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HUBERT SZANIAWSKI

THREE NEW POLYCHAETE JAW APPARATUSES FROM THE UPPER PERMIAN OF POLAND

Contents

Abstract. — Three new species of polychaete jaw apparatuses are described. They have been chemically prepared from Zechstein deposits, from bore holes in Northern Poland. The following systematic units have been established: the monotypic family Kielanoprionidae n. fam. with *Kielanoprion pomeranensis* n. gen., n. sp., as well as *Oxyprion compressus* n.gen., n.sp. (Mochtyellidae Kielan-Jaworowska) and *Atraktoprion eudoxus* n. sp. (Atraktoprionidae Kielan-Jaw.). These apparatuses are compared with other apparatuses and fossil scolecodonts as well as with recent forms.

INTRODUCTION

Single elements of polychaete jaw apparatuses, called scolecodonts, are among the most common microfossils in the Palaeozoic deposits. Complete apparatuses, however, are seldom found and until recently such findings were considered a rarity. The few apparatuses that were described, were, as a rule, badly preserved and incomplete. It was not until the works of Lange (1949), Kozłowski (1956) and Kielan-Jaworowska (1961, 1962, 1966), based on rich collections, comprising many well preserved

apparatuses, that a closer investigation of their structure and comparison with recent forms was possible. This enabled their zoological systematics to be established, independent of the parataxonomic systematics of scolecodonts. The latest work of Kielan-Jaworowska (1966) is of special importance for the establishment of the systematics of fossil polychaete jaw apparatuses. In that work 52 new species are described and all the so far known apparatuses grouped into 19 genera and 12 families which are included in the superfamily Eunicea. In addition, their phylogenetic development is outlined and a comparison with recent forms is given.

The present author, while elaborating the stratigraphy of Zechstein on the base of borings in Northern Poland, came across abundant and well preserved assemblages of scolecodonts containing many complete jaw apparatuses. In the collected material, three new species were distinguished.

For one species, it became necessary to establish a new genus and family, for the second, which was assigned to the family Mochtyellidae Kielan-Jaworowska, a new genus, while the third was included into the genus *Atraktoprion* Kielan-Jaworowska. These apparatuses are stratigraphically the youngest of all the so far known fossil apparatuses (not counting the single and very badly preserved findings from the Jurassic of Germany (Ehlers, 1867) and Cretaceous of Lebanon (Roger, 1946)) and they extend our knowledge of fossil Eunicea up to the end of the Palaeozoic, thus reducing somewhat the enormous gap between the Palaeozoic and modern forms.

Samples were first dissolved in 15% acetic acid. Then larger amounts of rock from those places, where scolecodonts were found, were dissolved in 20% hydrochloric acid, the residue being carefully washed several times. The scolecodonts were collected by pipette from the residue, and placed in glycerine with formaline added. Silica impurities were removed with 15% hydrofluoric acid. (Investigations and drawings were made by means of a Leitz binocular microscope, using magnification of up to 216 ×).

Terminology used in morphological descriptions after that adopted by Kielan-Jaworowska (1966).

The collection is deposited in the Geological Institute of the Polish Academy of Sciences in Warsaw, for which the abbreviation Z.N.G. is used.

The present author wishes to extend his sincere thanks to Prof. Zofia Kielan-Jaworowska, Director of the Palaeozoological Institute, Polish Academy of Sciences, Warsaw, for her interest and considerable help with the present paper. Thanks are also due to the Directors of the Petroleum Industry Enterprises and Geological Institute, Warsaw for putting the material from bore holes at the author's disposal. Finally, the author would like to thank his wife Bożena Szaniawska for the drawings.

STRATIGRAPHY AND MATERIAL

The material described in the present paper comes from the limestone and dolomite horizons of Zechstein in borings Wejherowo IG-1, Chojnice-3, Biały Bór-1 and Dźwirzyno-1, all in Northern Poland (Fig. 1).

The Zechstein deposits in Świdwin-3 boring were also examined, but no scolecodonts were found.

Out of 57 samples, scolecodonts were found in 6 samples.

Scolecodonts derive from the Zechstein limestone horizon (cyclothem Werra) in the borings Chojnice and Biały Bór. In the Dźwirzyno boring

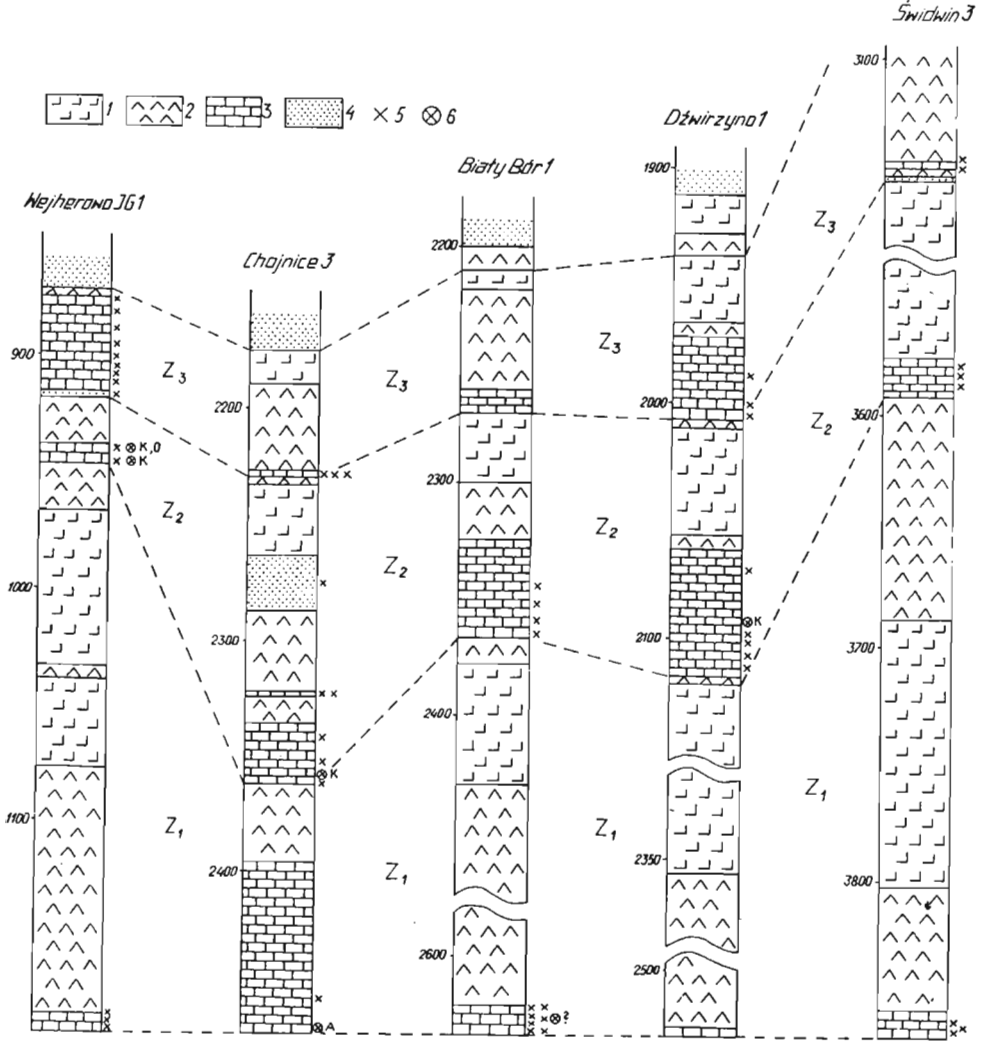

Fig. 1. — Lithological profile of Zechstein in examined bore holes; *1* rock salt, *2* anhydrite, *3* limestone and dolomite, *4* clastics, *5* negative samples, *6* positive samples with apparatuses: K *Kielanoprion pomeranensis* n. sp., O *Oxyprion compressus* n. sp., A *Atraktoprion eudoxus* n. sp. ? unelaborated single jaws.

this horizon was not sampled due to the lack of core. In the main dolomite horizon (cyclothem Stassfurt) scolecodonts were found in the borings Wejherowo, Chojnice and Dźwirzyno, but were not found in any of the borings in the plate dolomite horizon (cyclothem Leine). This latter horizon was not cored in bore hole Biały Bór.

Wejherowo IG-1 boring

Many complete jaw apparatuses and numerous single elements were found in the main dolomite horizon, lying at a depth of 940.2—949.0 m. All scolecodonts were found in a 4 m wide bed, at a depth of 942—946 m. In addition to the scolecodonts, foraminifers, pelecypods, gastropods and ostracods were also found. The sediments here consist of grey muddy dolomite with an admixture of gypsum and grains of pyrite. Chemical analysis showed the following composition of rock (given in weight per cent): at the base of the bed, $CaMg(CO_3)_2$ — 48.6, $MgCO_3$ — 1.0, $CaSO_4$ — 2.8; other noncarbonous elements — 47.6; at the top $CaCO_3$ — 0.9, $CaMg(CO_3)_2$ — 68.1, $CaSO_4$ — 1.1; other non carbonates — 29.9. Towards the top, therefore, the number of carbonates increases, while the detritus fraction gradually diminishes. Lithological changes are accompanied by changes in the faunal assemblages.

At the base, very numerous pelecypods, gastropods and ostracods occur, being gradually replaced towards the top by foraminifers. The scolecodonts content of the bed also undergoes change. At the bottom, only *Kielanoprion pomeranensis* n.sp. occur, while towards the top, one can find, in ever increasing numbers, *Oxyprion compressus* n.sp. The complete disappearance of fauna in the uppermost part of the main dolomite horizon is most probably the result of an increase in the salinity of the water, antecedent to precipitation of anhydrite. When the presence of well preserved jaw apparatuses was established, the whole main dolomite horizon was sampled every 50 cm. In all, about 30 kg of rock was dissolved, from the residuum of which 97 less or more complete apparatuses and about 1800 single elements of *Kielanoprion pomeranensis* n. sp. were found, as well as nearly 200 single and joined jaws of *Oxyprion compressus* n. sp. A considerable part of this material is in a good state of preservation.

Chojnice-3 boring

The Zechstein limestone horizon was pierced here at a depth of 2444.5 to 2464.6 m. Scolecodonts were found at the base of the horizon and directly above the boundary with Devonian, in grey, slightly marly dolomite with a considerable admixture of gypsum, the chemical composition being: $CaCO_3$ — 3%, $CaMg(CO_3)_2$ — 78,8%, $CaSO_4$ — 13,7%, other non carbonates — 4.5%. This dolomite is filled with bryozoans substituted by

gypsum. Somewhat higher, numerous pelecypods, gastropods and brachiopods appear. On dissolving 5 kg of rock, 28 single jaws belonging to *Atraktoprion eudoxus* n. sp. were found.

The main dolomite horizon in this bore hole occurs at a depth of 2336-2362.5 m. Scolecodonts were found 6.5 m above the base in light grey marly dolomite with pelecypods fauna and plant detritus. Here, just as in the Wejherowo bore hole, very numerous single elements and complete apparatuses of *Kielanoprion pomeranensis* n.sp. occur. On the other hand, not a single *Oxyprion compressus* n. sp. jaw was found. When 0.5 kg of rock was dissolved, 3 apparatuses and 32 isolated elements belonging exclusively to the genus *Kielanoprion* n. gen. were collected. Some of the single jaws, however, belong to a species so far unknown and for the present they remain unelaborated.

Dźwirzyno-1 boring

Scolecodonts were found at a depth of 2094 m in gray, marly dolomite in the middle part of the main dolomite horizon, which is here 56 m thick. From an 0.5 kg sample, 9 single jaws, belonging to *Kielanoprion pomeranensis* n. sp. were found.

In *Świdwin-3* bore hole no scolecodonts were found in any of the carbonate deposit horizons.

Stratigraphical significance

Until recently, scolecodonts were considered as fossils without any great stratigraphical significance. This is understandable in the light of what is now known, namely that their identification, without knowledge of the whole jaw apparatuses, to which they belong, may lead to considerable errors, as very similar jaws do occur in completely different apparatuses. The problem, however, assumes a different aspect when we have at our disposal complete jaw apparatuses. Kielan-Jaworowska (1966), elaborating a very rich collection of apparatuses from Ordovician and Silurian, stated, that some of the species and even genera are linked with particular stratigraphical horizons.

The material elaborated by the present author, as well as the existing literature on the subject, are not, however, sufficient for conclusions to be drawn as to the usefulness of scolecodonts for the stratigraphy of Zechstein. It is true that *Kielanoprion pomeranensis* n. sp. was found in three bore holes exclusively in the second cyclothem of the main dolomite horizon, however single jaws, belonging most probably to the same species, are known in Germany from the first cyclothem. *Oxyprion compressus* n. gen., n. sp. and *Atraktoprion eudoxus* n. sp. are known, up to now, only from the places their holotypes were described from. The fact that representatives of *Oxyprion* n. gen. appear later than *Kielanoprion* n. gen. in the main dolomite profile of Wejherowo, could be the result

of a change in the facies conditions as indicated by the distinct changes in the lithological character of the layer.

It is interesting that scolecodonts resembling the jaws of all three newly described apparatuses are known from the Wolfcampian stage of the Permian formation of North America (Tasch & Stude, 1966).

DESCRIPTIONS

Superfamily **Eunicea**
Family **Mochtyellidae** Kielan-Jaworowska, 1966
Genus *Oxyprion* nov.

Type species: Oxyprion compressus n. sp.
Derivation of the name: Gr. oxys = sharp, *prion* = saw.

