most probably belongs to a separate species according to the present authors (see also p. 245). Rarity of the jaws of this new genus in the Ordovician strata and their mass occurrence in Devonian ones makes a contribution to the knowledge of the phylogeny of the family Polychaetaspidae.

Among hitherto described species of this new genus left forms predominate. Similarly, left forms are also more numerous in the collection of the present authors. This presumably results from the occurrence of unpaired left MIII in the apparatuses to which the jaws in question belonged.

Trianguligenys lacinatus (Eller, 1964)

(Pl. VI, Figs 1-5)

1964. *Paleoenonites lacinatus* n.sp.; E. R. Eller, Scolecodonts of the Delaware..., p. 245, Pl. 3, Figs 14, 15.

Material. — Approximately 50 left jaws and 20 right jaws from the borehole Opole Lubelskie, depth from 1.202 to 1.212. m.

Description — Jaws 0.34 to 1.1 mm long.

Jaw with the appearance of irregular crescent obliquely truncated from antero-lateral side in dorsal view. Inner margin denticulated almost along its whole length, arcuate, strongly curved outside in its anterior part. Denticles, 8 to 12 in number, gradually decreasing in size towards the posterior; first denticle slightly longer and sharper than the remaining ones. Outer margin rectilinear or slightly concave, postero-laterally oriented along its anterior section, representing one-third of its length; becoming inwardly arcuate and postero-medially oriented along its posterior section. Change in direction of the outer margin takes place at the point of maximum jaw width, equalling ca. 0.35 of total jaw length; from this point, jaw becomes regularly sharper towards both anterior and posterior ends. Outer slope steep; inner slope vertical, very high, passing into attachment lamella. Jaw outline triangular, becoming narrower toward posterior, in side view. In this view jaw is maximally wide along anterior margin, where its width together with the attachment lamella equal ca. 0.85 of total jaw length. Anterior margin sinusoidal, convex over the proper jaw

and concave over attachment lamella. Outer margin of completely preserved attachment lamella strongly convex. Most posterior jaw section very narrow. Pulp cavity opening observable in side view; in its anterior part there is a sinus equalling in length to 0.21 of total jaw length and extending in antero-medial direction. Pulp cavity deep, with well-marked pits corresponding to denticles.

Left jaws differ from right ones in pulp cavity more widely open and in most posterior jaw section wider in side view.

Remarks. — Eller (1964) figured only left jaw of this species and did not specify in the description whether or not he also places right jaws in this species. In the collection of the present authors there are only one very common left, and very similar to it right form; thus, they undoubtedly belong to the same species. Moreover, there are also a few specimens of the left jaw, characterized by markedly higher width to length ratio; this form presumably is a MIII jaw of this same species.

The jaws of the species discussed presumably represent elements of an incomplete apparatus described herein under the name of *Polychaetaspis* sp A., as there are no other MI jaws in the collection, which may correspond to them.

Genus *Uncinogenys* nov.

Type species: *Uncinogenys uncinatus* n.sp.

Derivation of the name: Lat. *uncinus* — hook gr. *genys* — jaw; jaws of this genus are characterized by large size hooks.

Diagnosis. — MI jaws widening towards posterior. Hook very large, located in plane perpendicular to dorsal surface. Row of rudimentary denticles oriented upwards continuing along postero-internal part of the jaw. Right jaw posterior margin with short, wide bight. Pulp cavity opening almost completely exposed.

Occurrence. — Frasnian of Poland.

Remarks. — The new genus is somewhat close to some scolecodonts of the genus *Arabellites* Hinde, 1879, and to MI apparatuses of the genus *Atraktoprion* Kielan-Jaw. 1962, markedly differing in hook situated in a plane perpendicular to jaw surface, in rudimentary denticles and in pulp cavity much more exposed. No left jaws of this new genus were recorded; but, if they are similar to right one in general structural plane, as it might be expected their generic identification should not raise any difficulties.

Uncinogenys uncinatus n.sp.

(Pl. VI, Fig. 6a-c)

Holotype: Right MI, Z. Pal. No. Sc. II/128, Pl. VI, Fig. 6a-c.

Type horizon and locality: Frasnian, the borehole Opole Lubelskie, depth from 1.202 to 1.212 m.

Derivation of the name: Lat. *uncinus-* hook. From the hook-like shape of the jaw.

Diagnosis. — Hook extremely large. Width of jaw at the base equalling ca. 2/3 of total jaw length. Ridge with a few rudimentary denticles located in postero-inner corner of jaw. Pulp cavity covered only on anterior end. Right jaw posterior margin with bight two times wider than long.

Material. — Three right jaws from the borehole Opole Lubelskie, depth from 1.202 to 1.212 m.

Description. — Specimens 0.27 to 0.6 mm long. Jaw subtriangular in outline, becoming wider towards the base, where its width equals ca. 2/3 of total jaw length. Outer margin postero-laterally oriented, becoming convex along a short section below its middle. Posterior margin inwardly arcuate; bight formed by that margin is two times wider than long. Inner margin rectiliner, postero-medially oriented. Hook extremely large, bent high upwards and pointed backwards. A row of 3 to 5 small, blunt, upward projected denticles or knobs continues along narrow ridge situated in postero-inner corner of jaw; the ridge is postero-medially oriented and its length equals ca. 0.25 of total jaw length. Inner slope steep, passing into attachment lamella. Pulp cavity gaping except for its anterior extremity. Muscle scars obscure.

Genus *Serratula* nov.

Type species: *Serratula minutidentata* n.sp.

Derivation of the name: Lat. *serratus* — saw-like; from style of dentation of anterior plate.

Diagnosis. — Mandible with short thin shaft and long, flat anterior plate with denticulated inner margin and medially-oriented, triangular projection at the base.

Remarks. — The new genus markedly differs from all types of fossil mandibles hitherto described in its denticulated inner margin. The genera *Nothrites* Stauffer, 1933, and *Diopatraites* Eller, 1938, are also equipped with teeth, but much larger and spaced along anterior margin. Moreover, the latter genera differ from *Serratula* gen, nov. in general structural plan and markedly stouter shaft. Between recent polychaetes similarly denticulated mandibles possess genus *Dorvillea* Parfitt, 1866.

