

KRZYSZTOF BIRKENMAJER & JERZY TRAMMER

Lower Triassic conodonts from Hornsund, South Spitsbergen

ABSTRACT: Lower Triassic (Dienerian) conodont fauna determined from the *Myalina* marker horizon of the Vardebukta Formation at Hornsund, Spitsbergen, includes: *Ellisonia triassica* Müller, *Neospathodus dieneri* Sweet, *N. peculiaris* Sweet and *N. svalbardensis* Trammer, sp. n. This is the first record of the Triassic conodonts from Svalbard. The age of the Vardebukta Formation at Hornsund is determined as the Griesbachian and Dienerian.

INTRODUCTION

During the Polish 1960 Spitsbergen Expedition (leader Prof. S. Siedlecki) K. Birkenmajer collected on the southern slope of Hyrnefjellet, inner Hornsund, numerous fish remains (Birkenmajer 1964a, p. 14) in a thin intercalation of fine-grained conglomerate of Lower Triassic age. The samples were sent to Docent A. Jerzmańska (Wrocław University) for reexamination of the fish fauna known already to Stensiö (1918). While separating fish scales and teeth from the rock, she has also found some conodonts. These were handed over to J. Trammer who is responsible for their palaeontological determination. Both authors share the responsibility for stratigraphical conclusions, while the geological description of the faunal locality was made by the senior author. As far as we know, the conodont fauna here described is the first record of occurrence of the Triassic conodonts in Svalbard.

OUTLINE OF GEOLOGY

The Triassic section between Hyrnefjellet and Treskelodden, inner Hornsund (Figs 1, 2), was investigated by Birkenmajer (1959) and Buchan & al. (1965, Figs 20–21), and reexamined in 1974 by Birkenmajer. Its lowest lithostratigraphic unit is the Vardebukta Formation (Table 1).

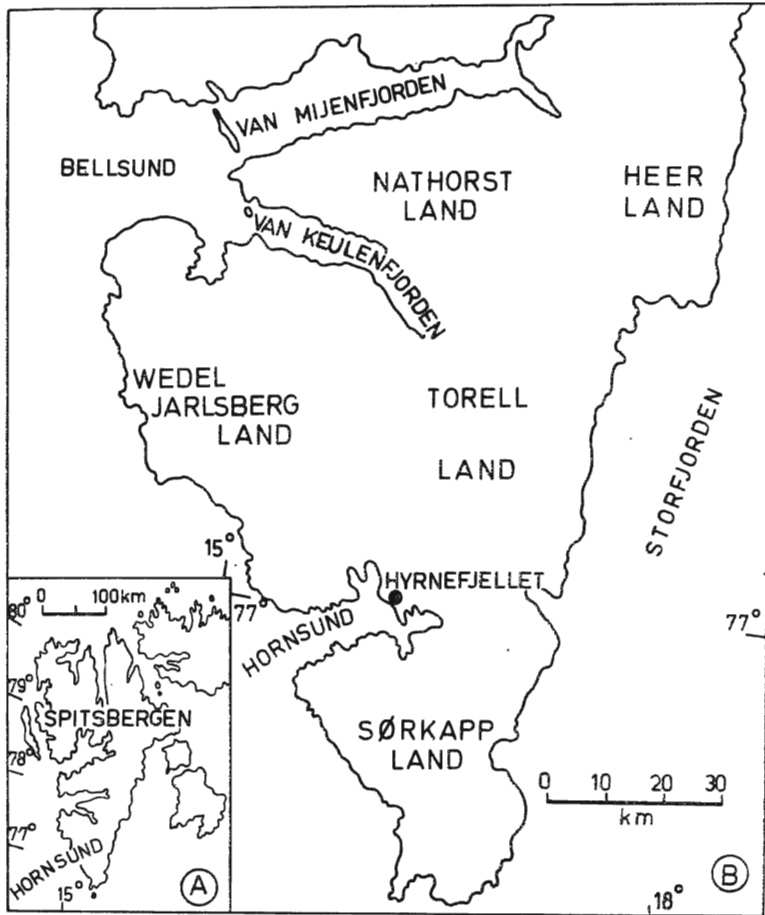


Fig. 1. Location of the conodont fauna (thick dot) at Hyrnefjellet, Hornsund, in the maps of Svalbard (A) and Spitsbergen (B)

resting paraconformably (hiatus) upon the Upper Permian brachiopod cherty limestone (Kapp Starostin Formation) of the Kungurian to Kazanian age (Birkenmajer & Czarniecki 1960; Birkenmajer 1964b — cf. Fig. 3).

