

BUI DUC THANG

## LOWER TRIASSIC CONODONTS FROM NORTH VIETNAM

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The paper concerns an assemblage of conodonts from the upper part of the Suoi Bang Formation (Olenekian), North Vietnam. 37 taxa, including 6 new ones: *Neospathodus gondolellaeformis*, *N. regularis*, *Ozakordina gigantea*, *Pachycladina multispinosa*, *Neohidneodella vietnamica*, *Hindeodella langsonensis*, have been described dating this part of the formation at the Smithian. The assemblage lacks the genus *Gondolella*.

Key words: Conodonts, Lower Triassic, stratigraphy, North Vietnam.

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## INTRODUCTION

This paper is the first report on Triassic conodonts from Vietnam. The conodonts were found in a section exposed near the railway station Bac Thuy (fig. 1) in the province of Lang Son in the northeastern part of Vietnam. The rocks exposed there belong to the Suoi Bang Formation (fig. 2), the lower part of which consists of sandstones, mudstones, and clays, while intercalations of marine carbonate sediments (dolomitic sandstones and limestones) appear towards the upper part (Vu Khuc 1980).

Thirteen samples (about 1 kilogram each sample) have been collected in the section (fig. 3). Only five samples from the highest part of the section yielded conodonts (fig. 3, table 1), on average 150—200 specimens per sample. Three hundred sixty specimens were suitable for determination. Samples with abundant conodonts included also fish scales and teeth, small ammonite shells, and foraminifera. It has been observed that conodonts are most numerous in those rocks (limestones) whose fraction of detrital grains is closest to the average size of the conodonts.

The samples have been collected by the author in 1985. The studied collection is stored at the Institute of Geology and Mineral Resources in Hanoi (IG MR).