Serratula minutidentata n.sp.
(Pl. VI, Figs 8-9)

Holotype: Left mandible, Z. Pal. No. Sc. II/131, P. VI, Fig. 8*a-c*.
Type horizon and locality: Upper Frasnian, the borehole Opole Lubelskie, depth from 1.202 to 1.212 m.
Derivation of the name: Lat. *minutus* — small, *dens* — tooth.

Diagnosis. — Anterior plate developed in the form of narrow, elongated crescent with numerous short denticles along convex inner margin. The shaft almost two times shorter than the plate, and laterally flattened in its posterior part.

Material. — Nine specimens from the borehole Opole Lubelskie, depth from 1.202 to 1.212 m.

Description. — Specimens 0.55 to 0.90 mm long.

Anterior plate narrow, long, bent outwards, tapering on the anterior end; its maximal width equals ca. 0.2 of total jaw length. Inner margin arcuate, convex, finely-denticulated. A row of 20—28 short, triangular denticles, slightly inclined anteriorly and decreasing in size towards the posterior, continues from anterior end of the plate along 0.8 of its length. Posterior section of inner margin smooth, sharp. Outer margin arcuate, concave. The whole anterior plate is somewhat concave from dorsal side, and its thickness gradually increases towards outer margin. Narrow furrow continues along outer lateral side, increasing in depth towards the anterior. Small, circular openings to the center of the plate may be found in the furrow on well-preserved specimens; numbers of openings and denticles along inner margin are roughly the same. Projection transversal, tooth-like, sharp, situated at the base of the plate; its length equals a half of the plate width. Shaft is almost as wide as the plate and approximately two times shorter. Its lateral margins are rectilinear, posteriorly oriented; posterior margin rounded. Posterior part of shaft laterally flattened.

Remarks. — The new species is most similar to *Nothrites multidentatus* Eisenack, from which it differs in possessing much more and smaller denticles. Closer comparison is impossible because *N. multidentatus* is incompletely preserved.

Serratula longidentata n. sp.
(Pl. VI, Fig. 7)

Holotype: Left mandible, Z. Pal. Sc. II/134, Pl. VI, Fig. 7.
Type horizon and locality: Frasnian, the borehole Opole Lubelskie, depth from 1.202 to 1.212 m.
Derivation of the name: Lat. *longus* — long, *dens* — tooth.

Diagnosis. — Mandible short, wide. Anterior plate bent outwards, subtriangular in outline, strongly widening towards the posterior. Denticles

numerous, long, and narrow. Shaft becoming slightly narrower towards the posterior; its length equals ca. 2/3 of anterior plate length.

Material. — The holotype only.

Description. — The holotype 0.7 mm long.

Anterior plate strongly bent outwards, subtriangular, strongly widening towards the posterior; its maximal width equals 0.45 of the length. Inner margin postero-medially oriented, slightly convex, denticulated along its whole length. Denticles, 27 in number, very narrow, long, inclined anteriorly and, with the exception of the first three, decrease in size towards the posterior. Second order very small denticles are marked along upper margins of all bigger denticles. Outer margin almost rectilinear, posteromedially oriented. Transversal projection short, triangular, wide at the base. Shaft length equals 0.6 of anterior plate length; shaft width equals a half of its length. Lateral margins somewhat converge towards the posterior. Posterior margin rounded. Whole mandible strongly dorsally flattened.

Remarks. — The new species is only represented by a single specimen, but it is so characteristic that determination of its diagnostic features leaves no doubt. It differs from *Serratula minutidentata* n.sp. in much longer denticles, plate shorter in relation to shaft length, and both plate and shaft wider.

THE MATERIAL NOT DESCRIBED

In the collection of polychaetes from the Frasnian of the Opole Lubelskie borehole, apart from the material described above, there are: one apparatus, several joint jaws, and many different scolecodonts which remain undescribed. The apparatus most probably belongs to the family Tetraprionidae Kielan-Jaworowska, 1966. It markedly differs from the only well-known apparatus of that family described so far, from the Ordovician, *Tetraprion pozaryskae* Kielan-Jaworowska, and seems to be markedly closer to the Silurian forms described as *?Tetraprion* sp. (Szaniawski, 1970, pp. 460—462, Pl. IV, Fig. 7). Deformation of the apparatus and impurities difficult to remove do not allow for its accurate description. The fact that it belongs to the family Tetraprionidae implicates a wider stratigraphical range of this family than it was assumed by Kielan-Jaworowska (1966) who stated that its occurrence was limited to the Ordovician and Silurian.

Besides the forms described above, the collection includes at least three other species of the family Mochtyellidae Kielan-Jaworowska, represented by left and right MI and their connections with anterior and lateral teeth. Among them there are compound right MI with three denticulated ridges, resembling right MI of the apparatus *Mochtyella cristata* Kielan-Jawo-

rowska, except that they are laterally more flattened. This indicates that in the phylogenetic development of this family, apart from the forms which underwent far-reaching changes resulting in the development of separate anterior jaws, similarly as in the genus *Multiprion* n.gen., there are also forms with apparatuses not differing in their structural plans from the most primitive Ordovician forms.

Moreover, there are some scarce jaws belonging to the apparatuses of the family Paulinitidae Lange and Atraktoprionidae Kielan-Jaworowska, and scolecodonts of unknown origin, among which anterior jaws of various apparatuses predominate.

However, among isolated scolecodonts, elements of the apparatuses described herein are in majority. Among them there are mandibles, carriers, and single teeth most probably also belonging to these apparatuses.

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APARATY SZCZĘKOWE WIELOSZCZETÓW I SKOLEKODONTY Z DEWONU GÓRNEGO POLSKI

Streszczenie

W utworach górnego dewonu wiercenia Opole Lubelskie znaleziono kompletne aparaty szczękowe wieloszczetów i liczne ich izolowane elementy — skolekodonty. Najbogatszą faunę stwierdzono w utworach górnego franu, w zakresie głębokości 1202—1212 m, 36 m poniżej poziomu konodontowego Ancyrognathus triangularis (Szulczewski 1972). Dotychczas z dewonu poznany był dobrze tylko 1 gatunek aparatów — *Paulinites paranensis* Lange z Brazylii. Po rozpuszczeniu w kwasie solnym około 30 kg wapieni z wyżej wymienionego interwału głębokości otrzymano materiał pozwalający na opisanie 7 nowych gatunków i 3 nowych rodzajów aparatów. Nadano im nazwy: *Multiprion opolensis* n.gen., n.sp., *Mochtyella kielanae* n.sp., *Xanioprion walliseri* n.sp., *Processoprion longiprocessus* n.gen. n.sp., *Polychaetaspis hindei* n.sp., *Kielanoprion elleri* n.sp., *Hindeoprion basalaris* n.gen., n.sp. Ponadto opisano trzy niekompletne aparaty, które ze względu na niedostateczny stan zachowania oznaczono jedynie do szczebla rodzajowego.