The Vardebukta Formation, 120–130 m thick, may be subdivided at Hornsund into the lower and upper members (Fig. 3), about 30 and 90–100 m thick respectively. The lower member begins with grey to greenish shale, 24–26 m thick, with thin intercalations of similarly coloured siltstone to fine-grained sandstone, sometimes also with clay-ironstone nodules. There follows the *Myalina* marker horizon, 5–6 m thick, which consists of grey pyritic-sideritic limestone and fine-grained sandstone layers in the lower part, passing upward into grey sideritic or marly shale, and finally into whitish sandstone and quartzite with sub-

Table 1

Subdivision of the Triassic succession in Svalbard

SPITSBERGEN: ISFJORDEN & BELLSUND (Buchan & al.,1965)				BARENTSØYA & EDGEØYA (Flood & al.,1971)			
Kapp Toscana Fm		De Geerdalen Mb. Tschermakfjellet Mb.		Kapp Toscana Group		De Geerdalen Fm. Tschermakfjellet Mb.	
Sassendalen Group	Kongressfjellet Subgp.	Botneheia Fm		Sassendalen Group	Kongressfjellet Fm.	Botneheia Mb.	
		Sticky Keep Fm.	Kaosfjellet Mb.			Sticky Keep Mb.	
	Iskletten Mb.						
	Vardebukta Fm.	Siksaken Mb.			Vardebukta Fm.		
Selmaneset Mb.							

ordinate grey sideritic-pyritic limestone. If weathered, the rocks of the *Myalina* marker horizon become distinctly brown-red. Numerous burrows occur in the horizon, especially within the sandstone bands. Pelecypod moulds occur abundantly, especially in the bottom and top parts of the horizon, with *Myalina degeeri* Lundgren and *Anodontophora* sp. determined from the bottom part of the horizon. An intercalation of fine-grained quartz conglomerate or coarse-grained sandstone, dark-grey if fresh and brownish if weathered, 5–10 cm thick, appears in the upper part of the *Myalina* marker horizon on the southern slope of Hyrnefjellet. From this conglomerate came fish teeth and scales collected by Hoel and Røvig's Spitsbergen Expedition in 1917, determined by Stensiö (1918) as: *Hybodus* sp., *Acrodus spitzbergensis?* Hulke, *Acrolepis arctica?* A. S. Woodward and *Gyrolepis?* sp. The conodonts from the same horizon include: *Ellisonia triassica* Müller, *Neospathodus dieneri* Sweet, *N. peculiaris* Sweet and *N. svalbardensis* Trammer, sp. n.

The upper member of the Vardebukta Formation consists of light-grey to black shale, marly shale and arenaceous marl, alternating with thin siltstone often showing small-scale current lamination and ripples. The siltstones are most frequent in the lower part of this member.

There is a transition from the Vardebukta Formation to the overlying Sticky Keep Formation, the latter characterized by alternating bands of hard calcareous siltstone to silty limestone and softer black to green arenaceous or argillaceous shale.

CONODONT FAUNA AND ITS AGE

The following conodonts have been determined from the fish-bearing conglomerate of the *Myalina* marker horizon (lower member of the Vardebukta Formation):

Ellisonia triassica Müller, 1956, *sensu* Sweet, 1970 (LB elements); 7 specimens — Pl. 1, Figs 1-3;

Neospathodus dieneri Sweet, 1970; 5 specimens — Pl. 1, Fig. 4;

Neospathodus peculiaris Sweet, 1970; 1 specimen — Pl. 1, Fig. 8;

Neospathodus svalbardensis Trammer, sp. n.; 12 specimens — Pl. 1, Figs 5-7; Pl. 2, Figs 1-7.