Diagnosis. — Jaw apparatus, consisting of mandibles, laeobasal plate, right and left MI, single right MII and an undefined number of lateral and anterior teeth. Basal plate probably missing, intercalary and laeointercalary tooth missing. Mandibles with a wide, oval, arched anterior part and a narrower, straight basal part. Laeobasal plate denticulated, coalesced with left MI. Both MI laterally compressed, the right with a small bight in posterior part. Right MII small, flat, situated in front of right MI.

Occurrence. — Zechstein of Poland.

Remarks. — The newly described species — *Oxyprion compressus* n. sp. — is stratigraphically the youngest of all the so far known apparatuses of the Placognatha group, recognized by Kielan-Jaworowska (1966). Apparatuses of this group, to which, besides the Mochtyellidae, the Xanioprionidae Kielan-Jaw. and the Rhytiprionidae Kielan-Jaw. belong, are according to Kielan-Jaworowska (apart from the apparatuses of the group Ctenognatha) among the most primitive Eunicea and have no comparable recent forms. *Oxyprion* n. gen., therefore, can only be compared with fossil apparatuses. It differs considerably from *Pistoprion* Kielan-Jaw. in the development of individual jaws and lack of basal plate and intercalary tooth. All jaws of the genus *Pistoprion* are flattened dorsally, with gaping pulp cavities. Right MI much shorter than left; right MII comparatively big. The new genus differs from *Mochtyella* Kielan-Jaw. in the absence of compound jaws with two or three ridges of denticles. Although the laeobasal plate is coalesced with MI, it differs from the compound jaws of *Mochtyella* in having a separate opening of the pulp cavity. MI in *Oxyprion* is very similar to the jaws of *Mochtyella trapezoidea* Kielan-Jaw., differing mainly in the absence of a basal ridge on right MI and the presence of MII. Mandibles in the Mochtyellidae were previously unknown.

Single MI jaws of apparatuses belonging to the Mochtyellidae were often described among other scolecodonts, as a rule assigned to the genus *Staurocephalites* Hinde and usually considered as MII. They were also occasionally assigned to the following genera: *Eunicites* Ehlers, *Lumbriconereites* Ehlers, *Arabellites* Hinde and *Marleneites* Eller, e.g. *Eunicites serrula* Hinde, *Lumbriconereites perfectus* Stauffer, *L. arcuatus* Stauffer, *L. modestus* Stauffer, *Arabellites* sp. *A* Stauffer, 1939, *Oenonites caducus* Eller, *O. marginatus* Eller, *Marleneites arduus* Eller, *M. ferrari* Eller, *M. elatus* Eller and *M. explicatus* Eller. As jaws of basically different apparatuses may sometimes be very similar, it is impossible to decide whether any of the scolecodonts so far described belong to the genus *Oxyprion* or not.

Single mandibles, similar to those newly determined, have been described only rarely, the closest being the species *Diopatraites aversus* Eller, known from the Devonian of North America. This latter differs mainly in having the shank shorter than the anterior part. Also known from this same place are scolecodonts resembling MI of *Oxyprion: Staurocephalites alterostris* Eller and *Staurocephalites articulatus* Eller. Among Permian scolecodonts, there is only one species of MI jaws, which comes from an apparatus of the family Mochtyellidae. This is *Staurocephalites fortrileyensis* Tasch & Stude from the Wolfcampian stage of North America. It differs from MI of *Oxyprion compressus* n. sp. in its smaller size, fewer denticles with slightly different arrangement, absence of bight in posterior part of right jaw, and in having a prominent process anteriorly.

Oxyprion compressus n. sp.

(Pl. I; Pl. II, Figs. 5-6)

Holotype: Incomplete jaw apparatus, consisting of right and left MI and laeobasal plate; Z.N.G. No. W 121, figured on Plate I, Fig. 3.

Type horizon and locality: Zechstein, second cyclothem, main dolomite horizon; Wejherowo IG-1 boring in Pomerania, depth of 942-945 m.

Derivation of the name: Lat. *compressus* = compressed; alludes to the laterally compressed shape of MI.

Diagnosis. — Both parts of mandible compressed, almost perpendicular to each other. Shank slightly longer and narrower than posterior part. Laeobasal plate narrow, about 0.75 length of MI, with slightly fewer denticles and separate opening of pulp cavity. MI strongly compressed laterally, slightly convex to the inside, in lateral view broad trapezoidal. Right MII semicircular, length 0.2 that of MI. Anterior and lateral teeth not well known.

Denticle formula:

Laeobasal plate . . .	12—18	—
MI	14—21	14—20
MII	—	7

Material. — Besides the holotype, there are in the collection, joined right MI and MII, a right and left mandible with part of MI and an anterior tooth, 18 left MI with laeobasal plate, right MI with lateral tooth as well as 74 single right MI, 66 left MI and 20 right and left mandibles. All these specimens came from the main dolomite horizon of Wejherowo IG-1 bore hole.

Description. — Length of MI varies from 0.4 to 1.3 mm.

Laeobasal plate coalesced with left MI, about 0.75 length of the latter; narrow, laterally compressed, with several triangular denticles. Anterior denticles usually somewhat narrower and sharper than posterior. In lateral view, slightly arched, with maximum width about 0.25 width of MI. On ventral side, opening of pulp cavity, separated from opening of MI and like the latter, gaping, narrow and deep.

Right MI, a laterally compressed plate-like jaw, 0.4—1.3 mm long. Along the very narrow dorsal side runs a row of 14 to 20 rather small, sharp denticles, the biggest usually being the 7-th or 8-th. At the anterior end of jaw, the denticulated margin turns to the right. Posterior part of this margin is undenticulated for about 0.1 of its whole length. In lateral view, the jaw has the shape of an elongated trapezium, its width about 0.3 its length, slightly convex from the left side. Lateral margins, almost parallel, run straight posteriorly, anterior margin straight, directed postero-laterally, posterior margin rounded. Anterior part of right lateral side — triangular, considerably thicker than the rest of the jaw and partly separated from it by a denticulated margin. In posterior part of left lateral side, there is a small, semicircular bight, extending to half the jaw width. Narrow, deep, gaping opening of pulp cavity, slightly widening anteriorly.

Left MI, similar to a mirror image of right MI. Dorsally, the denticulated margin usually extends almost to the very end of jaw. Number of denticles vary from 14 to 21, the first few irregularly increasing in size posteriorly, while the remainder slightly decrease posteriorly. Right lateral side slightly convex, smooth, without bight in posterior part. On left lateral side, it is coalesced with laeobasal plate.

Right MII, known only from one specimen, attached to the anterior end of right MI. It is a small, laterally compressed, plate-like jaw, about 0.2 length of MI and provided with seven denticles. In lateral view, without attachment lamella it is semicircular, slightly convex. Denticulated margin — strongly arched. Inner wall extended into slender, irregularly shaped, attachment lamella. Gaping opening of pulp cavity.

Lateral teeth — only one tooth known, preserved in the opening of the pulp cavity of one of the right MI. It is triangular, flattened, sharply pointed, with broad base. Length about 0.15 that of MI.

Anterior teeth — only one tooth known, attached to anterior part of left mandible. It is very slender, sharp, needle-like, 0.2 mm in length.

Mandibles. The collection contains, besides single mandibles, a pair of joined mandibles. Attached to the anterior part of one of them is a fragment of MI jaw of the here described species, and an anterior tooth, therefore one can assume that these mandibles also belong to the described apparatus.

Each mandible has a broad, flat anterior part and narrower, slightly longer shank. Anterior part almost oval, strongly medially curved in its posterior end, forming at the boundary with shank a projection, perpendicular to the whole mandible. Margins of anterior part sharp, inner one regularly arched, the outer straighter, usually jagged. Maximum width of anterior part about 0.25 length of the whole mandible. Anteriorly it is completely flat, thickening posteriorly on outer side. In transverse section, posterior end gradually thickens, from inner margin towards the outer side, where it divides into two lamellas. Surface of anterior part of some specimens, covered with arched lines, converging in its lower end. Shank, 0.7 width of anterior part, is also flattened, almost perpendicular to anterior part, with parallel margins. Posterior end rounded. The slightly concave ventral side is formed by two surfaces, obliquely disposed. One of them, a continuation of ventral side of anterior part, tapers posteriorly. Width of shank decreases posteriorly.

Family **Kielanoprionidae** nov.

Diagnosis. — Asymmetrical jaw apparatuses of labidognatha type. Carriers shorter than MI, becoming shorter posteriorly, without ventral median piece. Basal plate completely fused with right MI. MI almost symmetrical, narrowing anteriorly. Inner margins of MI denticulated. MII long, extending far backwards. Left side of the apparatus with one anterior jaw more than in right side. Laeobasal plate, intercalary tooth and lateral teeth lacking.

Remarks. — The new family is monotypic, established for the genus *Kielanoprion* n. gen. with one species — *Kielanoprion pomeranensis* n. sp. Closest to it are the fossil families Paulinitidae Lange and Kalloprionidae Kielan-Jaw., from which it differs in the lack of basal plate, as well as in the considerable differences in the shape of carriers and development of MI. In the new family these are almost symmetrical, while in Paulinitidae and Kalloprionidae they are decidedly asymmetrical, with bights in the posterior margin of right jaw. These differences, having the rank

of characteristic features for a family, exclude the assignment of the genus *Kielanoprion* to either of them.

Among recent Eunicea, the jaw apparatuses closest to Kielanoprionidae are found in the families Eunicidae and Onuphidae. Jaw apparatuses of both these families, considered as labidognatha type, are characterized by the semicircular arrangement of the jaws, when the apparatus is retracted, short, broad carriers without a ventral, median piece, undenticulated, forceps-like MI, comparatively big MII, single left MIII, small, denticulated MIV and single teeth as MV. Pulp cavities of MI and MII are usually strongly enclosed. The majority of these features also occur in the Kielanoprionidae. The similarity is still greater if we take into account the fact, that in both recent families under discussion there occurs, similarly as in Kielanoprionidae, a short ridge on right MI, homologous to the basal plate (Kielan-Jaworowska, 1966). The greatest difference lies in the development of MI, which in *Kielanoprion* are well denticulated and considerably broader. MII, on the other hand, although likewise long, extending far backwards as in recent families, are considerably narrower. In addition, in *Kielanoprion* the openings of pulp cavities of MII are more strongly gaping.

The recent prionognatha jaw apparatuses of the families Arabellidae and Lysaretidae are characterized by jaws arranged in two parallel rows and by long, slender carriers with a median piece on ventral side, which basically distinguishes them from the newly described apparatus. Besides, in apparatuses of the family Arabellidae, usually consisting of five pairs of jaws, there is no unpaired plate, and in the family Lysaretidae there is a well developed basal plate. Although *Kielanoprion* seems to be much less close to the recent families prionognatha than to labidognatha, one can not overlook a certain similarity in MI, which are denticulated in the families Prionognatha. The difference in the structure of MI lies mainly in the wery well developed first denticle (hook), which in recent forms is widely separated from the remaining denticles. There exist, however, genera with a much less developed first denticle, as e. g. *Notocrinus* Schmarda of the family Arabellidae, where MI is denticulated for the whole length of inner margin.

Kielan-Jaworowska (1966), studying the evolutionary changes in labidognatha jaw apparatuses came to the conclusion that their primitive features were: MI denticulated, tapering posteriorly, with gaping or slightly enclosed pulp cavity, large elongated basal plate and occurrence of laeobasal plate and intercalary tooth. On the other hand, features characterizing a high state of development are: MI smooth, broad, with transverse posterior margin and strongly enclosed pulp cavity, basal plate small or lacking, laeobasal plate and intercalary tooth lacking. The family Paulinitidae Lange is considered as ancestral of recent Polychaeta of the labidognatha type jaw apparatuses (Lange, 1947; Kielan-Jaworow-

ska, 1966). The newly established family is, in certain aspects, at a more advanced evolutionary stage than Paulinitidae. In particular, the absence of basal plate, replaced by a homologous ridge on right MI, makes it very similar to the apparatus of the recent families Eunicidae and Onuphidae. Also the Kielanoprionidae carriers do not differ in any way from the recent labidognatha apparatuses. The main primitive feature distinguishing it from recent forms is the denticulated MI. It could be supposed that this was the last feature to undergo change, this taking place on the Mesozoic. On the other hand, some representatives of *Langeites* Kielan-Jaw., found already in Silurian, have MI very similarly developed to the recent labidognatha, with only a few small denticles. Completely smooth MI were found as single scolecodonts in various Palaeozoic formations, e.g. *Eunicites simplex* Hinde from Cambro-Ordovician, *E. angulatus* Eller from Devonian, *E. reidiae* from Carboniferous, *E. capricornu* Seidel from Permian.

Kielan-Jaworowska (1966) is of the opinion that the great majority of Palaeozoic Eunicea became extinct. Not knowing Mesozoic forms it is difficult to state with complete certainty whether this also concerns the family Kielanoprionidae. What is sure, however, is that, in some aspects, it represents a high degree of evolutionary development.

Genus *Kielanoprion* nov.

Type species: Kielanoprion pomeranensis n.sp.

Derivation of the name: named in honour of Professor Zofia Kielan-Jaworowska.

Diagnosis. — Jaw apparatuses of subcircular shape, composed of eleven elements, not counting mandibles. Carriers shorter than MI, tapering posteriorly, with transverse anterior margin and lateral margins incurved in anterior part. Basal plate in the form of a short ridge in inner posterior part of right MI. MI almost symmetrical, with pulp cavities strongly enclosed. MII symmetrical, long, with short transverse branch. MIII single, left, crescent-shaped. MIV small, arched, right higger than left. MV — single teeth. Openings of pulp cavities of anterior jaws — gaping.