Opisano również część szczęk izolowanych wyróżniając w ramach systematyki parataksonomicznej ich 4 nowe gatunki i 3 nowe rodzaje: *Langeites lublinensis* n.sp., *Trianguligenys lacinatus* (Eller) n.gen., *Uncinogenys uncinatus* n.gen., n.sp., *Serratula minutidentata* n.gen., n.sp., *Serratula longidentata* n.sp.

Zespół aparatów dewońskich różni się zasadniczo od dotychczas znanych aparatów zarówno z formacji wcześniejszych jak i późniejszych. Potwierdza to jeszcze raz niejednokrotnie wysuwane już przypuszczenie (Kielan-Jaworowska 1966, 1968, Szaniawski 1968, 1970), że aparaty szczękowe wieloszczetów oraz ich dobrze oznaczalne elementy mają wartość stratygraficzną.

Ostatnio Kozur (1970) wysunął propozycję połączenia istniejących obecnie dwóch niezależnych systematyk skolekodontów i aparatów szczękowych. Autorzy uważają, że ze względu na niedostateczną jeszcze znajomość kopalnych aparatów oraz chaos panujący w systematyce skolekodontów łączenie tych systematyk obecnie jest przedwczesne. Propozycja Kozura oparta głównie na kompilacji zawiera liczne błędy i prowadzi często do łączenia form o bardzo różnej morfologii w jeden rodzaj.

ХУБЕРТ ШАНЯВСКИ & РИШАРД М. ВРОНА

ЧЕЛЮСТНЫЕ АППАРАТЫ И СКОЛЕКОДОНТЫ МНОГОЩЕТИНКОВЫХ ИЗ ВЕРХНЕГО ДЕВОНА ПОЛЬШИ

Резюме

В породах верхнего девона, вскрытых буровой скважиной Ополе-Любельске, были выявлены комплектные челюстные аппараты многощетинковых и многочисленные изолированные элементы челюстей — сколекодонты. Наиболее обильная фауна наблюдалась в верхнефранских породах, занимающих в разрезе скважины интервал 1202—1212 м, 36 м ниже конодонтового горизонта *Ancyrognatus triangularis* (Шульчевски 1972). До сих пор из девона был изучен детально лишь один вид челюстных аппаратов — *Paulinites paranensis* Lange, найденный в девоне Бразилии. Из указанного интервала были взяты пробы около 30 кг, состоящие из известняков. После растворения в соляной кислоте в полученном материале удалось определить 7 новых видов и 3 новых рода аппаратов. Они получили названия: *Multiprion opolensis* n. gen., n. sp., *Mochtyella kielanae* n. sp., *Xanioprion walliseri* n. sp., *Processoprion longiprocessaus* n. gen., n. sp. *Polychaetaspis hindei* n. sp., *Kielanoprion elleri* n. sp., *Hindeoprion basalaris* n. gen., n. sp. Кроме того, описаны три некомплектных аппарата, которые из-за плохой сохранности получили лишь родовое определение.

Описаны также часть изолированных челюстей, среди которых, согласно паратаксономической систематике, определены 4 новых вида и 3 новых рода: *Langeites lublinensis* n. sp., *Trianguligenys lacinatus* (Eller) n. gen., *Uncinogenys uncinatus* n. gen., sp., *Serratula minutidentata* n. gen., n. sp., *Serratula longidentata* n. sp.

Комплекс девонских аппаратов существенным образом отличается от изученных до сих пор аппаратов, как из более древних, так и более молодых формаций. Это является еще одним подтверждением многократно высказывавшихся предположений (Келян-Яворовска 1966, 1968; Шанявски 1968, 1970), что челюстные аппараты многощетинковых и их определимые элементы имеют стратиграфическое значение.

В последнее время Козур (1970) предложил объединить применяющиеся в настоящее время две самостоятельных систематики сколекодонтов и челюстных аппратов. Авторы считают, что из-за слабой изученности ископаемых аппаратов и хаоса в систематике сколекодонтов объединение этих систематик пока-что не обосновано. Предложение Козура, основывающееся, главным образом, на литературных данных, страдает рядом недостатков и часто приводит к объединению в один род форм с весьма разными морфологическими чертами.

EXPLANATION OF PLATES

All specimens represented in Plates I-VI become from Opole Lubelskie borehole, Frasnian, depth 1202—1212 m

Abbreviations

al — attachment lamella
At — anterior teeth
bp — basal plate
br — basal ridge
bs — bases
cr — carriers
lbp— laeobasal plate
lbr — laeobasal ridge
Lt — lateral teeth
MIl — MVl — left maxillae
MIr — MVr — right maxillae
Mdb — mandible
mr — main ridge
sr — second ridge

Plate I

Xanioprion walliseri n.sp.

Fig. 1. Holotype, incomplete jaw apparatus composed of bp, lbp, MIl, MIr, MIIl, MIIr, MIIIl, and Lt ,intentionally separated into parts; left, dorsal side of the apparatus covered by insoluble impurites (Z. Pal. No. Sc. II/40): *a-b* posterior part of the apparatus in dorsal and ventral views; laeobasal plate hidden under impurities; *c-d* anterior part of the apparatus in dorsal and ventral views. (see also Plate II and III).

Multiprion opolensis n.sp.

Fig. 2. Holotype, almost complete jaw apparatus composed of MIl, MIr, MIIl, MIIr, MIIIr and At in unnatural arrangement (Z. Pal. No. Sc. II/1).

Fig. *3a-b*. Left side of jaw apparatus composed of MIl, lbr, and MIIl in dorsal and left lateral views (Z. Pal. No. Sc. II/2).

Mochtyella kielanae n.sp.

Fig. 4. Holotype, jaw apparatus comopsed of compound MIl and MIr in dorsalo-left lateral view, laeobasal ridge broken (Z. Pal. No. Sc. II/10).