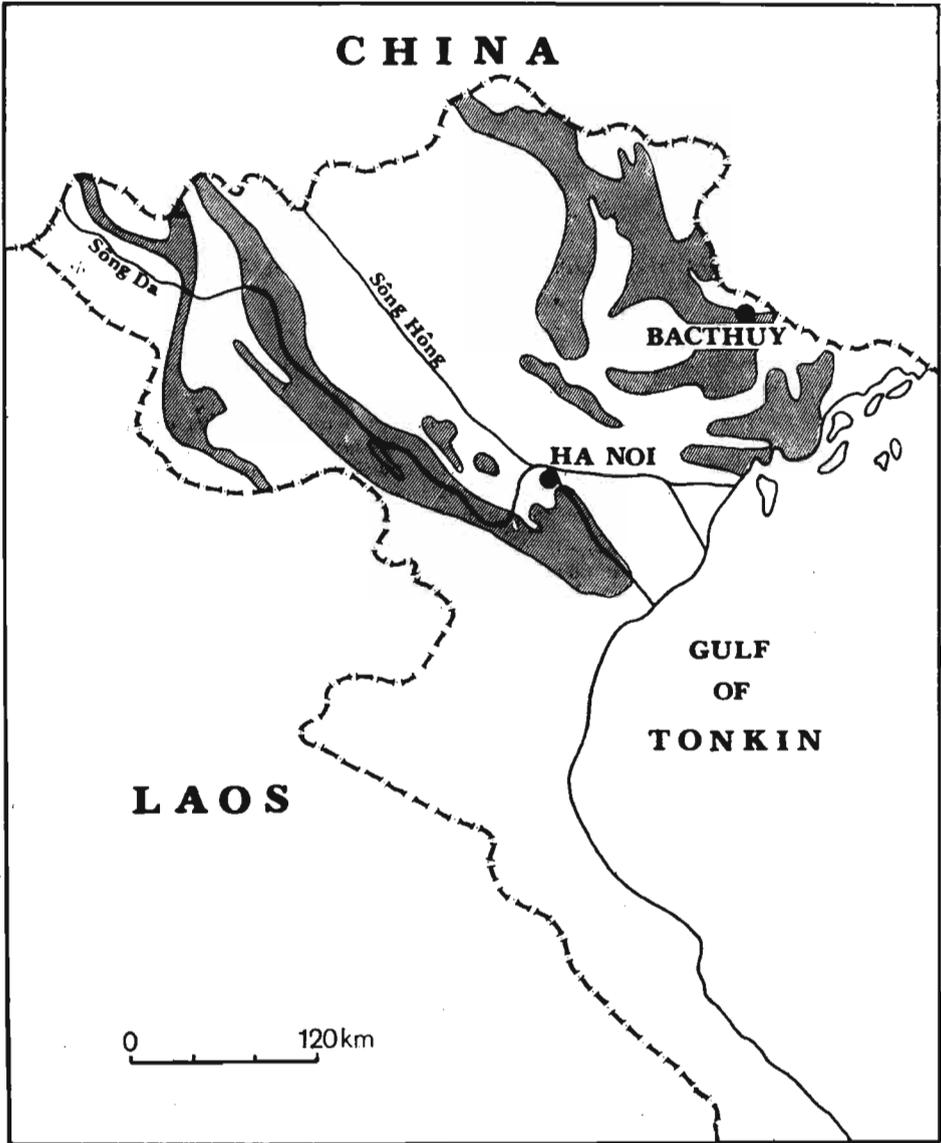


Fig. 1. Location of the Bac Thuy section.

The studies were done at the Faculty of Geology, Warsaw University, in the years 1985—1987, under the supervision of Dr. Jerzy Trammer.

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#### LITHOLOGICAL CHARACTERISTICS OF THE BAC THUY SECTION

The lithology and thickness of the rocks exposed in the section at Bac Thuy are as follows (see also fig. 3):

1. Alternating thin layers of black shales, grey and green mudstones, and light-grey fine-grained sandstones, 5 m.
2. Light-grey dolomitic quartzous sandstone containing dispersed calcite grains. Thin layers of clays and mudstones occur at top and bottom, 1.5 m. Sample LS8.
3. Light-grey dolomitic quartzous sandstone containing frequent grains of polycrystalline quartz, 0.8 m. Sample LS9.
4. Grey dolomitic quartzous sandstone containing single grains of glauconite and opaque minerals, 1.2 m. Sample LS10.
5. Very hard light-grey dolomitic quartzous sandstone containing single grains of carbonate rocks, 0.6 m. Sample LS11.
6. Rocks analogous to 5. Additionally dark-grey mudstones at base, 1.0 m. Sample LS12.
7. Light-grey, hard, dolomitic quartzous sandstone containing single grains of carbonate rocks. Clays and mudstones at base and top, 1.7 m. Sample LS13.
8. Rocks analogous to 7, 2.0 m. Sample LS14.

The overlying beds are alternating dark-grey fine-grained sandstones, calcareous mudstones and calcareous clays, with intercalated limestone layers, extending laterally for some tens of metres. The following description concerns these discontinuous limestone layers.

9. Layer of light-grey limestone (biomicrite). Numerous shells of cephalopods, conodonts and foraminifera are visible in thin sections, 0.8 m. Sample LS15.
10. Light-grey biomicrite containing shells of gastropods, conodonts and foraminifera. Quartz grains are frequent, 0.45 m. Sample LS16.
11. Light limestone (micrite), 0.85 m. Sample LS17.
12. Dark-grey dolomitic limestone (pelsparite), containing numerous conodonts and foraminifera, 0.5 m. Sample LS18.
13. Light-grey limestone (biomicrite), containing quartz grains. Conodonts and small cephalopod shells are numerous, 0.55. Sample LS19.
14. Light-grey limestone (biomicrite), containing quartz grains. Numerous shells of small cephalopods are visible on weathered surface, 0.65 m. Sample LS20.

Higher follow volcanic sediments of the Song Hien Formation.