The species *Neospathodus dieneri* is an index form for the Dienerian stage and lower part of the Smithian stage of the Lower Triassic¹ (Sweet & al. 1971; Kozur & Mostler 1972; McTavish 1973; Sweet 1973). *Neospathodus peculiaris* is known from the Griesbachian of British Columbia (Mosher 1973) and from the Upper Dienerian of West Pakistan (Sweet 1970). The common occurrence of these two forms determines the age of the fish-bearing conglomerate of the *Myalina* marker horizon as Dienerian. It has not been possible to decide whether we deal here with the Lower (Candidus Zone) or the Upper Dienerian (Sverdrupi Zone), as zonal indices were missing, but a Lower Dienerian age of the conodont assemblage seems most probable (see below).

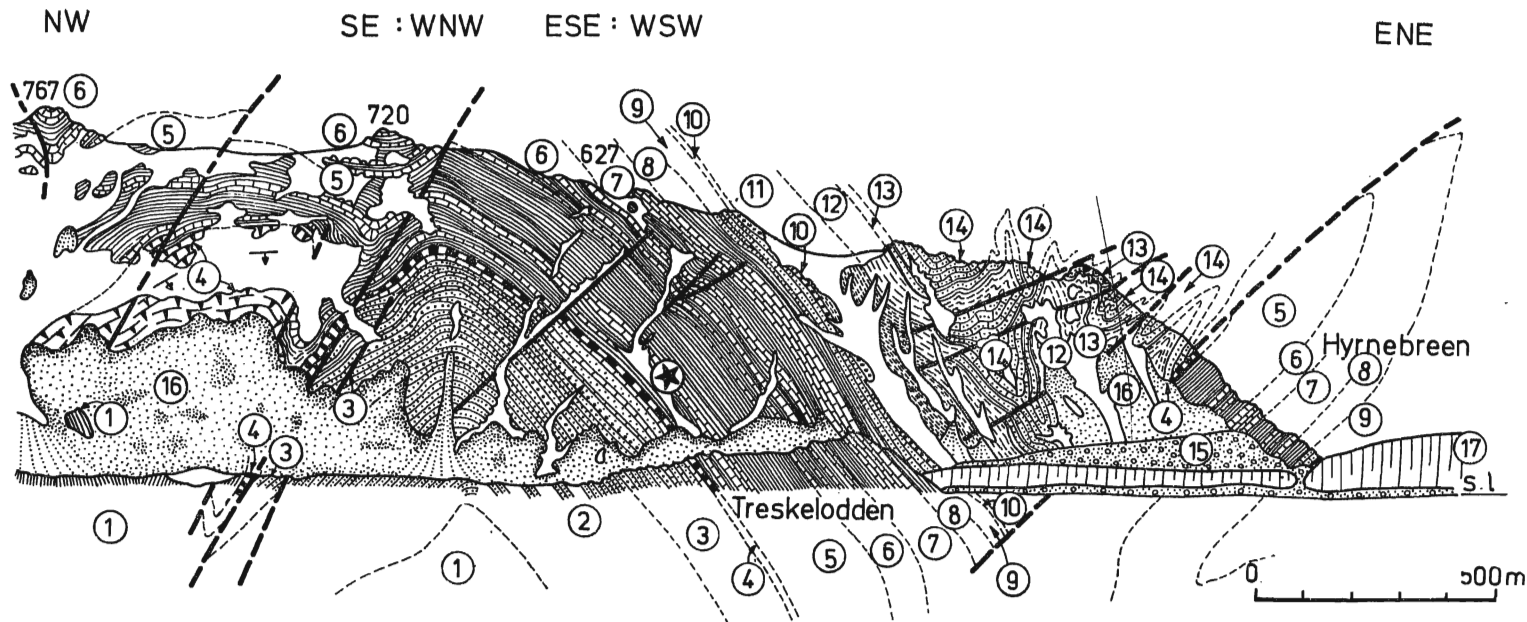
AGE OF THE VARDEBUKTA FORMATION AT HORNSUND

Buchan & al. (1965) determined the age of the Vardebukta Formation in Spitsbergen as Lower Scythian, and the Sticky Keep Formation as Upper Scythian. The formation was subdivided between Isfjorden and Bellsund into the lower Selmaneset Member and the upper Siksaken Member (Table 1), but no subdivision of the formation has so far been proposed for the Hornsund area.