Mochtyella sp. A

Fig. 5*a-b*. Jaw apparatus composed of compound MIl, MIr and Lt, in dorsal and ventral views, laeobasal ridge partly broken off (Z. Pal. No. Sc. II/15).

Fig. 6. Jaw apparatus composed of compound MIl, MIr and Lt in right lateral view (Z. Pal. No. Sc. II/20).

Plate II

Xanioprion walliseri n.sp.

Fig. 1*a-b*. Left MII in dorsal and ventral view (Z. Pal. No. Sc. II/42).

Fig. 2*a-b*. Right MII in dorsal and ventral view (Z. Pal. No. Sc. II/39).

Fig. 3*a-c*. Basal plate joined with three lateral teeth in dorsal, ventral and right lateral views (Z. Pal. No. Sc. II/49).
Fig. 4*a-b*. Right MI in dorsal and right lateral views (Z. Pal. No. Sc. II/48).
Fig. 5*a-c*. Joined right MIII and MIV in dorsal, ventral and right lateral views (Z. Pal. No. Sc II/43).
Fig. 6*a-c*. Left MI in dorsal, right lateral and ventral views (Z. Pal. No. Sc II/41) (see also Plate I and III)

Plate III

Polychaetaspis hindei n.sp.

Fig. 1*a-b*. Holotype, joined right and left MI in dorsal and ventral views; most posterior part of right jaw broken off (Z. Pal. No. Sc. II/51).
Fig. 2*a-b*. Almost complete right side of the apparatus composed of bp, MIr, MIIr, MIVr and MVr in dorsal and ventral views (Z. Pal. No. Sc II/55).
Fig. 3*a-b*. Right MII in dorsal and ventral views (Z. Pal. No. Sc II/55).
Fig. 4. Basal plate in dorsal view (Z. Pal. No. Sc. II/59).
Fig. 5. Lateral tooth (associated with left MI) in ventral view (Z. Pal. No. Sc. II/56).
Fig. 6. Left MI in dorsal view (Z. Pal. No. Sc. II/60).

Xanioprion walliseri n.sp.

Fig. 7*a-b* Laeobasal plate in right lateral and ventral views (Z. Pal. No. Sc. II/38). (see also Plates I and II)

Processoprion longiprocessus n.sp.

Fig. 8*a-b*. Holotype, almost complete jaw apparatus composed of MIl, MIr, MIIl, MIIr, and Lt in dorsal and right lateral views; outer parts of slopes of both MI broken off. (Z. Pal. Nc. Sc. II/50).

Plate IV

Hindeoprion basalaris n.sp.

Fig. 1. Holotype, previously joined MIl and MIr with bases, intentionally separated for to makes the drawings (Z. Pal. No. Sc II/114): *a-b* left MI in dorsal and ventral views, posterior part of the base broken off; *c-e* right MI with attached posterior part of the base of MIl in dorsal, ventral and left lateral views.

Kielanoprion elleri n.sp.

Fig. 2*a-b*. Incomplete jaw apparatus composed of MIl, MIIl, MIIr, MIIIl, MIVr and MVl in dorsal and ventral views (Z. Pal. No. Sc. II/77).
Fig. 3*a-b*. Holotype incomplete jaw apparatus composed of MIl, MIr, MIIl, MIIr, MIIIl, MIVl and MIVr in dorsal and ventral views (Z. Pal. No. Ss. II/76).
Fig. 4. Right MII in right lateral view (Z. Pal. No. Sc. II/79).
Fig. 5*a-b*. Left MIII in dorsal and left lateral views (Z. Pal. No. Sc. II/97).
Fig. 6*a-b*. Right MIV in dorsal and right lateral views (Z. Pal. No. Sc. II/82). (see also Plate V)

Plate V

Kielanoprion elleri n.sp.

Fig. 1*a-b*. Right MI in dorsal and ventral views (Z. Pal. No. Sc. II/80).

Polychaetaspis sp. A

Fig. 2*a-b*. Basal plate in dorsal and ventral views (Z. Pal. No. Sc. II/71).
Fig. 3. Joined left MI and lateral tooth in dorsal view (Z. Pal. No. Sc. II/65).
Fig. 4. Joined right MI and basal plate in dorsal view (Z. Pal. No. Sc. II/66),
Fig. 5*a-b*. Left MI in dorsal and ventral views (Z. Pal. No. Sc. II/70).
Fig. 6. Posterior part of left MI in left lateral view illustrating ligament scar (Z. Pal. No. Sc. II/75).
Fig. 7. Joined right MI and basal plate in ventral view (Z. Pal. No. Sc. II/67).

Langeites lublinensis n.sp.

Fig. 8*a-b*. Left MI in dorsal and ventral views (Z. Pal. No. Sc. II/126).
Fig. 9*a-b*. Holotype, right MI in dorsal and ventral views (Z. Pal. No. Sc. II/125).

Skalenoprion sp. A

Fig. 10*a-b*. Incomplete apparatus composed of MIl, MIIl and MIIr in dorsal and ventral views (Z. Pal. No. Sc. II/111).

Plate VI

Trianguligenys lacinatus n.sp.

Fig. 1a-c. Holotype, left MII in dorsal, right lateral and left lateral views (Z. Pal. No. Sc. II/116).
Fig. 2. **Left MII in left lateral view (Z. Pal. No. Sc. II/117)**
Fig. 3. Left MIII? in left lateral view (Z. Pal. No. Sc. II/118).
Fig. 4. Left MII in left lateral view (Z. Pal. No. Sc. II/119).
Fig. 5. Right MII in right lateral view (Z. Pal. No. Sc. II/120).

Uncinogenys uncinatus n.sp.