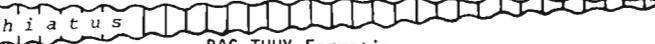
System	Series	Stage	North-eastern part of Vietnam An Chau Basin	
JURASSIC	Lower	HA COI Horizon continental red-beds conglomerate, sandstones, mudstones, clays and volcanics		
		Upper	Rhaetian	VAN LANG Formation conglomerate, clays, clayey shales, carbonaceous argillite 250m-1000 m
Norian				
Carnian	MAU SON Formation calcareous clays, sandstones, mudstones, clays 1200m-1800m			
TRIASSIC	Middle	Ladinian	NA KHUAT Formation mudstones, clays, limestones, tuffaceous sandstones 400m-1500m	
		Anisian	SONG HIEN Formation clays, conglomerate, tuffaceous sandstones, rhyolite, tuffs, basalt 900m-1500m	
	Lower	Olenekian	 BAC THUY Formation argillaceous limestone, calcareous clays, limestone, mudstones 50m-150m	
		Induan	LANG SON Formation mudstones, sandstones, clays 150m-400m	
PERMIAN	Upper	DONG DANG Formation limestones, bauxites		

Fig. 2. Development of the Triassic in the northern part of Vietnam (after Vu Khuc 1984, slightly modified).