Occurrence. — Zechstein of Poland and Germany. Possible representatives of this genus also occur in the Devonian, Carboniferous and Permian of North America.

Kielanoprion pomeranensis n.sp.

(Pl. II, Figs. 1, 2, 4; Pls. III—VI; Text-figs. 2-3)

Holotype: Almost complete apparatus, Z.N.G. No. W 19, figured on Pl. III, Fig. 1.

Type horizon and locality: Zechstein, second cyclothem, main dolomite horizon; Wejherowo IG-1 bore hole in Pomerania, depth 942—946 m.

Derivation of the name: pomeranensis — found in Pomerania.

Diagnosis. — Length of carriers; about 0.8 length of MI. Width of single carrier 0.34 its length. MI varying from crescent shaped to triangular. First denticle only slightly bigger than remaining ones and not separated from them by a wide interval. Undenticulated posterior part of inner margin about 0.2 its length. Basal ridge short, oblique. Opening of pulp cavity rounded, extending for about 0.4 length of jaw. MII hooked, only slightly shorter that MI. Transverse branch about 0.4 length of jaw. Opening of pulp cavity enclosed only at anterior end, MIII similar to left MII, only considerably shorter. MIV small, arched, provided with several denticles, broad from lateral side. MV — single teeth, claw-like, placed in front of first denticle of MIV.

Denticle formula:

MI	8—14	8—16
MII	7—12	7—15
MIII	5— 8	—
MIV	4— 6	6—10
MV	1	1

Material. — Ninety four apparatuses, more complete or less and about 1400 isolated elements, the great majority being MI and MII.

Description. — Length of MI varies in the limits 0.42—1.4 mm.

Carrriers about 0.8 length of MI. Greatest width, along anterior margin and middle part, equals on an average 0.34 of the length. Outer margin strongly curved inwardly in its anterior part forming a bight, from mid-length running postero-medially. Inner and anterior margins straight. Anterior lateral corners slightly rounded. Anterior part of dorsal side slightly convex and glossy, posterior part of dorsal and ventral side — dull.

Basal plate — completely fused with right MI, developed only as a short ridge. Situated obliquely on posterior inner corner of MI. Its length about 0.05 the length of MI. In some jaws, this ridge is not visible.

Right MI varies in outline from crescent-shaped to almost triangular. Average length 2.2 times greater than width. Greatest width usually along a line intersecting posterior end of outer margin and in some more rounded forms in the middle part of the jaw. Outer margin runs in an arch, postero-laterally from first denticle to middle part of jaw, then gradually changes to a posterior direction, in posterior part — incurved for a short distance, forming a small bight and a not very large rounded process in the postero-lateral corner. Posterior margin almost straight for half its length, from outer margin, directed postero-medially, then changing to an almost transversal direction, slightly inclined posteriorly. Inner margin runs, as a rule, almost straight posteriorly; in some jaws — slightly convex just below the middle part. A row of 8—16 triangular denticles extend to about 0.8 its length. First denticle bigger than the

remaining ones, directed laterally or antero-laterally. Remaining denticles usually gradually decrease in size posteriorly. Anterior denticles, narrower, directed laterally, posterior — broader, becoming gradually more inclined posteriorly. Denticulated inner edge bent upwards in

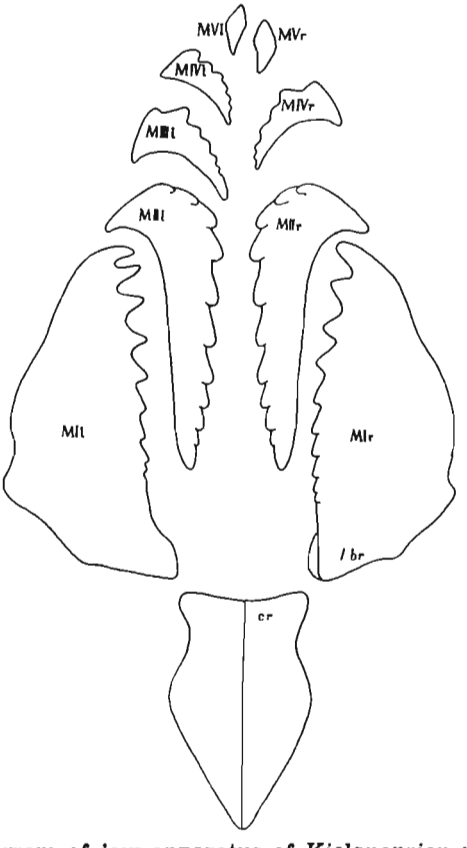

Fig. 2. — Diagram of jaw apparatus of *Kielanoprion pomeranensis* n. sp.

relation to jaw surface. Last denticles, usually very small, poorly defined, developed as crenulations on the inner margin, which gradually becomes smooth and rounded, extending to posterior end of jaw. Left of the smooth ridge some of the jaws enlarge into a small inner wing. Usually this wing is bent on ventral side. Anterior part of jaw, with first denticle, is curved upwards. Most posterior part, separated from the rest by a furrow. This furrow runs in an arch from the bight on the posterior part of outer margin towards inner margin, without, however, reaching the latter. On inner half of the most posterior part there is a short, antero-laterally directed, basal ridge. On ventral side, a rounded opening of pulp cavity occupies 0.4 of the jaw length. Its anterior margin semicircular, posterior edge convex, in the form of a collar, broadening towards the inner margin of the jaw. On inner side of opening, there is

a narrow belt, gradually narrowing downwards. In some jaws, its lower part is bent on to the dorsal side, forming an inner wing. At the corner of posterior and outer margins, in well preserved jaws, there is a small, vertically inclined process, well visible in right lateral view. In this view the jaw is widely arched, flat, slightly widening anteriorly. On the dorsal side, the tips of denticles are visible, on the ventral side — the posterior inner part of opening of pulp cavity.

Left MI, almost a mirror image of right jaw, differing from it only in the lack of basal ridge and slightly different development of posterior inner corner of jaw. In the majority of jaws, on posterior inner corner, there is a trapezoidal inner wing, somewhat bigger than that in right jaws. Its length is about 0.2 the length of jaw, ratio length to width about 2:1. Anterior margin directed postero-laterally. Lateral margins almost parallel, runing posteriorly; posterior margin transversal, slightly inclined posteriorly.

Right MII — a narrow long, hooked jaw. In joined apparatuses its posterior end reaches the undenticulated inner margin of MI. It is widest in anterior part, maximum width about 2.5 times smaller than its length. Rounded anterior margin prolonged postero-laterally, forming, together with outer margin, a transversally elongated shank. Tip of shank is usually directed postero-laterally. Inner margin straight, directed posteriorly. Outer margin forming a bight under shank, then continuing posteriorly. At posterior end, lateral margins converge to form, in some well preserved jaws, an elongated spine, most often slightly curved ventrally. Along almost the whole of inner and anterior margins runs a row of 7-13 comparatively big, stout denticles, posteriorly directed. In the majority of jaws, denticles increase in size from the first to the third or fourth, then decrease posteriorly. Right slope steep, narrow, broadening anteriorly; left slope vertical, not visible in dorsal view. From ventral side, opening of pulp cavity occupies almost the whole jaw with the exception of anterior end. In lateral view, the jaw has the shape of an elongated triangle, broadening anteriorly. Here, its greatest width, not counting attachment lamella, is equal to maximum dorsal width. Attachment lamella is either a prolongation of anterior part of left slope of jaw or is perpendicular to it. In only a few jaws, is it well preserved, in which case it is almost triangular in shape. It was probably considerably differentiated in size. In jaws without attachment lamella, left, anterior corner of left slope is elongated laterally in the form of a pointed process.

Left MII — mirror image of right MII. Differing from it only in the lack of a slender pointed spine at posterior end. Lamella attachment, in many jaws, long, sometimes reaching to the very posterior end.

Left MIII, a comparatively small jaw (0.2—0.4 mm). In dorsal view, crescent-shaped, similar in outline to MII. Anterior margin elongated

laterally, forming a lateral branch, ending in a hook. Longitudinal branch, about 1.7 times longer than transversal, tapering gradually posteriorly. Lateral margins, in the form of arches, convering at posterior end. Inner margin provided with a row of 5—8 denticles, directed vertically upwards. Second denticle bigger than the first, remaining ones — decreasing in size posteriorly. Left slope broadening anteriorly. Right slope vertical. In right lateral view, the jaw is strongly convex, widest at the level of second and third denticles, narrowing posteriorly. Attachment lamellas preserved in varying shapes and sizes. In those jaws with attachment lamella broken off, the most convex part of slope is usually laterally elongated in the form of a triangular process.

Right MIV in dorsal view almost a mirror image of MIII, differing from it mainly in a shorter transverse branch and narrower right slope. On inner margin there is a row of 6—10 denticles, the two first being almost equal in size. The remaining ones, decreasing in size posteriorly. In lateral view, this jaw is wide along all of its length. The irregularly shaped attachment lamella is, as in other jaws, a prolongation of the inner slope, or can be bent perpendicularly to it.

Left MIV — a small jaw, in dorsal view arched, almost a mirror image of right MIV but smaller; provided with 4 to 6 denticles, decreasing in size posteriorly.

Right and left MV — single teeth, claw-shaped, with triangular base, tip directed downwards. Gaping opening of pulp cavity on ventral side, triangularly shaped. In apparatuses, both MV are situated before first denticle of MIV and are usually attached to it. Left tooth — a mirror image of the right.

Variability. — Variability in the development of carriers mainly concerns the length to width ratio. Variability in MI applies both to shape and denticulation. The relation of length to width ratio varies in the limits 1.9—2.7 (Fig. 3 *c*). Outline varies from almost semicircular to almost triangular. The middle part of denticulated inner margin can be either convex or almost straight. Outer margin, in anterior half, can be slightly incurved or not. Posterior margin convex and curved anteriorly in some jaws, while in others — straight. The passage of denticulated part of inner margin into smooth part is gradual in most jaws, but in some is comparatively abrupt. In the majority of left jaws and in some right ones, the lower part of belt, delimiting the opening of pulp cavity, is completely bent over on to the dorsal side, forming a wide inner wing, in others, however, the belt extends to the very posterior end of the jaw, without bending at all or only slightly to the dorsal side, which results in the inner wing being narrow or completely absent (Fig. 3 *a*). An arched, transverse furrow, dividing, on dorsal side, the most posterior part of jaw, is in some specimens deep and well defined, in others — shallow, almost invisible. Variability in MI denticulation concerns the

number of denticles, their shape, size, arrangement and direction of incline. The number ranges from 8 to 16, mostly 9 to 11. Shape of denticles varies from broad and blunt to narrow, sharply ended (Fig. 3 *b*). Size is usually in inverse proportion to number, most often gradually decreasing posteriorly. There are, however, jaws in which some anterior denticles, beginning from the second, increase in size posteriorly and only then, usually from the fifth or sixth again decrease. The difference in size between the first denticle and remaining ones varies to a conside-

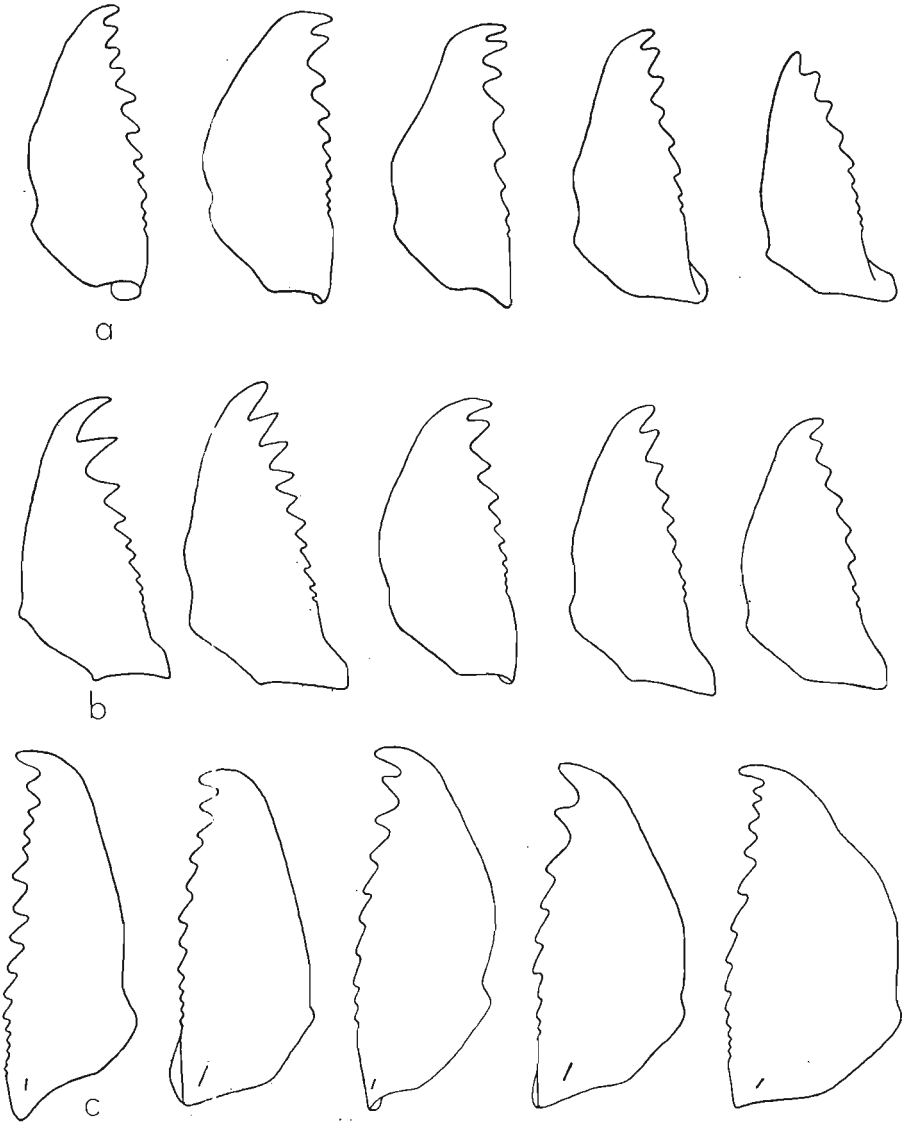

Fig. 3. — Several forms of MI *Kielanoprion pomeranensis* n. sp., illustrating: *a* variability of inner wing in left jaw, *b* variability of length and width of teeth as seen on left jaw, *c* variability of width of jaws as seen on right jaw.

rable degree. Anterior denticles are, as a rule, directed medially, the posterior ones postero-medially. In some specimens, however, anterior denticles are inclined antero-medially or postero-medially.