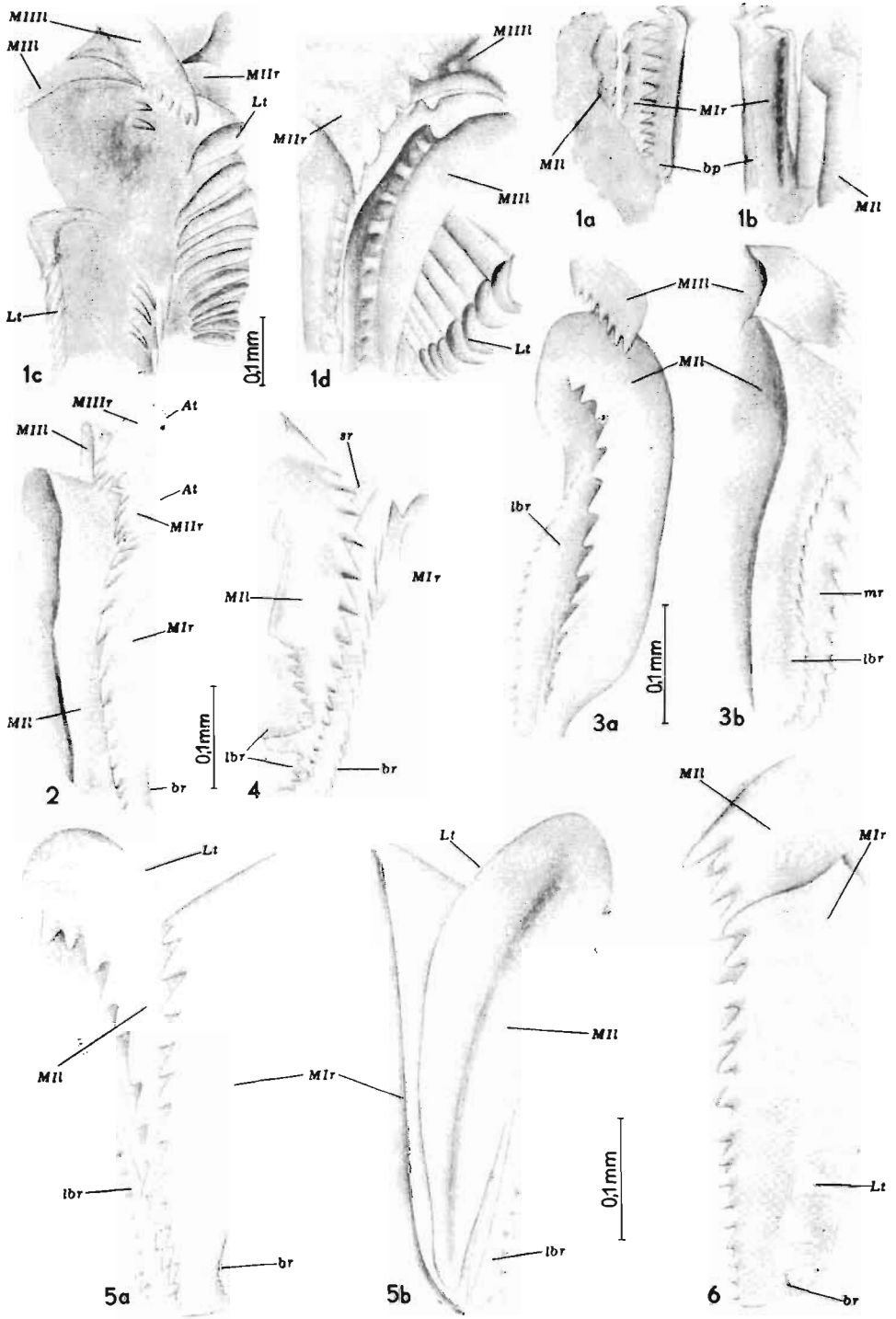
Fig. 6*a-c*. Right MI in dorsal, ventral and left lateral views (Z. Pal. No. Sc. II/128).

Serratula longidentata n.sp.

Fig. 7. Holotype, right mandible in ventral view (Z. Pal. No. Sc. II/134).

Serratula minutidentata n.sp.