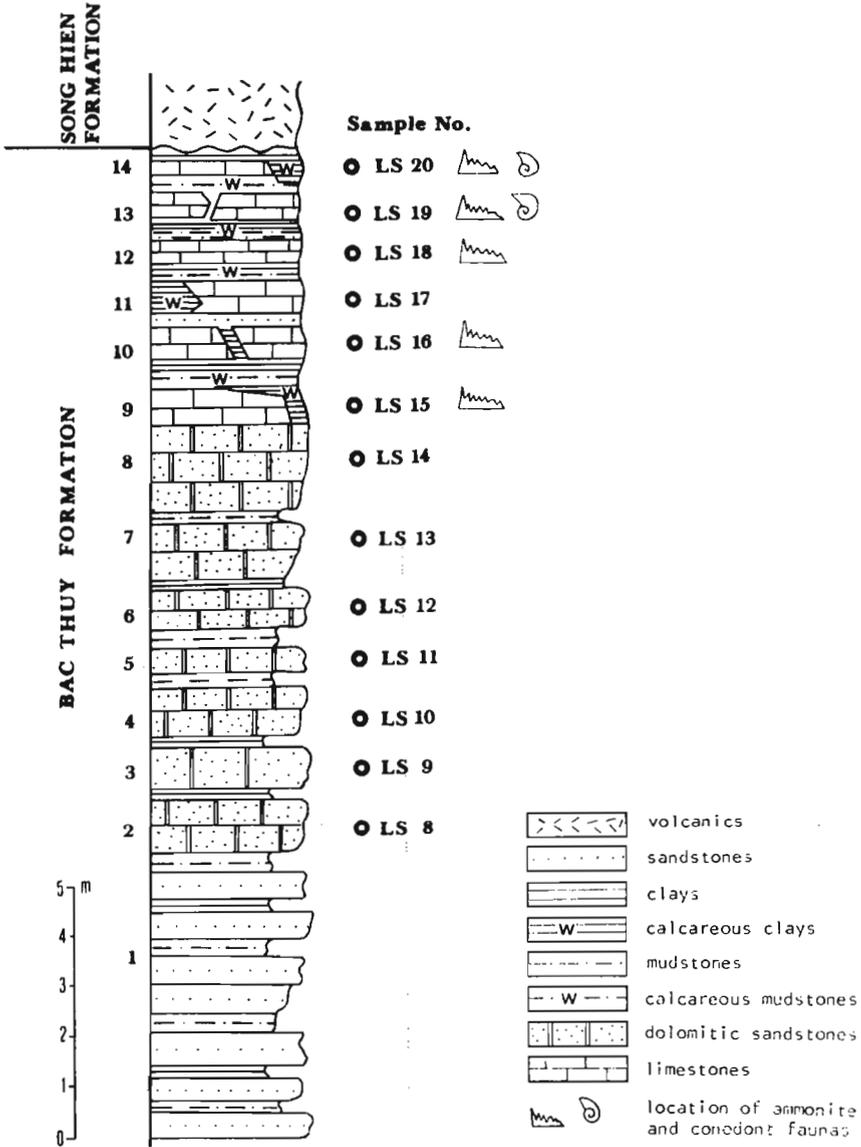


Fig. 3. Bac Thuy section with location of samples.

## GENERAL CHARACTERISTICS OF THE DESCRIBED CONODONT FAUNA

In total, 37 taxa were determined including 6 new ones (table 1). Conodonts of the genus *Neospathodus* are clearly dominant among the forms determined. Twelve species of this genus were found, and these forms constitute above 25 percent of all specimens found. Additionally, many bar-type conodonts were found. Noteworthy is the lack of the forms belonging to the genus *Gondolella*.

Table 1

List of conodonts found in the Bac Thuy section (indicated is their frequency in samples)

taxa	Samples	LS 15	LS 16	LS 18	LS 19	LS 20
1. <i>Neospathodus bransoni</i>			5			
2. <i>N. curtus</i>					2	
3. <i>N. dieneri</i>	6			13		
4. <i>N. discreta</i>			5		12	
5. <i>N. exelsus</i>	5					
6. <i>N. gondolellaeformis</i> sp. n.				6	9	
7. <i>N. homeri</i>				20	5	
8. <i>N. regularis</i> sp. n.			4			
9. <i>N. triangularis</i>			3	6		
10. <i>N. waageni</i>	15					6
11. <i>N. aff. cristagalli</i>	3		10			
12. <i>Neospathodus</i> sp.			3	5		3
13. <i>Cratognathodus robustus</i>	1		2	4		
14. <i>Cratognathodus</i> sp. A					2	4
15. <i>Diplododella magnidentata</i>	6					21
16. <i>D. meissneri</i>					2	
17. <i>Enantiognathodus aff. niegleri</i>						8
18. <i>Hadrodontina</i> sp.			3	6		
19. <i>Hibbardella cf. triassica</i>						1
20. <i>Hindeodella /Metaprioniodus/</i> <i>langsonensis</i> sp. n.			2		7	
21. <i>Neohindeodella budorovi</i>			9			
22. <i>N. nevadensis</i>				4	8	
23. <i>N. triassica</i>					2	23
24. <i>N. vietnamica</i> sp. n.						1
25. <i>Ozarkodina gigantea</i> sp. n.						5
26. <i>Ozarkodina aff. saginata</i>					1	
27. <i>Pachycladina multispinosa</i> sp. n.						1
28. <i>Platyvillosus costatus</i>				5		
29. <i>Prioniodina scolosculptura</i>					4	9
30. <i>P. (Cypridodella) muelleri</i>	20					1
31. <i>Prioniodina</i> sp. A					3	6
32. <i>Prioniodina</i> sp. B.				3		2
33. <i>Prioniodina</i> sp. C.			7			
34. <i>Ellisonia</i> sp.					3	4
35. <i>Prioniodella ctenoides</i>						7
36. <i>Prioniodella</i> sp.					2	
37. <i>Xaniognathodus expansus</i>						15

The lack of *Gondolella* in the Bac Thuy section may be explained by the hypothesis of Clark and Hatleberg (1983) and Hatleberg and Clark (1984). These authors suggest that conodont occurrence is bathymetrically controlled (Hatleberg and Clark: fig. 12). In their opinion, the Smithian *Neospathodus* forms preferred outer shelf and shallower zones of the basins, while *Gondolella* preferred the outer shelf and deeper zones of the basins. Accordingly, the higher part of the Bac Thuy Formation would be originated on the outer shelf or basin slope, and not in the deep zones.