Poorly fossiliferous shales of the lower part of the Selmaneset Member yielded *Claraia* cf. *stachei* Bittner, ?*Ophiceras* sp. and *Proptychites* cf. *rosenkrantzi* Spath (Frebold, in Hoel & Orvin 1937; Frebold 1929; Buchan & al. 1965). The sandstones and shaly limestones of the upper part of the Selmaneset Member and the Siksaken Member contained a better preserved bivalve fauna with *Myalina degeeri* Lundgren and *Anodontophora breviformis* Spath (Frebold 1939; Buchan & al. 1965).

¹ Subdivision of the Lower Triassic (Scythian) after Tozer (1967).

HYRNEFJELLET



LOWER TRIASSIC CONODONTS FROM HORNSUND

Fig. 2. Position of the conodont fauna (asterisk) in the geological section of Hyrnefjellet, Hornsund (after Birkenmajer, 1975)

1 Lower Carboniferous; 2 Middle Carboniferous; 3 Upper Carboniferous and Lower Permian (Treskelodden Formation); 4 Upper Permian (Kapp Starostin Formation); 5 Vardebukta Formation (Griesbachian — Dienerian); 6 Sticky Keep Formation (Smithian — Spathian); 7 Botneheia Formation (Anisian — Lower Ladinian); 8 Kapp Toscana Formation, Tschermakfjellet Member (Upper Ladinian — Karnian); 9 Kapp Toscana Formation, De Geerdalen Member (Norian — Rhaetian — Hettangian); 10—13 Jamusfjellet Formation: 11 — Ingebrigtsenbukta Member (Callovian — Kimmeridgian) with Brentskardhaugen Bed (10) at the base; 12 Tirolarpasset Member (Volgian — Valanginian); 13 Ullaberget Member (Valanginian — Hauterivian); 14 Helvetiafjellet Formation, Festningen Sandstone Member (Barremian).

Quaternary: 15 moraine, 16 talus, 17 glacier. Thick lines denote faults and overthrusts

This fauna occurs especially in the *Myalina* shale of Lundgren (1887) which corresponds to our *Myalina* marker horizon at Hornsund, and was regarded as being of Lower Scythian age (Frebold 1935, 1939, 1951).

Tozer & Parker (1968) determined the age of the Vardebukta Formation in Spitsbergen as Griesbachian and Dienerian (Table 2). Finds of ammonoids of the genus *Otoceras* (cf. Petrenko 1963 — *vide* Tozer & Parker 1968; Pchelina 1965), and especially of *Otoceras boreale* Spath (Tozer & Parker 1968) at the base of the Vardebukta Formation in central Spitsbergen are indicative of Lower Griesbachian age (Borealis Zone). The species *Claraia stachei* Bittner is indicative of the Griesbachian, probably Upper Griesbachian, while *Proptychites* cf. *rosenkrantzi* Spath determined by Buchan & al. (1965), according to Tozer & Parker (1968),