Fig. 8*a-c*. Holotype left mandible in dorsal, ventral and left lateral views (Z. Pal. No. Sc. II/131).
Fig. 9. Right mandible in dorsal view (Z. Pal. No. Sc. II/132).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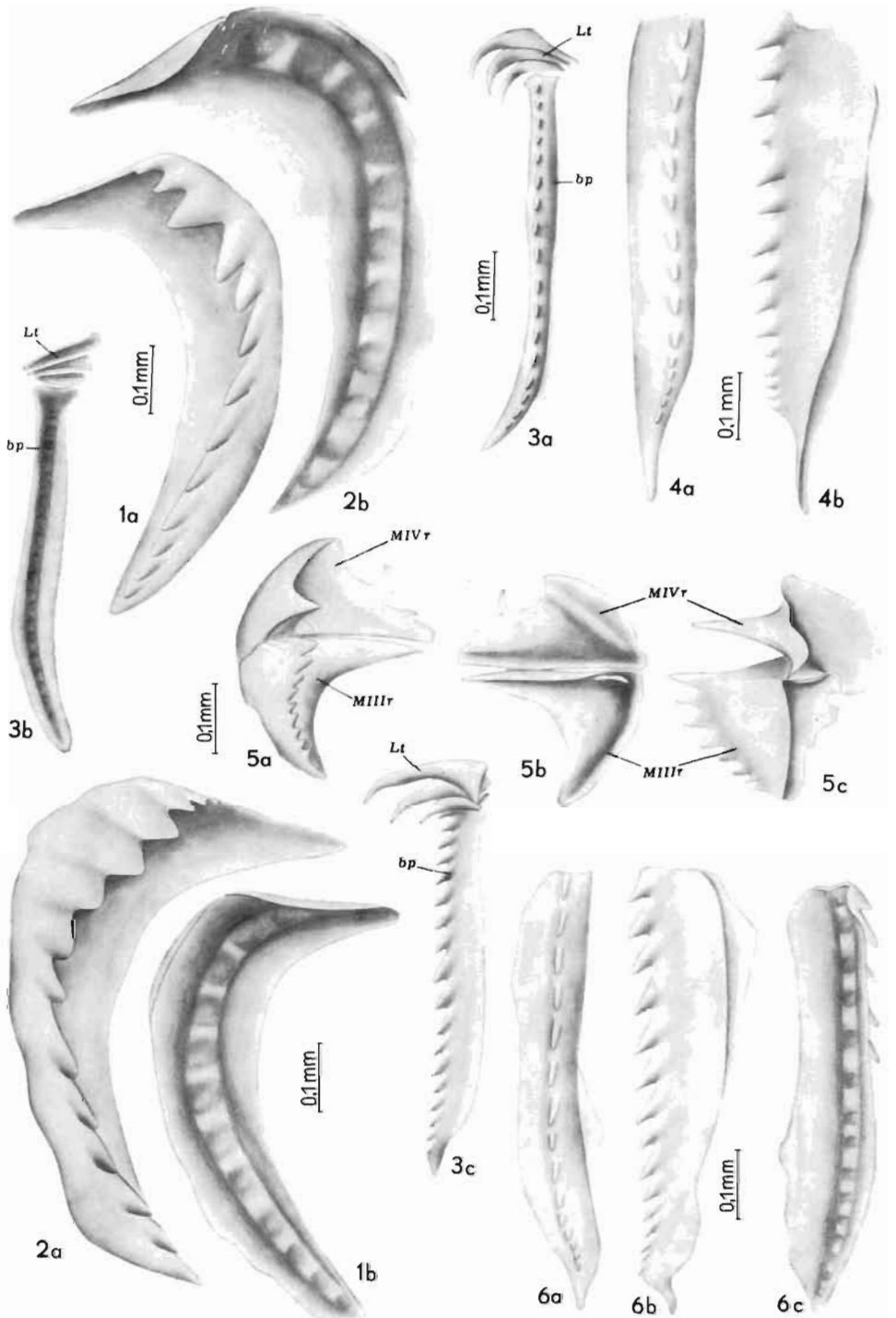