Variability in MII concerns mostly the length to width ratio, as well as number and shape of denticles. Relation between length and width, depending mainly on the length of transverse branch, varies from 2.3 to 3.1. Shank is, in some jaws, straight, directed laterally, in others curved backwards. The number of denticles varies from 7 to 13, mostly there are 8 or 9. Similarly as in MI, they can be narrow and sharp or broad and blunt, the differences here are not so marked. Considerable variability is observed in the shape and size of attachment lamella, which can extend to the very posterior end of jaw or be much shorter. Its range of variability is difficult to define as it is often fragmented or completely broken off. In MIII and MIV, in addition to the number and size of denticles, variability concerns the degree of arching of jaws, which corresponds to changes in the length to width ratio. Width in lateral view also varies, this being difficult to measure, as the inner wall of the jaw often passes gradually into the attachment lamella. Attachment lamellas can be of varying shape and size. In some MIV the first denticle is the biggest, while in others — the second.

Remarks. — Single jaws, similar to MI of *Kielanoprion pomeranensis,* were most often assigned to the genus *Arabellites* Hinde, for example *Arabellites comis* Eller, *A.? compressus* Seidel, *A.? spinosus* Seidel, *A.? biconvexus* Seidel, *A.? magnidentatus* Seidel, *A.? robustus* Seidel, *A.? oblongus* Seidel, *A.? falcatus* Seidel and *A. demissicius* Eller. Close to them are also some jaws assigned to the genus *Nereidavus* Grinnel, e.g. *Nereidavus hamulus* Eller and *N.? admixtus* Eller. Scolecodonts similar to MII were described under the names of several genera, such as *Arabellites* Hinde, *Leodicites* Eller, *Lumbriconereites* Ehlers, *Paleoenonites* Eller, e.g. *Arabellites falciformis* Stauffer, *A. cultriformis* Stauffer, *Leodicites angiformis* Eller, *L. hamatus* Seidel, *L. cristatus* Seidel, *L. imparilis* Sylvester (described as MIII), *L. crassimarginatus* Eller, *L. finitimus* Eller, *Lumbriconereites cooperi* Eller (described as MI), *L.? serratus* Seidel and *Paleoenonites commodus* Eller.

Jaws similar to MIII and MIV in *Kielanoprion pomeranensis* n.sp. are also known under the names of different genera: *Eunicites* Ehlers, *Oenonites* Hinde, *Paleoenonites* Eller, *Anisocerasites* Eller, e.g. *Eunicites coronatus* Hinde, *E. nanus* Hinde, *E. placidus* Stauffer, *Eunicites* sp. Tasch & Stude, *Oenonites alpenensis* Eller, *Paleoenonites angiportus* Eller, *P. auctificus* Eller, *P. curtilobus* Eller, *P. circulus* Eller, *P. deltoides* Eller, *P. latissimus* Eller, *Anisocerasites caudagallus* Eller and *A. cultidaclylus* Eller.

Single teeth were usually assigned to the genus *Eunicites,* the closest to MV in *Kielanoprion pomeranensis* n.sp. are: *Eunicites capax* Eller,

E. conicus Eller, *L. conoideus* Eller, *E. consimilis* Eller and *E. whiteae* Eller. Carriers among scolecodonts are rare. The closest species to the carriers of the newly described apparatus is *Marphysaites junctus* Eller.

The majority of the mentioned scolecodonts are known from the Devonian of North America. Closest, however, to the jaws of the newly described apparatus are the forms from the Zechstein of Germany (Malzahn, 1958; Seidel, 1959). Included in the work of Malzahn were photographs of MI and MII jaws, most probably belonging to the apparatus of *Kielanoprion pomeranensis,* however their descriptions were not given. They were assigned to the following: MI — *?Arabellites* cf. *comis* Eller and *Lumbriconereites* sp., MII — *Leodicites* aff. *artus* Eller, *Leodicites* sp., *Lumbriconereites* sp. and *Arabellites* sp. The majority of forms described by Seidel seem to be identical to MI and MII in *Kielanoprion pomeranensis.* In particular *Arabellites? spinosus, A.? biconvexus, A.? robustus, A.? oblongus* and *A.?* cf. *comis* among MI and *Leodicites hamatus* among MII, do not differ at all from individual jaws of the newly described apparatus. The not very great differences in shape and denticulation, on which differentiation of separate species was based, is within the range of species variability. The material in the present author's collection allows identification of several transition forms between the above mentioned species of MI jaws.

Taking into consideration that both faunas come from the same Zechstein sea basin, that there are only small differences in their stratigraphical position, as well as the fact that four identical jaws occur in each (right and left MI and MII), one can assume that all the above mentioned species of jaws come from an apparatus belonging to genus *Kielanoprion,* and probably even from species *Kielanoprion pomeranensis.*

Species *Arabellites? magnidentatus* and *Arabellites falcatus* do not fit within the range of documented variability of MI in *Kielanoprion pomeranensis* and belong probably to another species or even genus. The same applies to the MII described as *Leodicites? falcarius.* On the other hand, *Arabellites compressus, Leodicites? cristatus* and *Lumbriconereites? serratus,* established on the base of single specimens (Seidel, 1959), are probably deformed or partly crushed forms of MI and MII jaws, belonging also to the apparatus *Kielanoprion pomeranensis.* Of all the Zechstein scolecodonts, described by Seidel, only *Eunicites capricornu* comes from a completely different, so far unknown apparatus.

From the Permian of North America, Tasch and Stude (1964) described an incomplete jaw apparatus, consisting of right and left MI and MII and a right MIV. Its individual jaws were determined as *Arabellites comis* Eller, *Arabellites falciformis* Stauffer and *Eunicites* sp., the whole apparatus being assigned to the genus *Eunicites* Ehlers, as *Eunicites* sp. indet. As seen from the works of Lange (1949), Kozłowski (1956) and Kielan-Jaworowska (1961, 1962, 1966), the entire jaw apparatuses should be

described in a taxonomic system different from the parataxonomy of scolecodonts and combining the two systematics into one system is impossible.

Jaws of the apparatus described by Tash and Stude are similar to the corresponding jaws of *Kielanoprion pomeranensis,* but not identical. MI has much fewer denticles, a bigger first denticle and a slightly different general shape. MII is more flattened, with differently developed transverse branch. Unfortunately, none of the jaws were illustrated in ventral view. It is also not known whether there is a remnant ridge of the basal plate on right MI. In this state of knowledge, several elements being missing, especially carriers, determination of the systematic position of the apparatus described by Tasch and Stude is problematic. Most probably it belongs to the family Kielanoprionidae and maybe even to the genus *Kielanoprion.* It should be noted that its elements — *Arabellites comis* and *Arabellites falciformis* — are known not only from the Permian, but also from the Devonian and Carboniferous (Eller, 1938, 1941, 1964; Stauffer, 1939; Sylvester, 1959; Loranger, 1963). Usually only left MII has been described as *Arabellites falciformis* and its corresponding and occurring with it, right MII has been described as *Arabellites cultriformis* Stauffer. Almost identical to it, however, is *Leodicites crassimarginatus* Eller.

?*Kielanoprion pomeranensis* n.sp.
(Pl. II, Fig. 3)

Material. — No mandibles have been found with any of the jaw apparatuses of *Kielanoprion pomeranensis.* However, in core samples from the main dolomite horizon of Wejherowo bore hole, containing the described apparatuses, and apparatuses of *Oxyprion compressus* n.sp., two different types of mandibles have been found. Attached to one of them is a fragment of an *Oxyprion compressus* jaw. Most probably, then, it belongs to that genus. It seems reasonable, therefore, to suppose that the second type of mandible, occurring with it, belongs to *Kielanoprion pomeranensis,* especially as no other scolecodonts have been found in this horizon. Their number in relation to the number of jaws is very small. In the present collection there are barely 14 single mandibles of this type, the majority of which are partly broken.

Description. — Length 0.7 to 2.2 mm; maximum width about 0.2 of length. Each mandible consists of two parts. Anterior part — length about 1/3 that of the whole, flattened, about 1.5 times wider than shank. It has the shape of an elongated pentagon with rounded angles and extended anterior end. Posterior part, in dorsal view, slightly convex. Ventral side — an elongated triangle, broadening posteriorly. Thickness,

greater at posterior inner corner, decreasing anteriorly outwards. On dorsal surface of some specimens, faintly marked lines run parallel to the margin. Shank almost straight, beam like, with tapering posterior end. Outer side flattened, forming an uniform surface with anterior part. In dorsal view, strongly convex with furrows running along both margins. The furrow along inside margin — narrow, shalow ending at the boundary of anterior part of mandible. Furrow on outer side wider, deeper, continuing onto the anterior part, forming a deep hollow, narrowing anteriorly in the form of a tunnel.

Family **Atraktoprionidae** Kielan-Jaworowska, 1966
Genus *Atraktoprion* Kielan-Jaworowska, 1962
Atraktoprion eudoxus n.sp.
(Pl. VII; Text-fig. 4)

Holotype: Right MI; Z.N.G. No.Ch.2, figured on Plate VII, Fig. 5.
Type horizon and locality: Zechstein, first cyclothem, Zechstein limestone horizon; bore hole Chojnice-3 in Pomerania, depth 2464 m.
Derivation of the name: Gr. *eudoxos* = splendid.

Diagnosis. — Apparatuses comparatively big. Basal plate, width almost equal to length, tapering towards antero-lateral corner, hook in both MI circularly curved, equals 1/3 jaw length. Outer margin of MI slightly incurved for a short distance in posterior part. Opening of pulp cavities, about 0.5 jaw length, without distinct muscle scars. Bight in right MI about 1/3 jaw length. Left MI with an inner wing, narrowing posteriorly. MII with transverse branch perpendicular to longitudinal.

Denticle formula:

Basal plate . . .	—	7—9
MI	9—10	9
MII	7— 8	7
MIII	7	—
MIV . . .	unknown	unknown

Material. — 5 MIr, 8 MI1, 4 MIIr, 8 MIII, 1 MIIII, 4 basal plates and 1 right carrier.

Description. — Length MI varies from 0.75 to 1.15 mm.

Carriers — only one right carrier, with posterior part broken off, is known. In dorsal view, completely flat, wide anteriorly (0.26 mm), narrowing posteriorly. Anterior margin arched, inner margin straight, outer margin at first directed postero-medially and then posteriorly. In ventral view, anterior part is flat. Posterior part strongly convex, in cross section almost semicircular.

Basal plate — length 0.26—0.34 mm, width almost equal length;

longest by inner margin; tapering towards antero-lateral corner; anterior margin incurved. Postero-outer margin arched postero-medially, inner margin runs straight posteriorly. The inner margin is provided with a row of 7—9 small denticles, inclined backwards, the biggest usually being the middle denticles and first denticle, which has a somewhat different shape and is separated by a wider interval from the rest. In relation to jaw surface, they are inclined obliquely upwards. On the left side of posterior part of denticulated margin, an inner wing is visible,

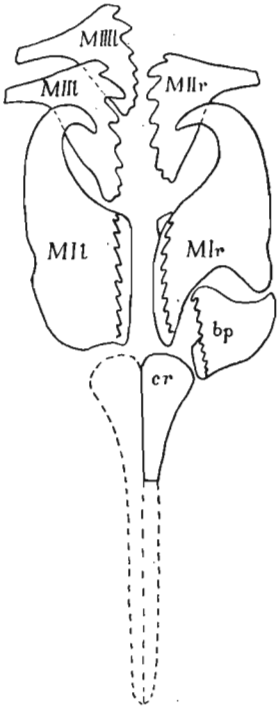

Fig. 4. — Diagram of jaw apparatus of *Atraktoprion eudoxus* n. sp.

widest in the middle part, tapering at both ends. The whole dorsal side of basal plate is convex, only its narrow and sharply ended antero-lateral corner is bent downwards. Gaping opening of pulp cavity on ventral side separated from denticulated margin by a wide belt. Outer part of belt, bent on to the dorsal side, forms an inner wing. In left lateral view, plate is comparatively wide, strongly concave.