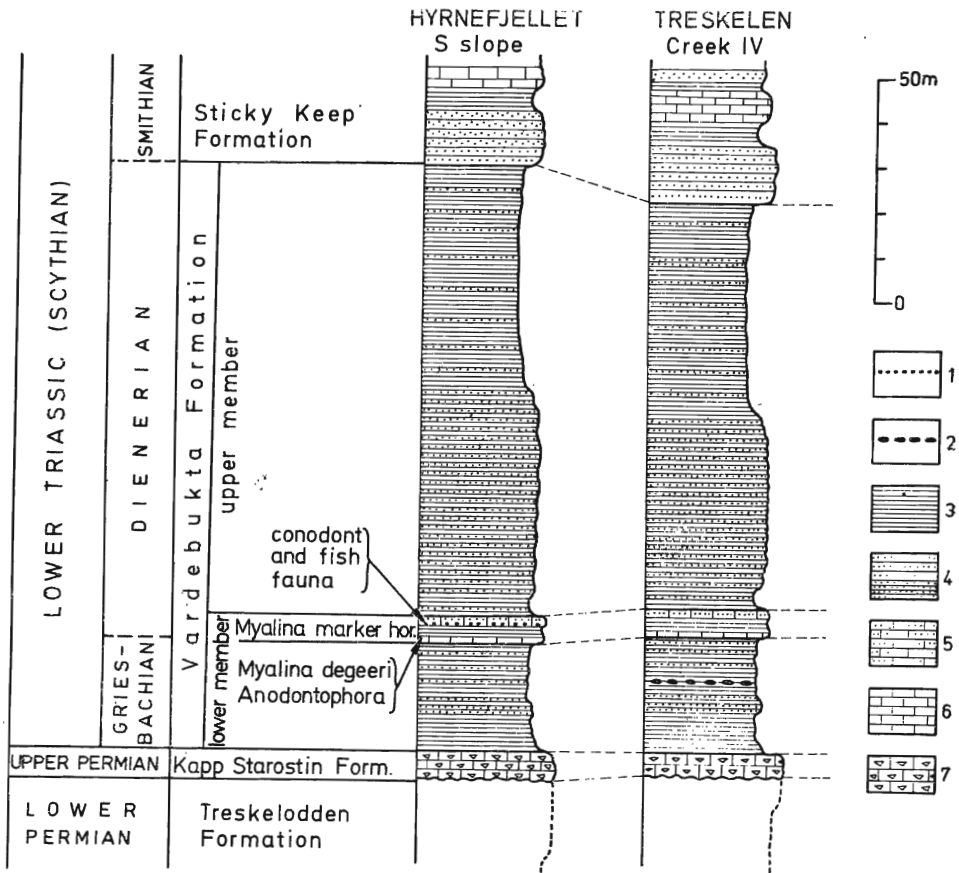


Fig. 3. Lithological columns of the Vardebukta Formation in inner Hornsund, and the position of the conodont fauna

1 conglomerate; 2 clay ironstone; 3 shale, silty shale, marl; 4 siltstone; 5 sandstone, quartzite; 6 sideritic or silty limestone; 7 cherty limestone

is either a *Proptychites* or *Paranorites*, probably of Upper Griesbachian or Dienerian age. The Dienerian age of a higher part of the Vardebukta Formation was suggested by these authors on the occurrence of "*Pseudomonotis* cf. *multiformis* Bittner 2" (Frebold 1939). The *Myalinenniveau*

Table 2
Stratigraphic position of the Vardebukta Formation

Series	Stage	Sub-stage	Zone	SPITSBERGEN		BARENTSØYA & EDGEØYA (Flood & al., 1971)	
				BELLSUND & ISFJORDEN (Tozer & Parker, 1968)	HORNSUND (this paper)		
LOWER TRIASSIC	SPATHIAN		Subrobustus	Sticky Keep Formation	Sticky Keep Formation	Sticky Keep Member	
			Pilaticus				
	SMITHIAN		Tardus				
			Romunderi				
	DIENERIAN		Sverdrupi	Vardebukta Formation	Vardebukta Formation		
			Candidus				
	GRIESBACHIAN	UPPER	Strigatus				
			Commune				
		LOWER	Boreale				
			Concavum				
							Kongressfjellet Frm. ↑

of Frebold was placed by them in the Griesbachian or the Dienerian, above the Griesbachian *Claraia* bed.

Flood & al. (1971) restricted the age of the Vardebukta Formation in Barentsøya and Edgeøya to the Griesbachian, as, in Barentsøya, *Claraia stachei* Bittner occurred in the uppermost part of the formation, together with *Ophiceras*(?) sp.