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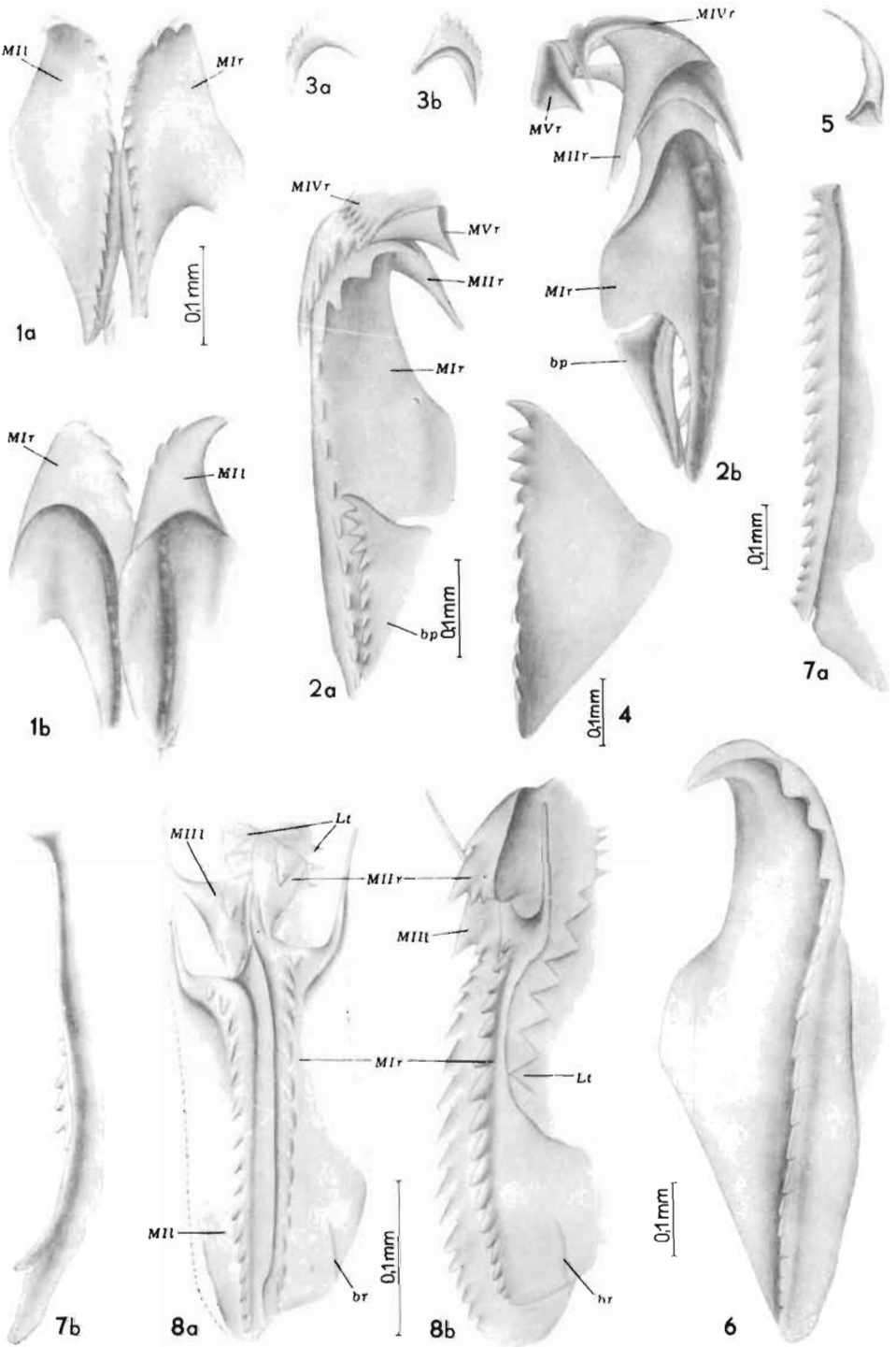
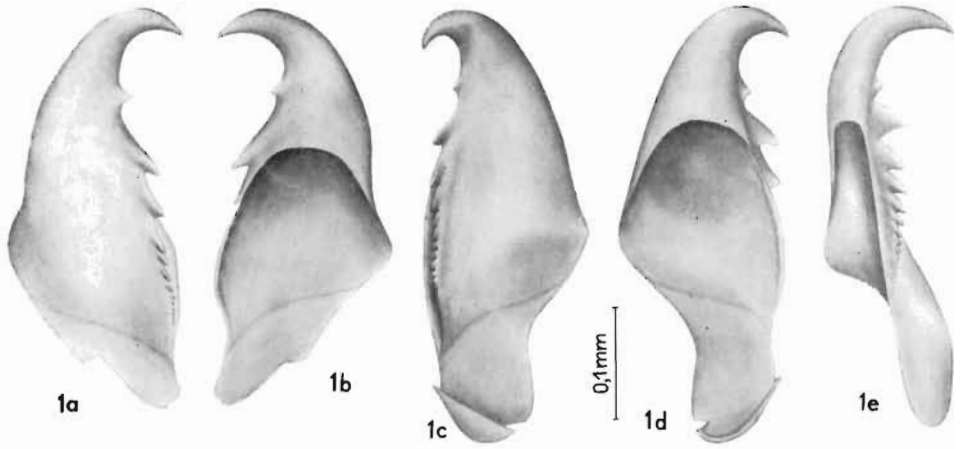
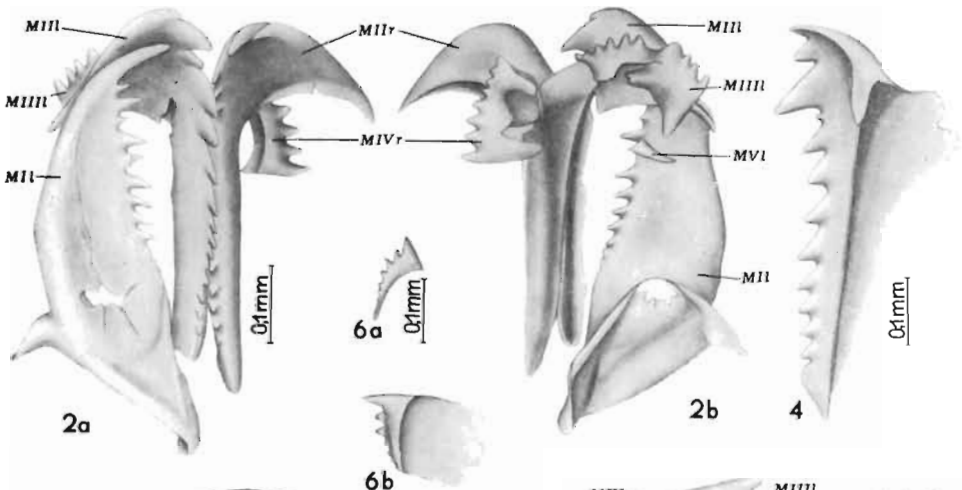
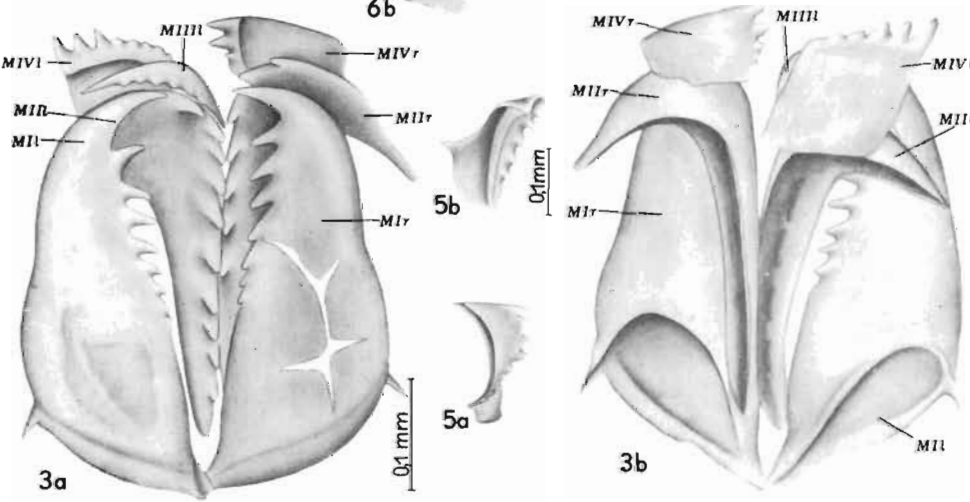
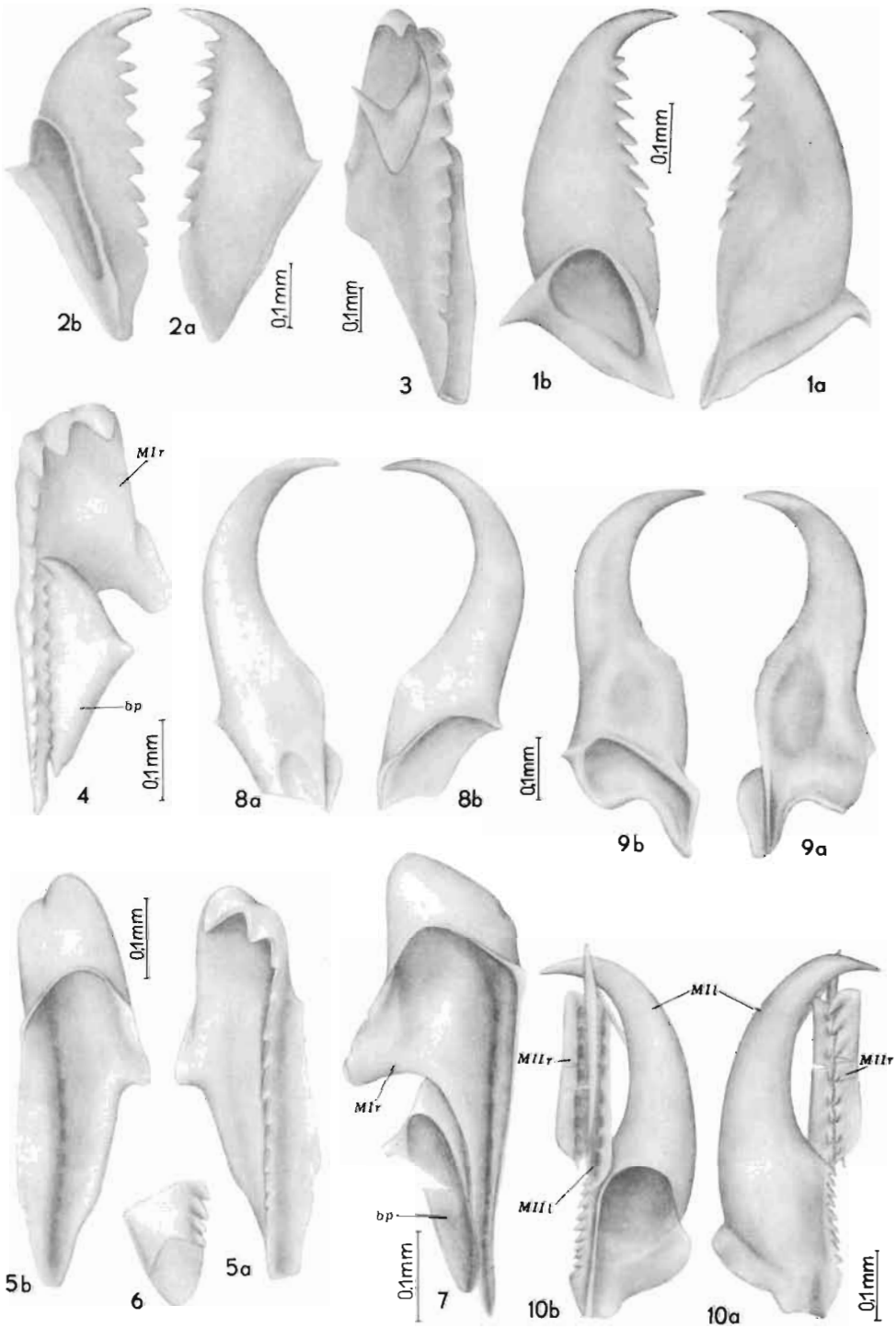
6b
6c