Right MI. Maximum width — about half the length. Hook, about 0.3 length of jaw, semicircularly curved, directed postero-medially, slightly bent upwards. Along its anterior part, almost parallel to outer margin, runs a very narrow, faintly marked furrow. Outer margin runs in an arch around hook, then straight posteriorly. Posterior margin deeply incurved anteriorly, forming a bight 0.3 of the jaw length. About 9 coni-

cal, comparatively narrow, posteriorly directed denticles run along the outer margin from the base of hook, almost to posterior end of jaw. The first is considerably smaller than the second, the next two or three gradually increasing in size, while the remainder decrease posteriorly. All denticles are vertically inclined in relation to jaw surface. Left slope steep, narrow, tapering in posterior end. In dorsal view, the jaw is flat or slightly convex. Only hook is slightly bent upwards and posterior part of the jaw to the right of middle denticles is strongly concave. Opening of pulp cavity extends for 0.55 the jaw length. Its anterior margin semicircular, joining with outer margin of jaw near posterior end. Opening separated from inner margin of jaw by a narrow belt. Left of the belt and parallel to it there is a groove, in which pits associated with the denticles are visible. In left lateral view, the jaw is narrow, denticles directed to the right. Left slope in the shape of an elongated rectangle, with convex ridge in the middle. Along the whole hook runs a narrow furrow, parallel to that visible on dorsal side. Due to these furrows the inner part of the hook is somewhat thinner than the outer.

Left MI. Length of jaws in collection varies from 0.7 to 1 mm. Hook similar to that in right jaw, circularly curved, bent upwards, with narrow furrows on both sides. Outer margin at first directed postero-laterally then posteriorly; at about 2/3 its length, counting from the front, it is for a short distance curved inwards, then changes direction to postero-medial, finally passing in a gentle arch into the posterior margin. Posterior margin short, transversal. A row of 9—10 narrow denticles, vertically inclined and directed backwards, form inner margin from base of hook to posterior end of jaw. The first denticles increase in size towards the middle, the remainder decreasing anteriorly. This margin runs straight posteriorly. On the right of it, there is an inner wing, which in dorsal view is narrow, tapering posteriorly. On the left of the posterior part of the denticulated margin, there is an oblong, wide, deep groove. In ventral view length of opening of pulp cavity is 0.58 that of the whole jaw. From inner side, it is separated by an inner wing, slightly bent upwards. On outer side, a postero-medially directed part of outer margin of jaw forms at the same time the margin of the opening of pulp cavity. Anterior part of opening is somewhat narrower than in right jaw. Bottom of pulp cavity in outer-anterior part is strongly concave. Under inner wing runs a narrow groove with faintly marked pits associated with the denticles. Visible in right lateral view is a narrow, right slope, perpendicular in relation to the jaw surface, an inner wing bent upwards, denticles and a hook directed to the left and posteriorly.

Left MII — in dorsal view a flat tringular jaw, with narrow transverse branch. Anterior margin transverse, long and straight. Outer margin runs medially along transverse branch and than turns postero-

medially. Disposed along inner margin are 7 to 8 comparatively big denticles, inclined posteriorly and slightly bent upwards. The first considerably smaller than the second, the remainder gradually decreasing in size posteriorly. Longitudinal branch widest in anterior part, narrowing posteriorly. Transverse branch perpendicular to longitudinal, narrow, slightly bent upwards, obliquely beveled at end. In ventral view, gaping opening of pulp cavity occupies outer part of jaw. Inner part convex, inclined towards denticles. Length of jaws in collection 0.4 to 0.56 mm, ratio length to width, including transverse branch, about 1.2:1.

Right MII little known due to badly preserved specimens. It is almost a mirror image of left MII, only second denticle here is a little smaller, the biggest being the third denticle.

Left MIII developed similar to left MII only with considerably longer transverse branch, greater than length. Length of specimen in collection 0.38 mm, width 0.45 mm.

Remarks. — None of the here described jaws were found joined together. There is no doubt, however, but that they came from apparatuses which belong to one species, as:

a) all jaws were found in a single, about 1.5 m thick, layer in one bore hole,
b) differences in development between corresponding elements are very small and cannot be considered as differences of specific rank,
c) although 7 kg of rock from this horizon were dissolved, no other scolecodonts besides the here described were found,
d) all the elements fit well together.

From among the so far known apparatuses of this genus, the jaws most similar to the newly described are those of the apparatuses of *Atraktoprion robustus* and *Atraktoprion major,* described by Kielan-Jaworowska (1966). MI in *Atraktoprion robustus* are much smaller, with a less curved hook, slightly longer openings of pulp cavities, with well defined muscle scars. There are also some less important differences. Differences in MII are greater. They are wider in lateral view than in dorsal, the first denticle being much bigger than the remaining ones. Basal plate has a completely different shape, widest in lower part, with a distinct protuberance on posterior margin. MI in *Atraktoprion major* are more elongated, with a longer and more slender hook. In addition, in left jaws, posterior section of outer margin is strongly concave. Right jaws have a considerably longer opening of pulp cavity. MII are more similar than in *A. robustus,* differing mainly in a transverse branch, tapering towards the end and a different arrangement of denticles, with regard to size. Both the above mentioned, as well as all other so far known apparatuses of the genus *Atraktoprion* come from Ordovician or Silurian deposits. On the other hand, only single scolecodonts, similar to the newly described right and left MI, are known from the Permian. These

are *Ildraites anatinus* Stauffer and *Arabellites hamiltonensis* Stauffer (Tasch & Stude, 1966). They differ in having a longer and less curved hook. In addition, *Ildraites anatinus* (right jaw) has a considerably shorter bight. Forms similar to them, described under the same species, are also common in the Devonian (Stauffer, 1939; Eller, 1961, 1964). Among the many other scolecodonts occurring with them are sometimes jaws similar to MII of the newly described apparatus, i.e. *Leodicites magnificus* Stauffer (Stauffer, 1939; Eller, 1941), which differ from them mainly in the arrangement of denticles with regard to size. It is possible that all the three species of scolecodonts belonged to one jaw apparatus similar to *Atraktoprion eudoxus*.

Geological Institute
of the Polish Academy of Sciences
Warszawa, Żwirki i Wigury 93
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REFERENCES

EHLERS, E. 1864-1868. Die Bornstenwürmer (Annelida, Chaetopoda). **1/2**, I-XX+1--748, Leipzig.

— 1868. Über eine fossile Eunice aus Solenhofen (Eunicites avitus) nebst Bemerkungen über fossile Würmer überhaupt. — *Ztschr. Wiss. Zool.*, **18**, 3, 421-443, Leipzig.

ELLER, E. R. 1934*a*. Annelid jaws from the Upper Devonian of New York. — *Ann. Carnegie Mus.*, **22**, 303-317, Pittsburgh.

— 1934*b*. Annelid jaws from the Hamilton Group of Ontario Country, New York. — Ibidem, **24**, 51-57.

— 1936. A new scolecodont genus, Ildraites, from Upper Devonian of New York. — *Ibidem*, **25**, 73-77.

— 1938. Scolecodons from the Potter Farm Formation of the Devonian of Michigan. — *Ibidem*, **27**, 275-287.

— 1940. New Silurian scolecodonts from the Albion Beds of the Niagara Gorge, New York. — *Ibidem*, **28**, 9-47.

— 1941. Scolecodonts from the Windom, Middle Devonian of Western New York. — *Ibidem*, **28**, 323-341.

— 1942. Scolecodonts from the Erindale Ordovician, at Streetsville, Ontario. — *Ibidem*, 29, 241-270.

— 1944. Scolecodons of the Silurian Manitoulin Dolomite of New York and Ontario. — *Amer. Midland Natur.*, **32**, 732-755, Notre Dame.

— 1945. Scolecodonts from the Trenton Series (Ordovician) of Ontario, Quebec and New York. — *Ann. Carnegie Mus.*, **30**, 119-212, Pittsburgh.

— 1946. New scolecodonts from the Kagawong of Manitoulin Island, Ontario. — *Proc. Pennsylvania Acad. Sci.*, **20**, 71-75, Pittsburgh.

— 1955. Additional scolecodons from Potter Farm Formation of the Devonian of Michigan. — *Ann. Carnegie Mus.*, **33**, 303-317, Pittsburgh.

— 1961. Scolecodonts from well samples of Dundee, Devonian of Michigan. — *Ibidem*, **36**, 4, 29-48.

ELLER, E. R. 1963*a*. Scolecodonts from the Sheffield Shale, Upper Devonian of Iowa. — *Ibidem*, **36**, 159-168.

— 1963*b*. Scolecodonts from the Dundee, Devonian of Michigan. — *Ibidem*, **36**, 173—178.

— 1964. Scolecodonts of the Delaware Limestone, Devonian of Ohio and Ontario. — *Ibidem*, **36**, 229-266.

FAUVEL, P. 1923. Faune de France, 5: Polychètes errantes. 1-488, Paris.

HARTMAN, O. 1944. Polychaetous annelids. Part V: Eunicea. — *Allan Hancock Pacific Exped.*, **10**, 1, 1-200, Los Angeles.

HINDE, G. 1879. On annelid jaws from the Cambro-Silurian, Silurian and Devonian Formations in Canada and from the Lower Carboniferous in Scotland. — *Quart. J. Geol. Soc. London*, **35**, 370-389, London.

— 1880. On annelid jaws from the Wenlock and Ludlow Formations of the West of England. — *Ibidem*, **36**, 368-378.

— 1882. On annelid remains from the Silurian strata of the Isle of Gotland. — *Bih. kongl. Svenska Akad. Handl.*, **7**, 5, 1-28.

— 1896. On the jaw apparatus of an annelid from the Lower Carboniferous of Halkin Mountain, Flintshire. — *Quart. J. Geol. Soc. London*, **52**, 438-451, London.

KIELAN-JAWOROWSKA, Z. 1961. On two Ordovician polychaete jaw apparatuses (O dwóch ordowskich aparatach szczękowych wieloszczetów (Annelida, Polychaeta)). — *Acta Palaeont. Pol.*, **6**, 3, 237-259, Warszawa.

— 1962. New Ordovician genera of polychaete jaw apparatuses (Nowe rodzaje ordowickich aparatów szczękowych wieloszczetów (Annelida, Polychaeta)). — *Ibidem*, **7**, 3/4, 291-332.

— 1963. Ordovician polychaete jaw apparatuses from Poland. Abstract. — *Proc. XVI. Int. Congr. Zool.*, **1**, 173, Washington.

— 1966. Polychaete jaw apparatuses from the Ordovician and Silurian of Poland and a comparison with modern forms (Aparaty szczękowe wieloszczetów z ordowiku i syluru Polski i porównania z formami współczesnymi). — *Palaeont. Pol.*, **16**, 1-152, Warszawa.

KOZŁOWSKI, R. 1956. Sur quelques appareils masticateurs des Annélides Polychètes ordoviciens (O paru narządach szczękowych pierścienic wieloszczetów z okresu ordowickiego). — *Acta Palaeont. Pol.*, **1**, 3, 165-210, Warszawa.

LANGE, F. W. 1949. Polychaete annelids from the Devonian of Parana, Brazil. — *Bull. Amer. Paleont.*, **33**, 134, 1-71, Ithaca.

LORANGER, D. M. 1963. Devonian microfauna from Northeastern Alberta. Part 3: Annelida. 1-13, Calgary.

MALZAHN, E. 1958. Neue Fossilfunde und vertikale Verbreitung der niederrheinischen Zechsteinfauna in den Bohrungen Kampf 4 und Friedrich Heinrich 57 bei Kampf-Lintfort. — *Geol. Jahrbuch*, **73**, 91-126, Hannower.

MARTINSSON, A. 1960. Two assemblages of polychaete jaws from the Silurian of Gotland. — *Bull. Geol. Inst. Univ. Uppsala*, **39**, 1-8, Uppsala.

SEIDEL, S. 1959. Scolecodonten aus dem Zechstein Thüringens. — *Freiberger Forschungsh., C*, **76**, 1-32, Berlin.

ŠNAJDR, M. 1951. On Errant Polychaeta from the Lower Paleozoic of Bohemia. — *Shorn. Geol. Surv. Czechosl.*, **18**, 241-296, Prague.

STAUFFER, C. R. 1933. Middle Ordovician Polychaeta from Minnesota. — *Bull. Geol. Soc. Amer.*, **44**, 6, 1173-1218, New York.

— 1939. Middle Devonian Polychaeta from the Lake Erie district. — *J. Paleont.*, **13**, 5, 500-511, Menasha.

SYLVESTER, R. K. 1959. Scolecodonts from Central Missouri. — *Ibidem*, **33**, 1, 33-49.

SZANIAWSKI, H. 1966. Rozwój facjalny i paleogeografia cechsztynu w rejonie wy-

niesienia Łeby (Facial development and paleogeography of the Zechstein within the elevation of Łeba). — *Acta Geol. Pol.*, **16**, 2, 229-247, Warszawa.
TASCH, P. & STUDE, J. R. 1965. A scolecodont natural assemblage from the Kansas Permian. — *Trans. Kansas Acad. Sci.*, **67**, 4, Lawrence.
— & — 1966. Permian scolecodonts from the Fort Riley Limestone of Southeastern Kansas. — *Wicht. State Univ. Bull., Univ. Studies*, **68**, 1-35.

HUBERT SZANIAWSKI

O TRZECH NOWYCH APARATACH SZCZĘKOWYCH WIELOSZCZETÓW Z PERMU GÓRNEGO POLSKI

Streszczenie

W poziomach skał węglanowych cechsztynu, w wierceniach Wejherowo IG-1, Chojnice-3, Biały Bór-1 i Dźwirzyno-1 na Pomorzu, znaleziono bogatą w okazy faunę skolekodontów, wśród której zachowały się mniej lub bardziej kompletne aparaty szczękowe. Zebrany materiał pozwolił na wyróżnienie trzech nowych gatunków aparatów. Ustanowiono nową, monotypową rodzinę Kielanoprionidae, z jednym przedstawicielem — *Kielanoprion pomeranensis* n. gen., n. sp. W obrębie rodziny Mochtyellidae Kielan-Jaworowska ustanowiono nowy rodzaj *Oxyprion* n. gen., z jednym gatunkiem *Oxyprion compressus* n. sp. Trzeci gatunek zaliczono do rodzaju *Atraktoprion* Kielan-Jaw. i nadano mu nazwę *Atraktoprion eudoxus* n. sp. Wszystkie trzy aparaty należą do nadrodziny Eunicea Grube. Nie licząc dwóch pojedynczych i źle zachowanych znalezisk z mezozoiku, aparaty te są geologicznie najmłodsze z dotychczas znanych aparatów kopalnych.