In China, the geographically closest region, many conodonts were found in the Lower Triassic strata (Wang C. and Wang Z. 1976; Wang Z. and Cao Y. 1981; Wang Z. 1982); among them many species and genera in common with assemblages from Vietnam, including *Neospathodus dieneri*, *N. homeri*, *N. waageni*, *N. exelsus* and *Ozakordina*, *Hibbardella*, *Platyvillosus*, *Hindeodella*, *Pachycladina*. In the area of Jolmo Lungma, *Neospathodus dieneri* appears in the Indnan and is concurrent with cephalopods of the genus *Ophiceras* (*Litophiceras*) (Wang C. and Wang Z. 1976).

#### STRATIGRAPHICAL POSITION OF THE BAC THUY SECTION

Vu Khuc (1984) found ammonite fauna in the same section at the Bac Thuy station, which provided the conodonts here considered. This fauna comes from the highest part of the section, from places where conodont samples LS 19 and 20 have been collected (fig. 3). Among others, the following taxa have been stated (Vu Khuc 1984): *Paranorites praestans*, *Spath*, *Owenites carinatus* Shevyrev, *Ussuria lenticularis* Vu Khuc, *Meekoceras* cf. *yukiangense* Chao, *Flemingites* cf. *rursiradiatus* Chao.

The age of a ammonite-bearing strata known as Beds with *Paranorites* (Vu Khuc 1984), was determined as the lower Olenekian. According to Vu Khuc his lower Olenekian corresponds to the Smithian of Tozer (1967), as is apparent in Table 1, where Vu Khuc (1984) correlates the beds with *Paranorites* in Vietnam with Tozer's (1967) *romunderi* and *tardus* zones (= Smithian, see table 2 herein).

The age determination given by Vu Khuc (1984) seems to be undoubtfull, as all hitherto known species of the genus *Owenites* Hyatt et Smith, 1905 were found in the Smithian strata (Tozer 1981: 90). The former division of the Lower Triassic included even the Owenitan stage, corresponding to the Smithian (Tozer 1967).

It may be thus accepted that the samples LS19 and LS20 derived from the Smithian strata. The age of the other conodont-bearing layers (samples LS15, 16, and 18) is not clear in the light of the studies on ammonites (see below).

## BOUNDARY BETWEEN THE BAC THUY AND SONG HIEN FORMATIONS

The layer with the Smithian ammonites near the Bac Thuy station is almost directly overlain by volcanic rocks of the next, Song Hien Formation (fig. 3).

Another ammonite fauna was found (Dinh Huu 1977; Vu Khuc, 1984) at the localities Ky Lua and Ky Cung, where the Bac Thuy Formation is developed similarly as near the Bac Thuy station, i.e. it comprises discontinuous limestone layers alternating with calcareous claystones, calcareous mudstones and sandstone. It includes ammonites of the genera *Columbites* and *Tirolites*. These are guide genera for the Spathian (Tozer 1981).

At Ky Lua and Ky Cung similarly as near the Bac Thuy station, volcanic rocks of the Song Hien Formation occur closely above the layers with ammonites (Dinh Huu 1977: fig. 1).

These facts permit one to conclude that the boundary between the Bac Thuy and Song Hien Formations is diachronous — near the Bac Thuy station the volcanics overlie Smithian strata, and at Ky Lua and Ky Cung, they overlie Spathian strata. At all these localities the strata of the Bac Thuy Formation are overlain by continental sediments. It is thus suggested that the deposition of these sediments was preceded by a stage of erosion. In the studied section of Bac Thuy, the erosion reached deeper levels than in the area of Ky Lua and Ky Cung.

These conclusions are taken into account in the interpretation presented in fig. 2. The figure is given after Vu Khuc (1980), but the position of the boundary between the Bac Thuy and Song Hien Formations is changed. Vu Khuc drew the boundary straight and without hiatuses.