The conodont fauna determined from the *Myalina* marker horizon at Hornsund indicates the age of its upper part as the Dienerian. The Griesbachian age is thus suggested for the lowermost part of the Vardebukta Formation at Hornsund, represented by unfossiliferous shale with siltstone intercalations, underlying the *Myalina* marker horizon. The upper member of the Vardebukta Formation at Hornsund, above this horizon, would naturally fall into a higher part of the Dienerian, as there is faunal evidence for the Smithian and Spathian ages of the Sticky Keep Formation elsewhere in Spitsbergen (cf. Tozer & Parker 1968).

SYSTEMATIC DESCRIPTION

Genus *NEOSPATODUS* Mosher, 1968
Neospathodus svalbardensis Trammer, sp. n.
 (Pl. 1, Figs 5–7; Pl. 2, Figs 1–7)

Holotype: The specimen presented in Pl. 2, Figs 1a, b.

Type horizon: Vardebukta Formation, Lower Triassic (Dienerian).

Type locality: Hyrnefjellet, S slope, Hornsund, Spitsbergen (Svalbard archipelago).

Derivation of the name: *svalbardensis* — after Svalbard, the Norwegian name of the Spitsbergen islands.

Diagnosis. — Species of the genus *Neospathodus* with high even crest, without posterior process. Main tooth thickest of all teeth, vertical or slightly oblique. The remaining teeth equal in size, only 2–3 anterior teeth distinctly smaller.

Material. — 12 specimens.

Description. — Large, thick form with a prominent lateral rib and straight basal margin. Basal cavity medium sized, rectangular, with rounded angles, or drop-like; 7–12 teeth fused, only their apices are free. Height of teeth similar, only 2–3 anterior teeth distinctly smaller than the others. Teeth usually vertical, but sometimes those close to the main tooth are slightly tilted posteriorly. Teeth roundish or slightly laterally flattened in cross-section. Main tooth vertical or slightly oblique, usually distinctly thicker than the other teeth.

Remarks. — The species described differs from *Neospathodus pakistanensis* Sweet, 1970, and from *N. novaehollandiae* McTavish, 1973, in the lack of posterior process, the mode of teeth development and the proportions between them. The species *N. conservativus* (Müller, 1956) is devoid of straight basal margin.

Occurrence. — The species is known from the type locality only.

Polish Academy of Sciences
 Institute of Geology
 Senacka 3, 31-002 Cracow, Poland
 (K. Birkenmajer)

Institute of Geology
 of the Warsaw University
 Al. Żwirki i Wigury 93, 02-089 Warsaw, Poland
 (J. Trammer)