Kielanoprion pomeranensis n. sp. znaleziono w poziomie dolomitu głównego w wierceniach Wejherowo IG-1, Chojnice-3 i Dźwirzyno-1, *Oxyprion compressus* n. sp. — również w poziomie dolomitu głównego, lecz w wierceniu Wejherowo IG-1, zaś *Atraktoprion eudoxus* n. sp. — w poziomie wapienia cechsztyńskiego wiercenia Chojnice-3.

Nowopoznane aparaty porównano szczegółowo z innymi aparatami i skolekodontami kopalnymi oraz z formami współczesnymi. Pojedyncze szczęki (MI i MII) *Kielanoprion pomeranensis* n. sp. znane są z cyklotemu pierwszego cechsztynu Niemiec, a skolekodonty zbliżone do szczęk wszystkich trzech nowo opisanych aparatów — z piętra Wolfcampian permu Ameryki Północnej (Tasch & Stude, 1964, 1966). Możliwe, że aparaty szczękowe wieloszczetów, a nawet zespoły ich pojedynczych elementów mogą okazać się przydatne dla stratygrafii cechsztynu, lecz zarówno materiał opracowany przez autora, jak i dotychczasowe publikacje nie są wystarczające dla wyciągnięcia ostatecznych wniosków.

ГУБЕРТ ШАНЯВСКИ

О ТРЕХ НОВЫХ ЧЕЛЮСТНЫХ АППАРАТАХ МНОГОЩЕТИНКОВЫХ КОЛЬЧЕЦОВ

Резюме

В горизонтах карбонатных пород цехштейна, из скважин Вейгерово IG-1, Хойнице-3, Бялы Бур-1 и Дзвиржино-1 на Поморжу, найдена обильная фауна сколекодонтов, среди которой сохранились менее или более полные челюстные аппараты. Собранный материал разрешил установить три новых вида аппаратов. Установлено новое, монотипное семейство Kielanoprionidae, с одним представителем — *Kielanoprion pomeranensis* n. gen., n. sp. В пределах семейства Mochtyellidae Kielan-Jaworowska установлено новый род *Oxyprion* n. gen., с одним видом *Oxyprion compressus* n. sp. Третий вид причислен к роду *Atraktoprion* Kielan-Jaw. и дано ему название *Atraktoprion eudoxus* n. sp. Все три аппарата принадлежат к надсемейству Eunicea Grube. Не учитывая двух отдельных и плохо сохраненных находок из мезозоя, аппараты эти в геологическом отношении наиболее молодые из всех до сих пор известных в ископаемом состоянии.

Kielanoprion pomeranensis n. sp. найден в горизонте главного доломита, в скважинах Вейгерово IG-1, Хойнице-3 и Дзвиржино-1; *Oxyprion compressus* n. sp. происходит из этого самого горизонта, но из скважины Вейгерово IG-1, а *Atraktoprion eudoxus* n.sp. — из известняка цехштейна в скважине Хойнице-3.

Новоизученные аппараты сопоставлено детально с иными аппаратами и ископаемыми сколекодонтами, а также с современными формами. Отдельные челюсти (MI и MII) *Kielanoprion pomeranensis* n. sp. известны из первого циклотема цехштейна в Германии, а сколекодонты сходные с челюстными аппаратами всех трех новоописанных аппаратов — из пермской свиты Wolfcampian Северной Америки (Tasch & Stude, 1964, 1966). Возможно, что челюстные аппараты многощетинковых кольчецов, а даже комплексы их отдельных элементов могут оказаться полезными для стратиграфии цехштейна. Однако данные из изученного автором материала, а также из до сих пор известных публикации, еще недостаточны для окончательных выводов.

PLATES

Abbreviations used:

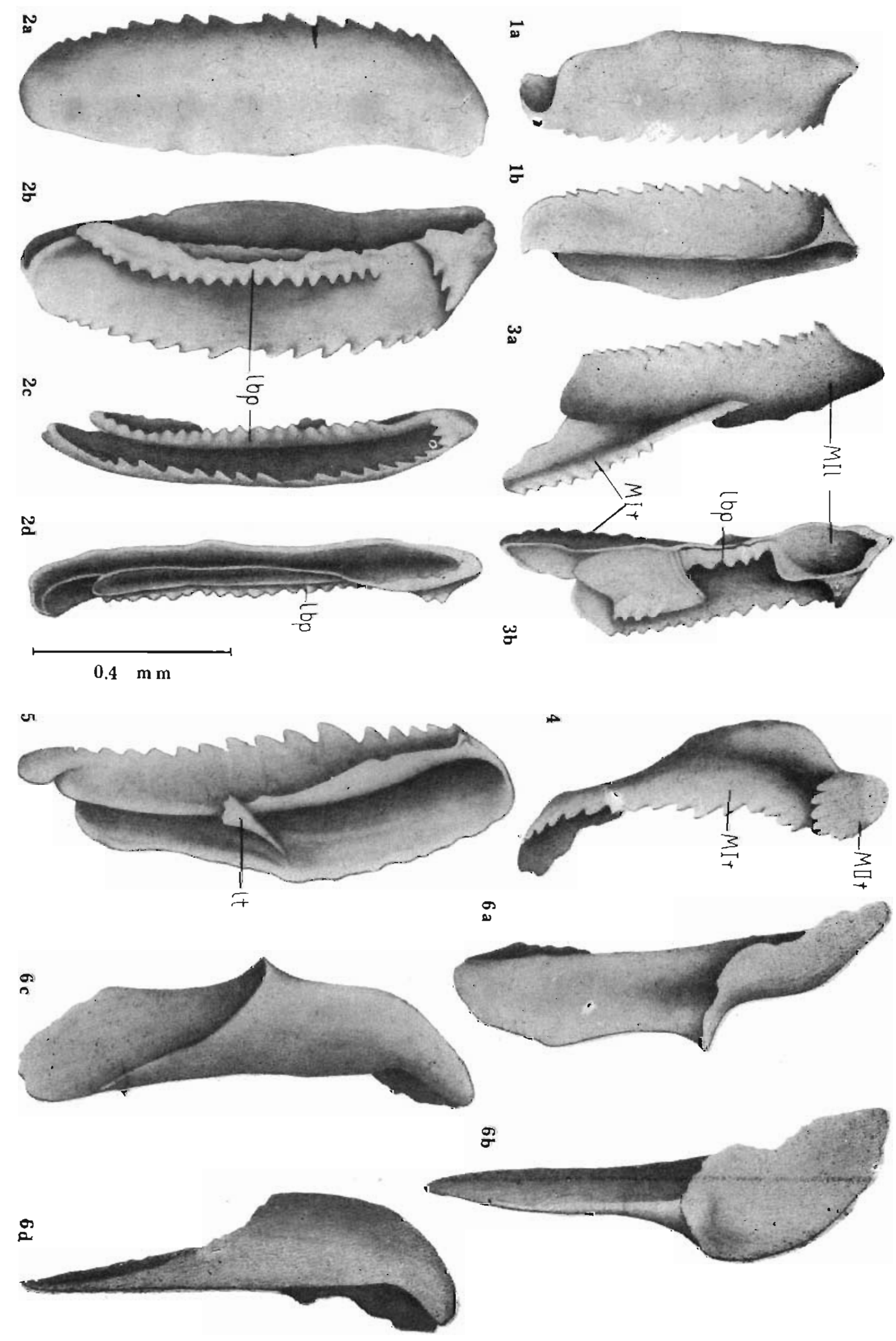
at — anterior tooth
bp — basal plate
br — basal ridge
cr — carriers
lbp — laeobasal plate
lt — lateral tooth
MIl-MVl — particular left jaws
MIr-MVr — particular right jaws

Plate I

Oxyprion compressus n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

Fig. 1. Right MI: *a* from left lateral side, *b* from right lateral side (Z.N.G. No. W. 126).
Fig. 2. Left MI with laeobasal plate: *a-d* from right lateral, left lateral, dorsal and ventral sides (Z.N.G. No. W. 125).
Fig. 3. Holotype, incomplete jaw apparatus, composed of a right and left MI, and laeobasal plate preserved in unnatural arrangement. Right MI and laeobasal plate, broken: *a* from right lateral side, *b* from left lateral side (Z.N.G. No. W. 121).
Fig. 4. Joined right MI and MII from left lateral side (Z.N.G. No. W. 122).
Fig. 5. Right MI from right lateral side, and lateral tooth attached to it in unnatural arrangement (Z.N.G.No.W. 123).
Fig. 6. Left mandible: *a-d* from dorsal, right lateral, ventral and left lateral sides (Z.N.G.No.W. 128).

(see also Plate II)


1a
1b
2a
2b
2c
2d
3a
3b
4
5
6a
6b
6c
6d
lbp
MII
MIr
MIIr
lt
0.4 mm

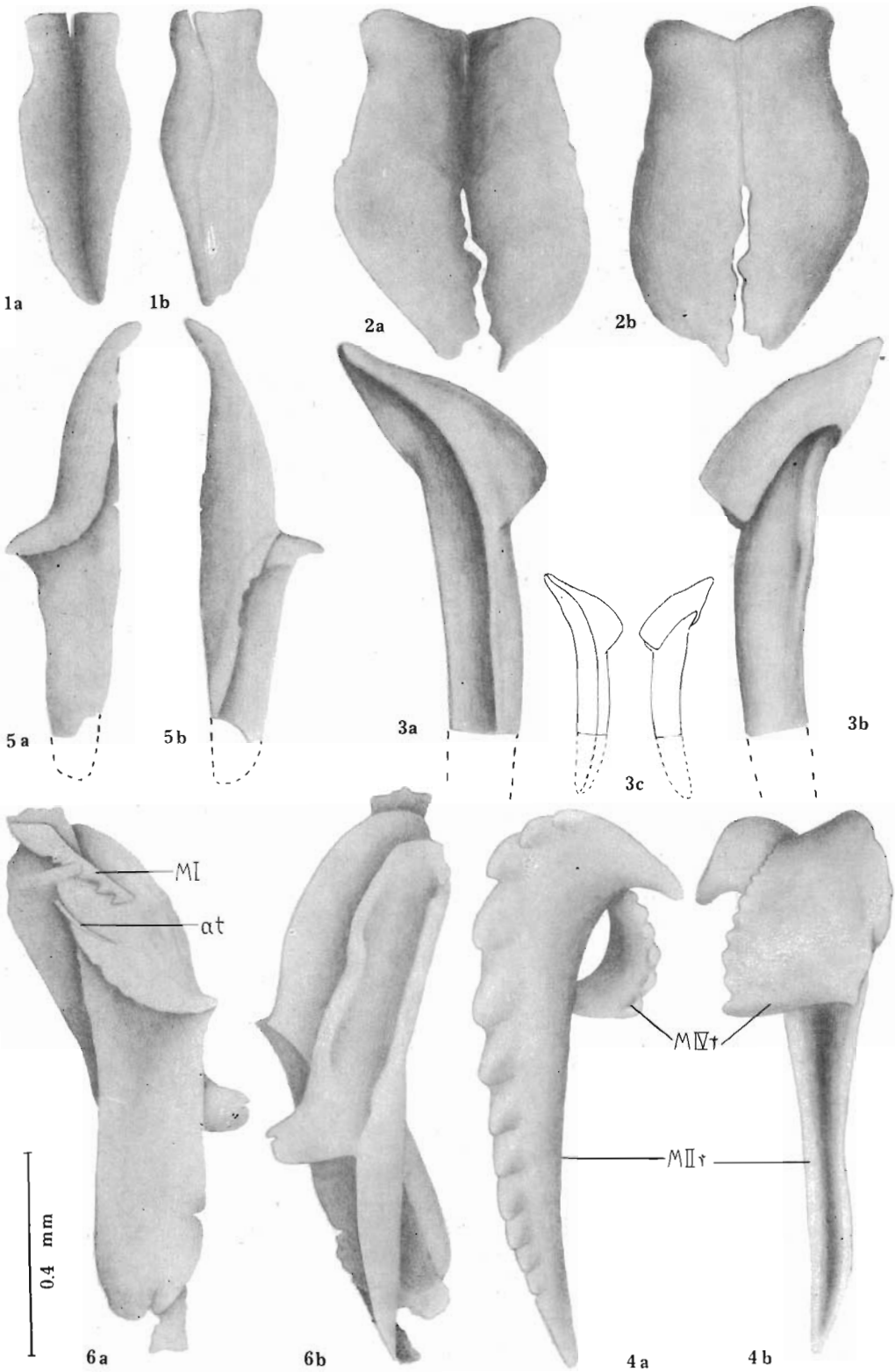

1a
1b
2a
2b
5a
5b
3a
3b
3c
MI
at
MIV†
MII†
0.4 mm
6a
6b
4a
4b

Plate II

Kielanoprion pomeranensis n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

Fig. 1. Joined carriers partly closed: *a* from dorsal side, *b* from ventral side (Z. N.G.No.W. 116).
Fig. 2. Joined carriers: *a* from dorsal side, *b* from ventral side (Z.N.G. No. W. 116).
Fig. 3. Right mandible with broken off posterior end: *a* from ventral side, *b* from dorsal side, *c* schematic drawing of the whole mandible from ventral and dorsal side (Z.N.G.No.W. 117).
Fig. 4. Joined right MII and MIV in unnatural arrangement, MIV turned back to front: *a* from dorsal side, *b* MII from ventral side, MIV from left lateral side (Z.N.G.No.W. 144).