STRATIGRAPHICAL IMPORTANCE OF THE CONODONTS DESCRIBED  
FROM THE BAC THUY SECTION  
(Table 2)

*Neospathodus waageni* Sweet, 1970 is present in the samples LS15 and 20. This is an index form of the Smithian (Sweet *et al.* 1971). Mosher (1973) found it together with ammonites *Euflemingites romunderi* and *Wasatchites tardus* in Canada. Collinson and Hasenmuller (1978) established that these forms occur in the USA in the higher part of the Meekoceras gracilitatis Zone and higher in the so called beds with *Anasibirites*. Buriij (1979) found this conodont (two specimens only) in Primorie in the strata of the *Anasibirites nevolini* Zone. Also Kozur and Mostler (1972) report that *N. waageni* is the index form of the Meekoceras gracilitatis Zone and the Beds with *Anasibirites*, and that it occurs, among others, in Asia, but they do not discuss any detailed sections.

Finally, Murata (1981) found *N. waageni* in Kashmir together with the ammonites *Owenites* and *Kashmirites*. Many other authors have found *N. waageni* (e.g. Solien 1979; Goel 1977), but not accompanied by guide ammonites, and the studied rocks were dated by them at the Smithian on the basis of this conodont only.

The fragment of the Bac Thuy section from the sampling points LS15 to LS20, is thus dated at the Smithian on the presence of *N. waageni*, as was stated by the present study.

Other index conodonts are *Neospathodus homeri* and *N. triangularis*. The former occurs in samples LS18 and 19, the latter in LS16 and 18. In the USA they are index forms of the Spathian (Sweet *et al.* 1971: Collinson and Hasenmuller 1978). On the other hand, many published data (Nazarevich and Zawidzka 1981: fig. 3) indicate that these conodonts are present also in the Smithian in many places in Europe and Asia. It seems that in the USA they appear later than in other areas. The strata bearing *N. homeri* and *N. triangularis* may be dated at the Smithian or Spathian on the basis of these species only. In the Bac Thuy section, these conodonts occur in the Smithian, as is shown by their concurrence with ammonites (samples LS19) and with *N. waageni*, hitherto reported from the Smithian only. Strictly speaking, *N. homeri* and *N. triangularis* have not been found in the same samples with *N. waageni*, but they both occur in the interval of the section situated between sampling points LS15 and 20 where *N. waageni* occurs, the guide form of the Smithian.

The fourth index conodont found is *Neospathodus dieneri*. It was stated in samples LS15 and 18. According to Sweet *et al.* (1971) and to Collinson and Hasenmuller (1978) it occurs in the Dinerian and in the lower and middle part of the Smithian. Similar opinion on the range of *N. dieneri* is held by other authors (e.g. Kozur and Mostler 1972 who state, however, that *N. dieneri* continues until the end of the Smithian; Goel 1977). Thus, the presence of *N. dieneri* alone, is a sufficient proof of the Dienerian or Smithian age of the strata in which it occurs. In the Bac Thuy section, this form occurs in the Smithian, as it is concurrent with *N. waageni*. Also the concurrence of *N. dieneri* with *N. homeri* and *N. triangularis* (sample LS18) indicative of the Smithian, even if one does not take into account the presence of *N. waageni*. If the total range of *N. dieneri* comprises the Dienerian and Smithian, and that of *N. homeri* and *N. triangularis*—the Smithian and Spathian, then the concurrence of these three forms dates the layer at the Smithian.