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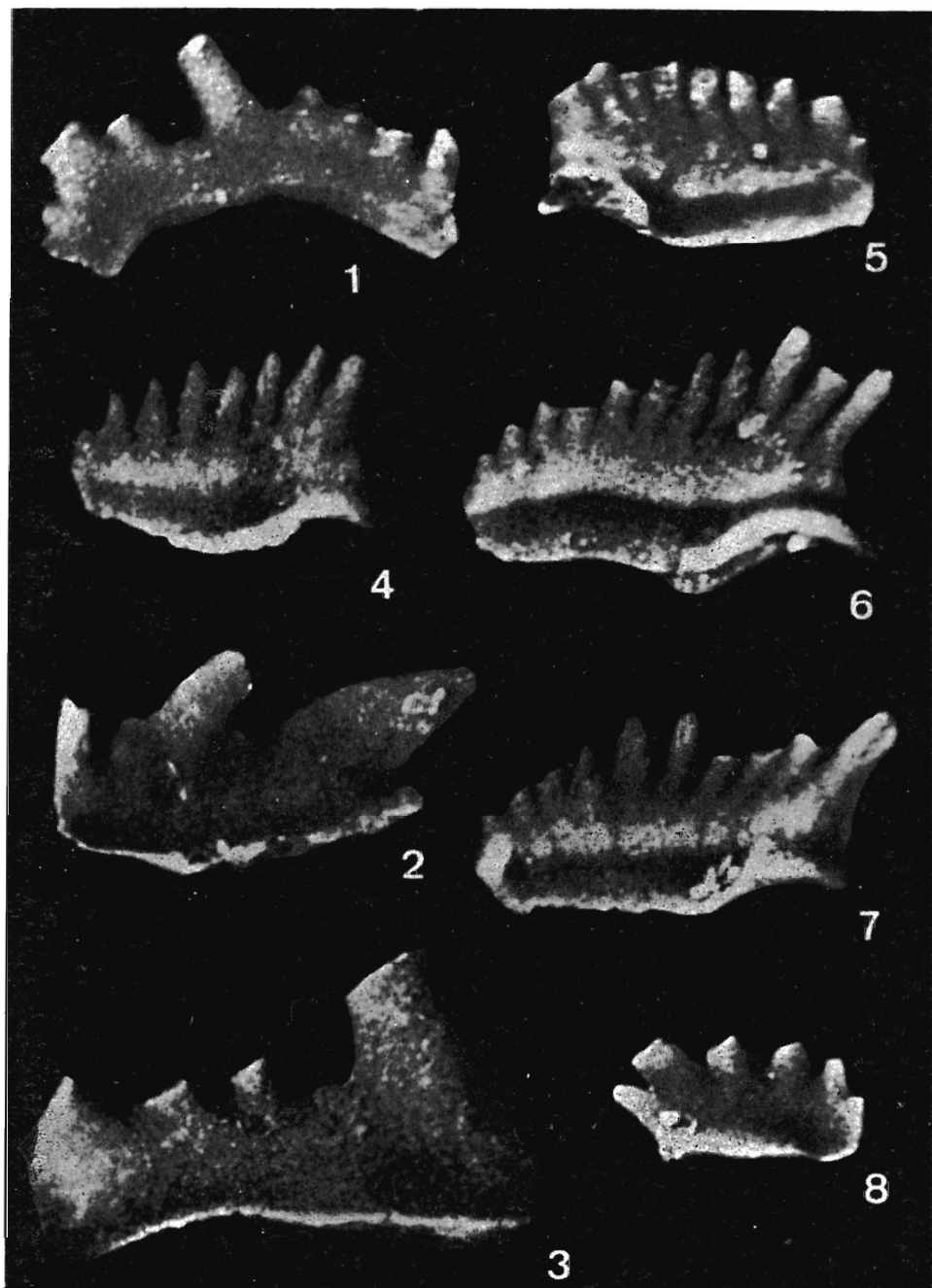
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K. BIRKENMAJER i J. TRAMMER

DOLNOTRIASOWE KONODONTY Z FIORDU HORNSUND NA SPITSBERGENIE

(Streszczenie)

W drobnoziarnistym zlepieńcu poziomym z *Myalina* dolnotriasowej formacji z Vardebukta we fiordzie Hornsund (południowy Spitsbergen), stwierdzono występowanie następujących konodontów: *Ellisonia triassica* Müller, *Neospathodus dieneri* Sweet, *N. peculiaris* Sweet oraz nowej formy oznaczonej jako *Neospathodus svalbardensis* Trammer, sp. n. Jest to pierwsze stwierdzenie występowania konodontów w triasowych utworach archipelagu Svalbard. W pracy rozważono także pozycję stratygraficzną formacji z Vardebukta we fiordzie Hornsund i przeprowadzono dyskusję wieku tej formacji, który określono na Griesbachian i Dienerian, z tym że poziom z *Myalina* zawierający konodonty określono jako dolny Dienerian. W części systematycznej opisano nowy gatunek konodonta, *Neospathodus svalbardensis* Trammer, sp. n.



Lower Triassic (Dienerian) conodonts from the Vardebukta Formation at Hornøund, Spitsbergen