(see also Plates III—VI)

Oxyprion compressus n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

Fig. 5. Right mandible: *a* from dorsal side, *b* from ventral side (Z.N.G. No.W. 128).
Fig. 6. Joined right and left mandible, fragment of MI and anterior (?) tooth, preserved in unnatural arrangement, anterior part of left mandible touches basal part of right mandible: *a* from dorsal side, *b* from ventral side (Z.N.G. No. W. 124).

(see also Plate I)

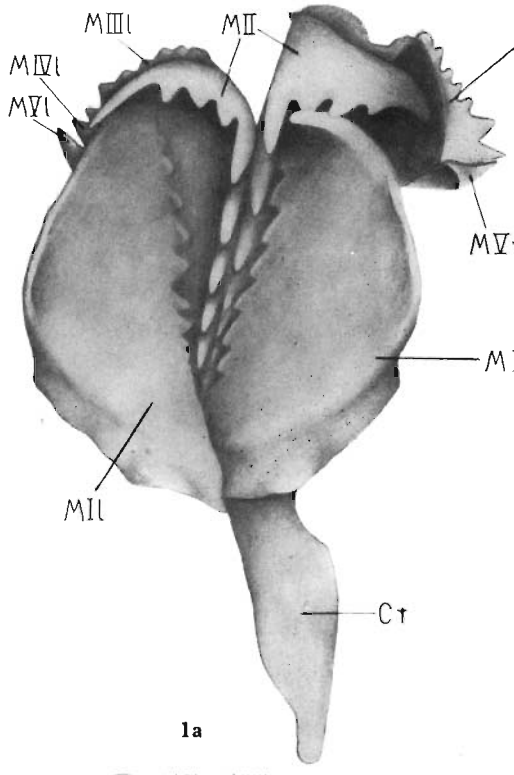
Plate III

Kielanoprion pomeranensis n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

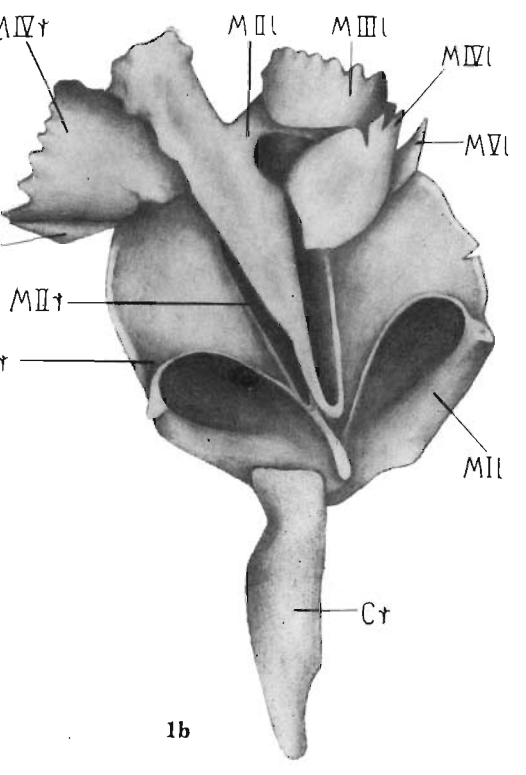
Fig. 1. Holotype, almost complete jaw apparatus without left carrier and fragment of left MIV in almost natural arrangement: *a* from dorsal side, *b* from ventral side (Z.N.G. No.W. 19).

Fig. 2. Complete jaw apparatus with partly deformed and broken anterior jaws, shifted posteriorly, and broken off posterior part of right carrier, right MV covered by MIV — not visible on drawing; *a* from dorsal side, *b* from ventral side (Z.N.G. No. W. 59).

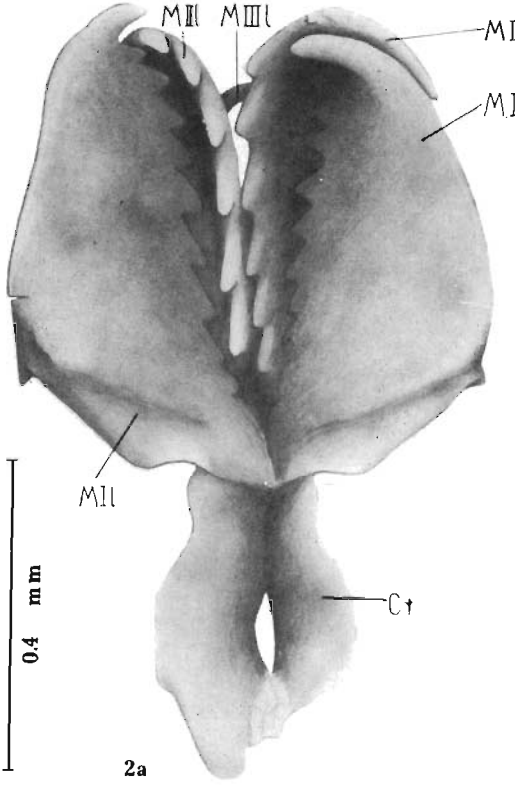
(see also Plates II, IV—VI)


MIII l
MII
MIV l
MV l
MIV r
MV r
MII r
MI r
MI l
C r

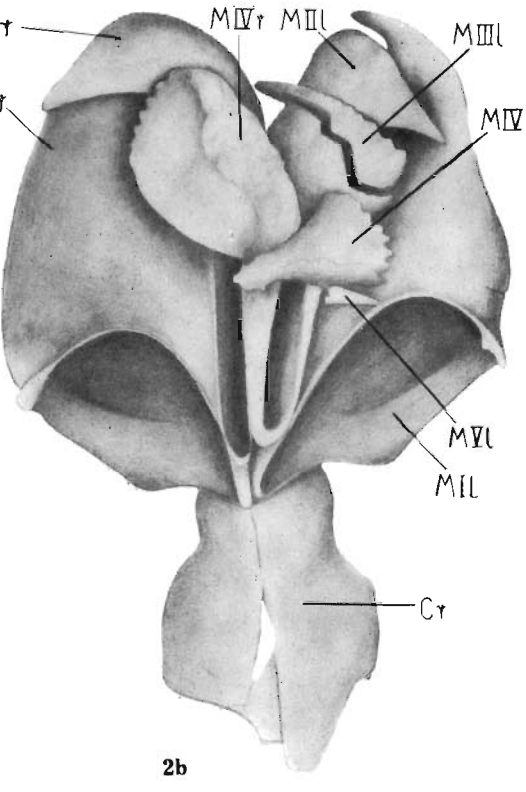
1a


MII l
MIII l
MIV l
MV l
MII r
MI l
C r

1b


MII
MIII l
MII r
MI r
MI l
C r
0.4 mm

2a


MIV r
MII l
MIII l
MIV l
MV l
MI l
C r

2b

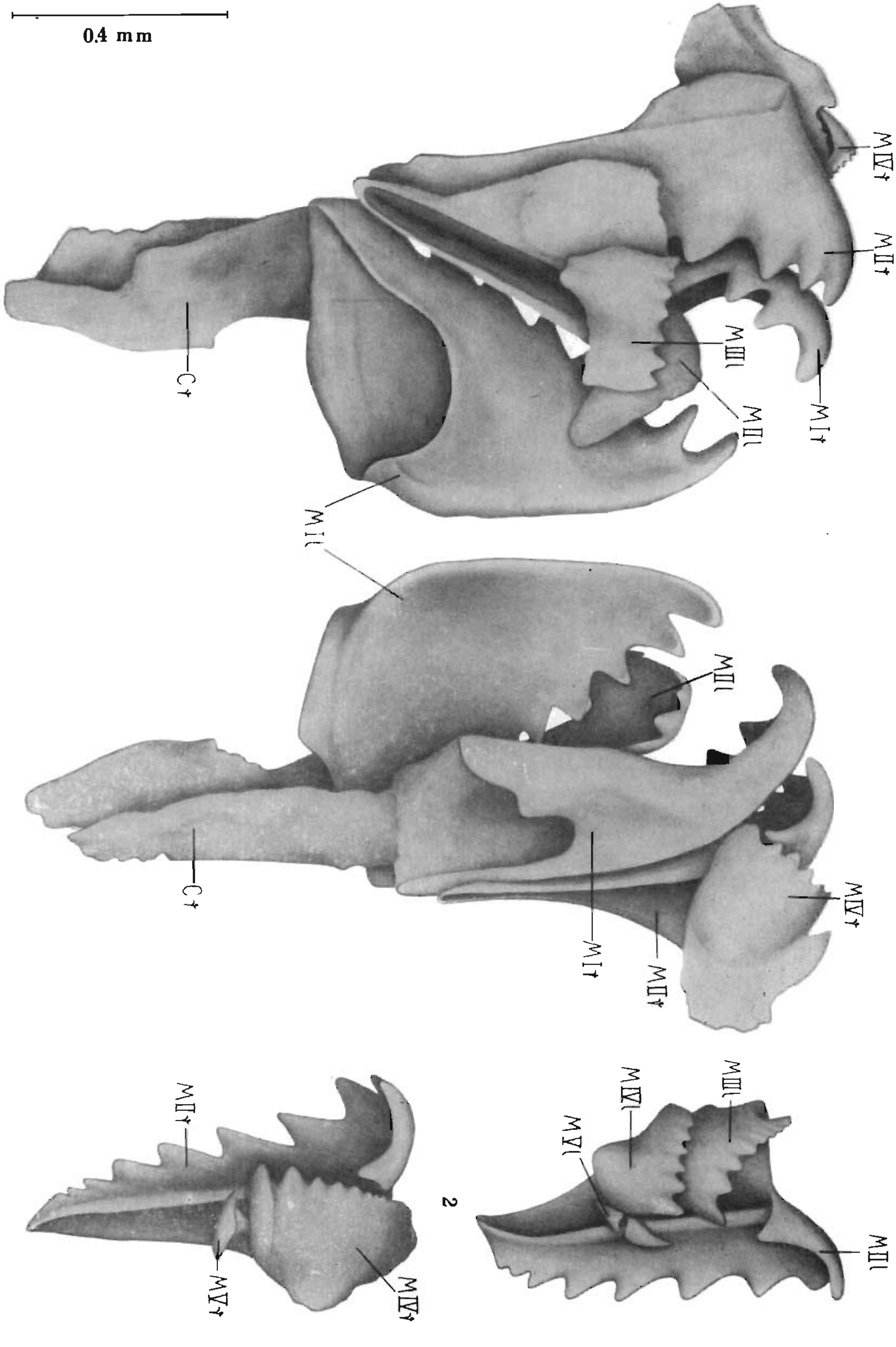

0.4 mm
1a
1b
2
3

Plate IV

Kielanoprion pomeranensis n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

Fig. 1. Jaw apparatus, with left MIV, MV and right MV missing, preserved in unnatural arrangement: *a* left MV of apparatus from dorsal side, *b* the same from ventral side (Z.N.G. No. W. 22).
Fig. 2. Joined left MII, MIII, MIV and MV; MV broken in the middle (Z.N.G. No. W. 115).
Fig. 3. Joined right MII, MIV and MV (Z.N.G. No. W. 114).

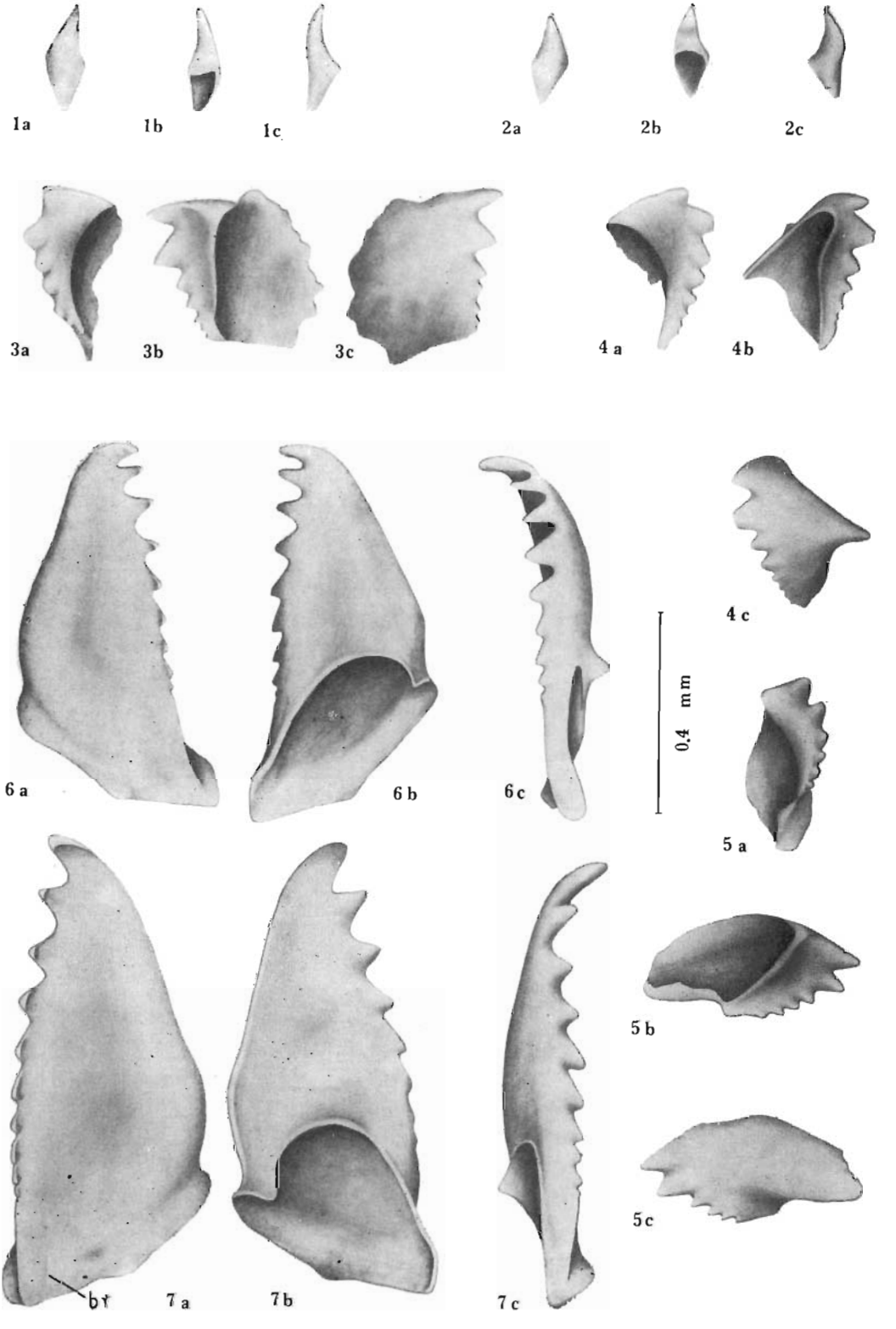
(see also Plates II, III, V, VI)