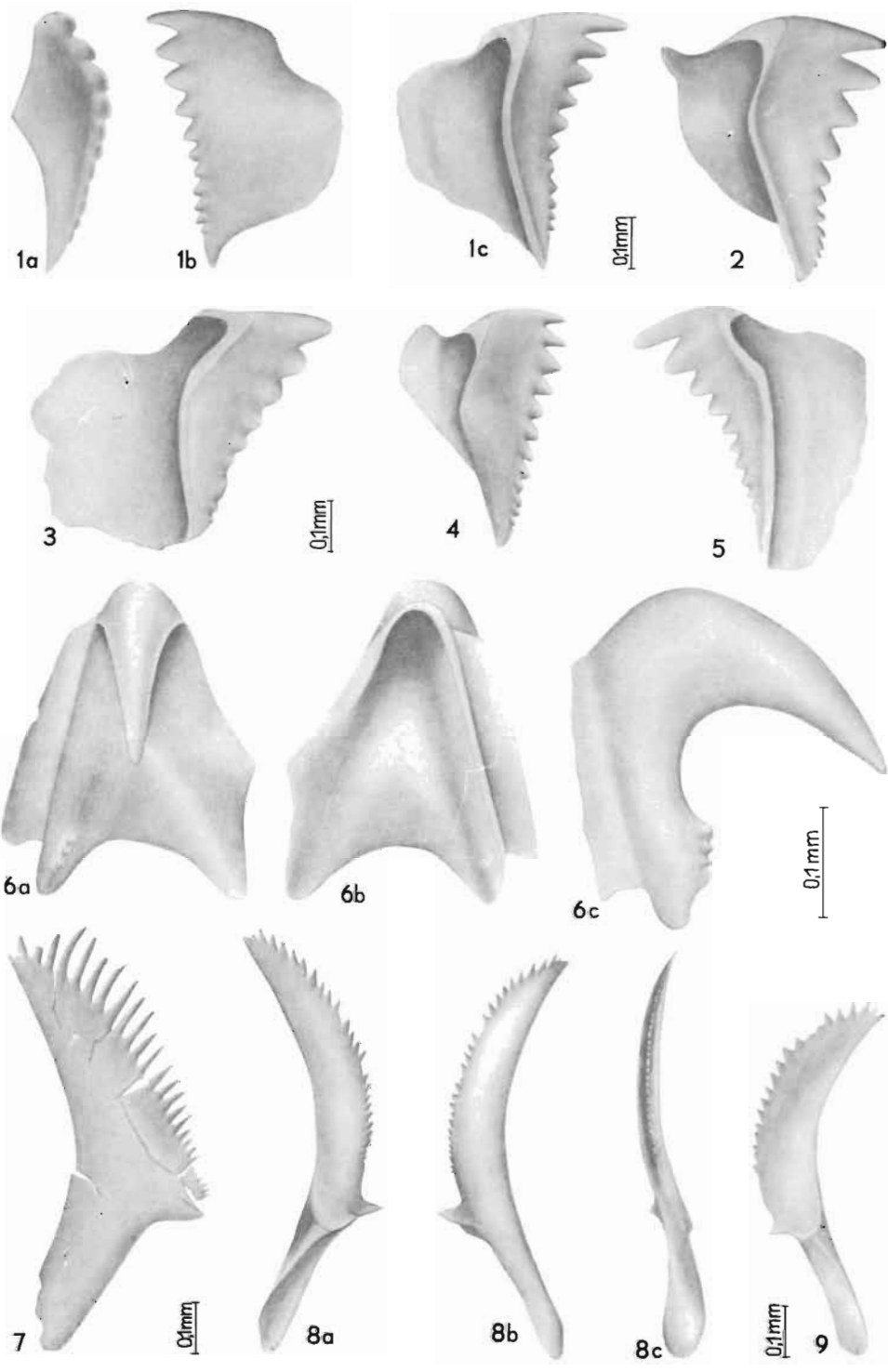

MIl
MIr
0,1 mm
1a
MIr
MIl
1b
3a
3b
MIVr
MVr
MIIIr
MIr
bp
0,1mm
2a
MIVr
MVr
MIIIr
MIr
bp
2b
0,1mm
5
7a
4
0,1mm
MIIIl
Lt
MIIr
MIIl
MIr
Lt
MIl
br
0,1mm
8a
br
8b
7b
0,1mm
6


1a
1b
1c
0,1mm
1d
1e


MIIl
MIIIl
MIl
MIIr
MIVr
0,1mm
2a
6a
0,1mm
6b
MIIl
MIIIl
MVl
MIl
2b
4
0,1mm


MIIIl
MIVl
MIVr
MIIl
MIl
MIIr
MIr
3a
0,1 mm
5b
0,1mm
5a
MIVr
MIIIl
MIVl
MIIr
MIIl
MIr
MIl
3b


2b
2a
0,1mm
3
0,1mm
1b
0,1mm
1a
MIr
bp
4
0,1mm
8a
8b
0,1mm
9b
9a
0,1mm
5b
6
5a
MIr
bp
0,1mm
7
MIIr
MIIl
MIIIr
MIIIl
10b
10a
0,1mm


1a
1b
1c
0.1mm
2
3
0.1mm
4
5
6a
6b
6c
0.1mm
7
0.1mm
8a
8b
8c
0.1mm
9