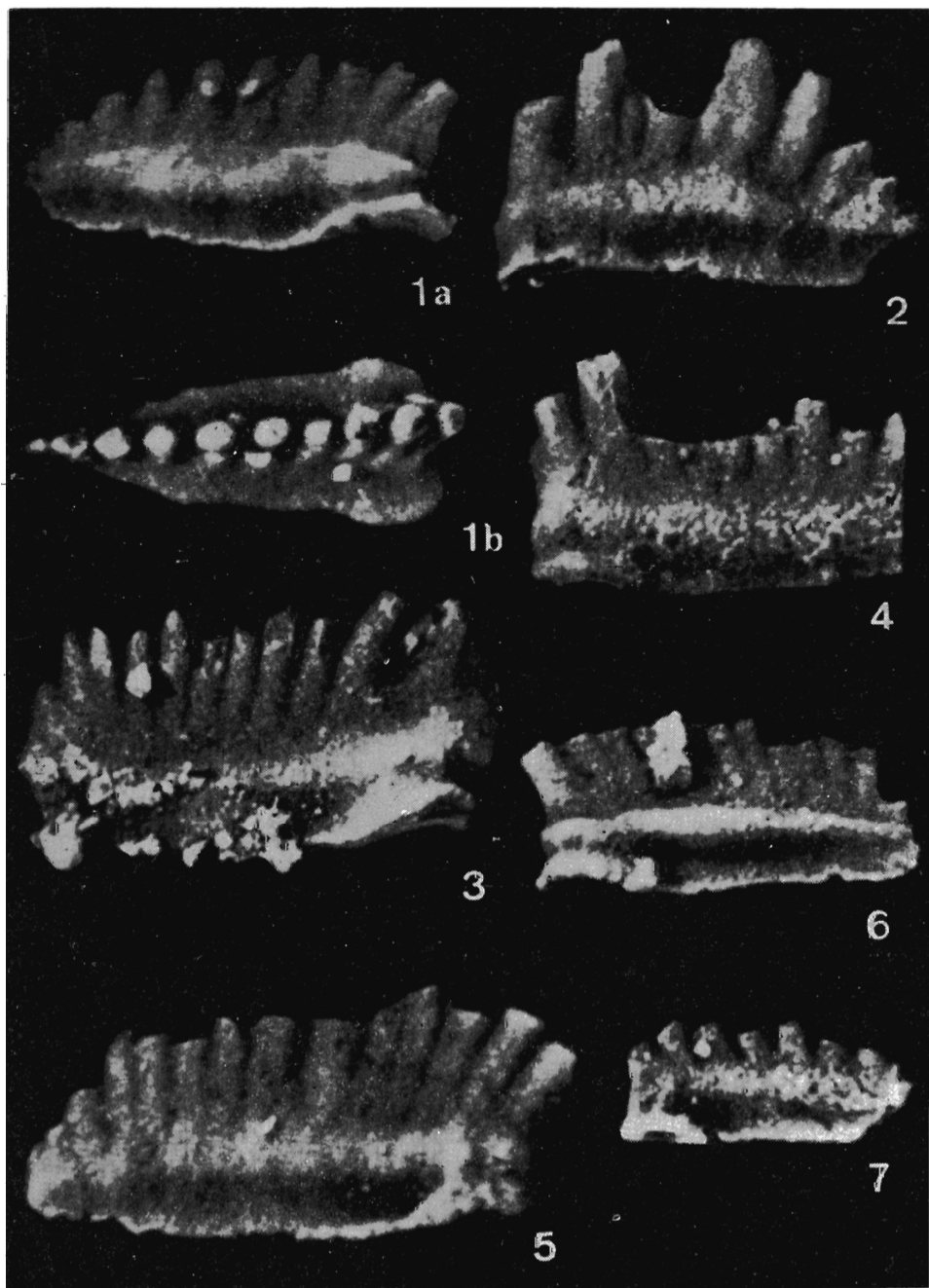
1, 2, 3 — *Ellisonia triassica* Müller, 1956, *sensu* Sweet, 1970 (LB elements)

4 — *Neospathodus dieneri* Sweet, 1970

5, 6, 7 — *Neospathodus svalbardensis* Trammer, *sp. n.*

8 — *Neospathodus peculiaris* Sweet, 1970

All photos $\times 100$; taken by L. Łuszczewska, M. Sc.



Lower Triassic (Dienerian) conodonts from the Vardebukta Formation at Hornsund, Spitsbergen

1-7 — *Neospathodus svalbardensis* Trammer, sp. n.; 1a, b — presents the holotype (1a side view, 1b top view)

All photos $\times 100$; taken by L. Łuszczewska, M. Sc.