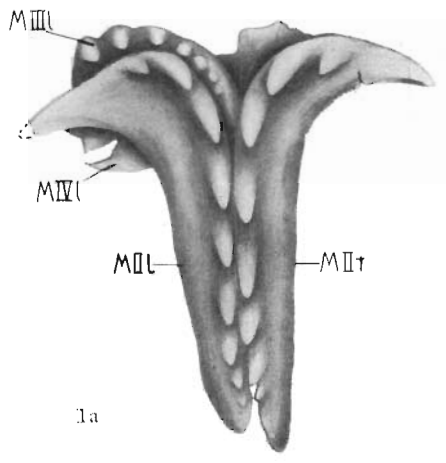
Plate V

Kielanoprion pomeranensis n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

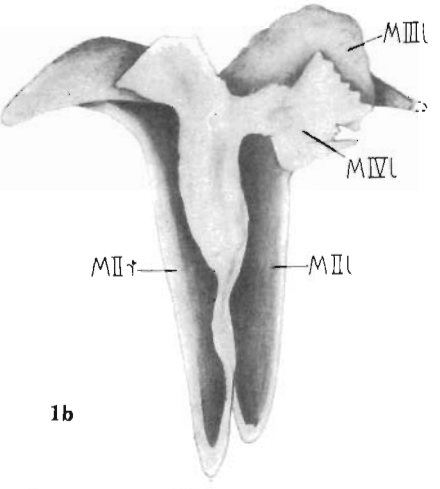
Fig. 1. Right MV: *a-c* from dorsal, ventral and right lateral sides (Z.N.G.No. W. 114).
Fig. 2. Left MV: *a-c* from dorsal, ventral and left lateral sides (Z.N.G. No. W. 115).
Fig. 3. Right MIV: *a-c* from dorsal, right lateral and left lateral sides (Z.N.G. No. W. 114).
Fig. 4. Left MIII: *a-c* from dorsal, left lateral and right lateral sides (Z.N.G. No. W. 113).
Fig. 5. Left MIV: *a-c* from dorsal, left lateral and right lateral sides (Z.N.G. No. W. 115).
Fig. 6. Left MI: *a-c* from dorsal, ventral and right lateral sides (Z.N.G. No. W. 101).
Fig. 7. Right MI: *a-c* from dorsal, ventral and left lateral sides (Z.N.G. No. W. 102).

(see also Plates II-IV, VI)

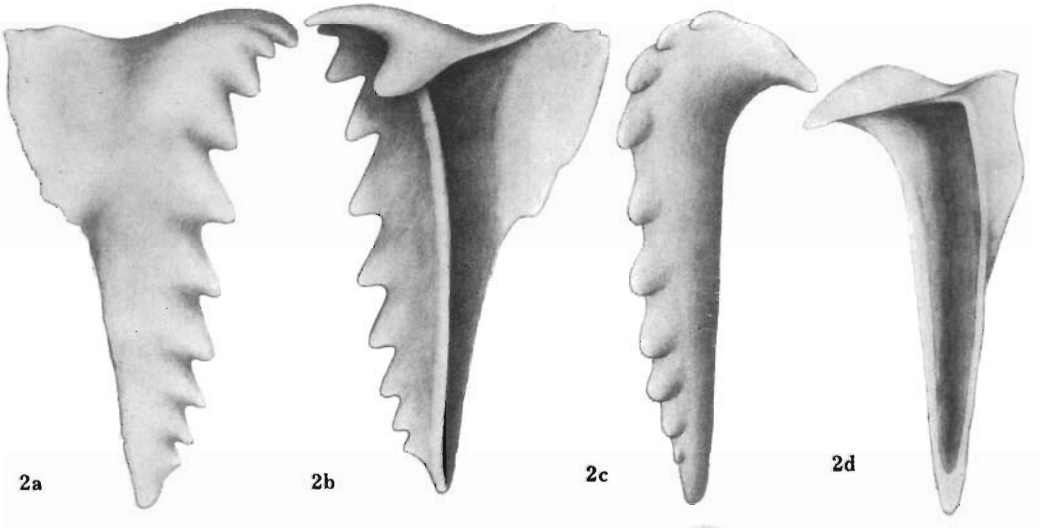

1a
1b
1c
2a
2b
2c
3a
3b
3c
4a
4b
4c
6a
6b
6c
0.4 mm
5a
5b
5c
br
7a
7b
7c



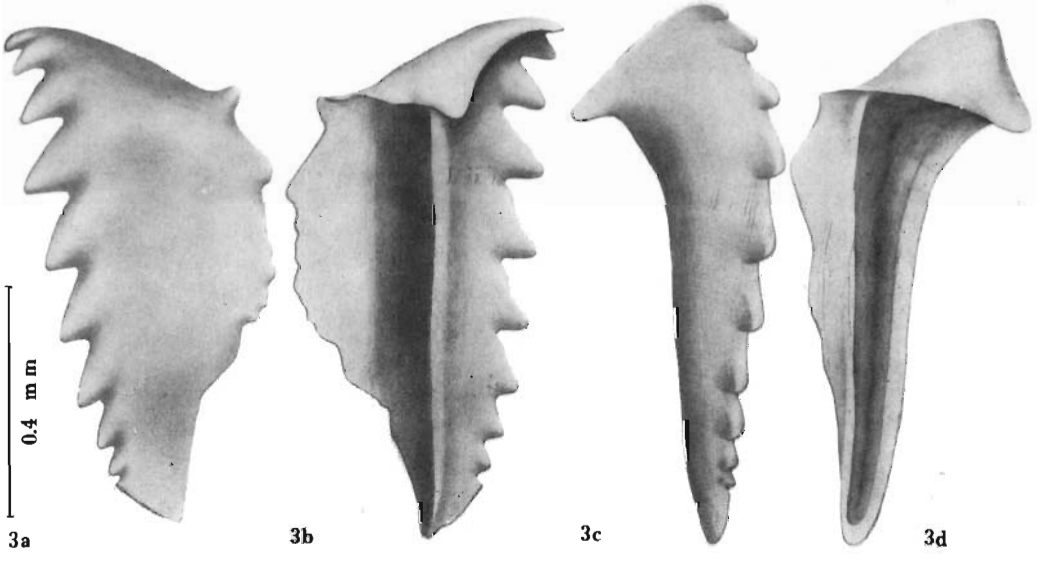
1a



1b



2a 2b 2c 2d



3a 3b 3c 3d

Plate VI

Kielanoprion pomeranensis n. sp.
(Wejherowo IG-1 bore hole in Pomerania, Zechstein, main dolomite horizon)

Fig. 1. Joined left MII, MIII, MIV and right MII, both MI detached for drawing, left MIV broken and shifted posteriorly: *a* from dorsal side, *b* from ventral side (Z.N.G. No. W. 35).

Fig. 2. Right MII: *a-d* from left lateral, right lateral, dorsal and ventral sides (Z.N.G. No. W. 103).

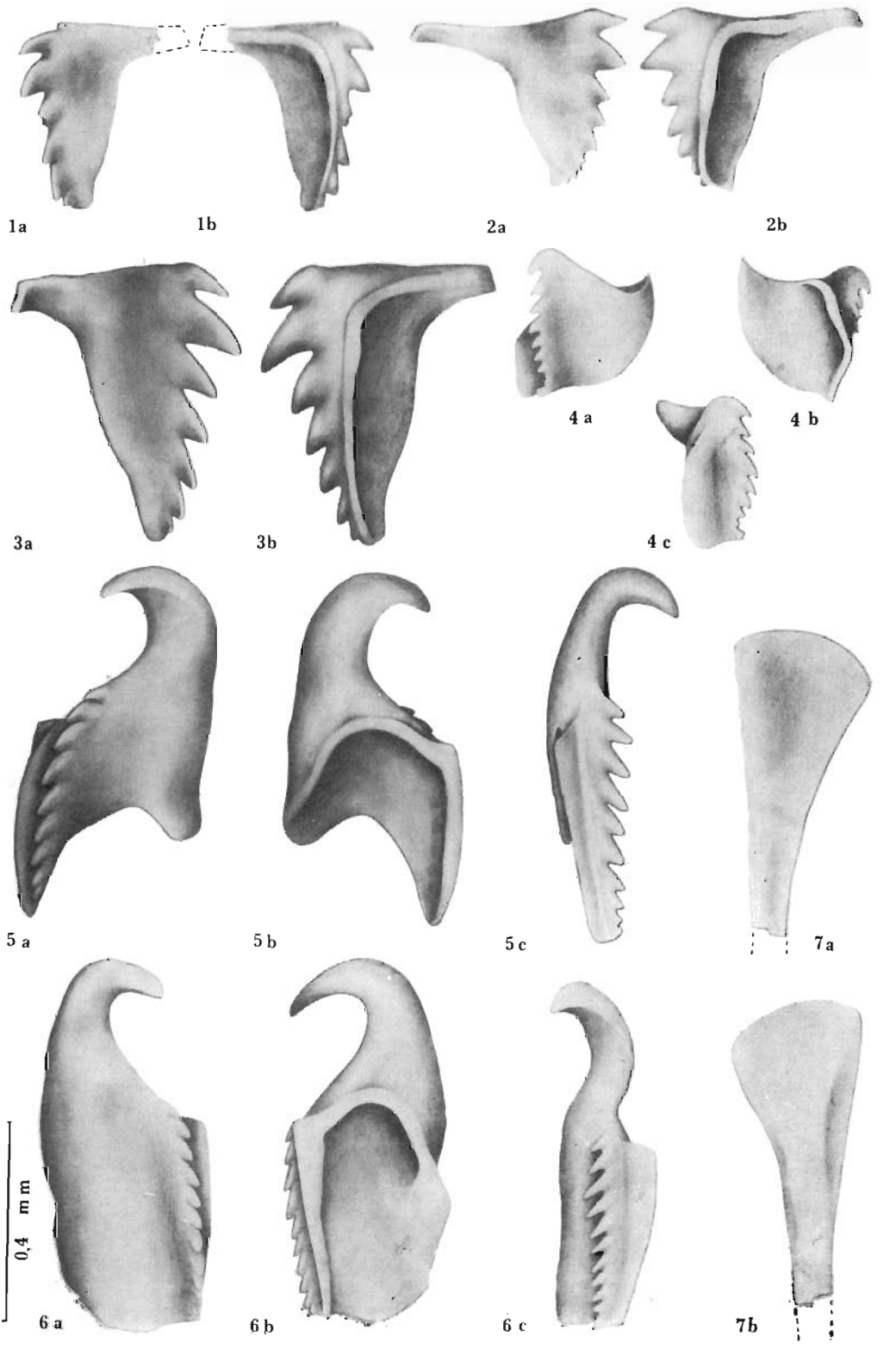
Fig. 3. Left MII: *a-d* from right lateral, left lateral, dorsal and ventral sides (Z.N.G. No. W. 104).

(see also Plates II—V)

Plate VII

Atraktoprion eudoxus n. sp.
(Chojnice-3 bore hole in Pomerania, Zechstein, the Zechstein limestone horizon)

Fig. 1. Right MII with broken off end of transverse branch and fragment of first and fourth denticle: *a* from dorsal side, *b* from ventral side (Z.N.G. No. Ch. 2).
Fig. 2. Left MIII: *a* from dorsal side, *b* from ventral side (Z.N.G. No. Ch. 2).
Fig. 3. Left MII: *a* from dorsal side, *b* from ventral side (Z.N.G. No. Ch. 2).
Fig. 4. Basal plate with broken off last denticle: *a-c* from dorsal, ventral and left lateral sides (Z.N.G. No. Ch. 2).
Fig. 5. Right MI: *a-c* from dorsal, ventral and left lateral sides (Z.N.G. No. Ch. 2).
Fig. 6. Left MI: *a-c* from dorsal, ventral and right lateral sides (Z.N.G. No. Ch. 2).
Fig. 7. Right carriers with broken off posterior part: *a* from dorsal side, *b* from ventral side (Z.N.G. No. Ch. 2).


1a
1b
2a
2b
3a
3b
4 a
4 b
4 c
5 a
5 b
5 c
7a
0,4 mm
6 a
6 b
6 c
7b