There follows a question, if the concurrence of the conodonts *N. dieneri*, *N. homeri*, and *N. triangularis* could be used for a more precise age determination? Such concurrence was found in sample LS18 directly (table 1), and for sample LS16 it may be presumed. It is known (table 2), that in the USA these three conodonts are nonconcurrent, moreover

Table 2

Stratigraphical range of *Neospathodus dieneri*, *homeri*, *waageni* and *triangularis* in North America and East Asia

		CANADA, USA SWEET et al. 1971	USA COLLINSON & HASENMUELLER 1978	PRIMORIE BURIJ, 1979	VIETNAM
		<i>Neospathodus dieneri</i> <i>N. homeri</i> <i>N. waageni</i> <i>N. triangularis</i>	<i>N. dieneri</i> <i>N. homeri</i> <i>N. waageni</i> <i>N. triangularis</i>	<i>N. dieneri</i> <i>N. homeri</i> <i>N. waageni</i> <i>N. triangularis</i>	<i>N. dieneri</i> <i>N. homeri</i> <i>N. waageni</i> <i>N. triangularis</i>
SPATHIAN					
SMITHIAN					

their ranges are separated by a certain fragment of section: *Neospathodus homeri* and *N. triangularis* appear only in the Spathian and do not concur with *N. dieneri* (Sweet et al. 1971: fig. 2; Collinson and Hasenmuller 1978: fig. 1). Nevertheless, in the Middle East and souther Europe (Bulgaria, Greece, Turkey), *N. homeri* and *N. triangularis* appear already in the upper Smithian and concur with *N. dieneri* (Nazarevich and Zawidzka 1981: fig. 3). In Primorie (Buriij 1979), the three conodonts are concurrent in one sample coming from the upper part of the nevolini Zone (Buriij 1979: fig. 9). Hence, in Primorie, the concurrence of the three conodonts takes place in the nevolini Zone, which is equivalent (fig. 6) to the tardus Zone (= upper Smithian). In Vietnam, the three conodonts are also concurrent, however, it is known that they are concurrent in the Smithian. It is not precised in which part of this stage they occur, because the ammonites and conodonts date the strata at the Smithian only. Would be

such concurrence of the three conodonts as in Primorie confirmed in material from more sites and from more samples, then the concurrence of *N. dieneri*, *N. homeri*, and *N. triangularis* could be considered in Asia as an index of the upper Smithian.

It should be accepted, hence, that the moment of the first appearance of *N. homeri* and *N. triangularis* is different in North America as compared with Asia and southern Europe. When Sweet *et al.* (1971) published their conodont zonation for the Triassic, they considered it as being universally applicable. Later data revealed, however, that this zonation must be modified for the Triassic of Asia and southern Europe. This is not surprising, as the conodont zones nos. 7 to 12 were based on sections from the US territory (Sweet and al. 1971: 452).

#### DESCRIPTIONS

##### Order *Conodontophorida* Eichenberg, 1930

##### Genus *Neospathodus* Mosher

##### *Neospathodus bransoni* (Müller, 1956)

(pl. 29: 10)

1956. *Neoprioniodus bransoni* Müller: 892, pl. 95: 19—21.

1976. *Neospathodus bransoni* (Müller); Wang and Wang: 412, pl. 3: 8, 9, fig. 20.

*Material.* — 5 specimens from sample LS16. Nos.: IG MR/LS16-82a, b, c, d, e.

*Remarks.* — Müller's (1956) specimens from Nevada on one hand, and those of Wang and Wang (1976) and the present author on the other, are slightly different. The specimens from Nevada usually have more denticles, and their lower edge is arcuately curved upwards, while in the specimens from Asia, the lower edge is straight. Though Wang and Wang (1976) attributed their specimens to *N. bransoni* (Müller) one may suppose that we are dealing with two separate species. Due to the scarcity of material it can not be decided now if the form here discussed represent a new species.

*Occurrence.* — North America and China: Olenekian. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

##### *Neospathodus curtus* Dagis, 1982

(pl. 30: 11)

1968. *Neospathodus lanceolatus* Mosher: 930, pl. 115: 7 (*non* 10, 11).

1979. *N. lanceolatus* Mosher; Buriij: 54, pl. 8: 5, 6.

1984. *N. curtus* Dagis: 28, pl. 6: 1—3.

*Material.* — 2 specimens from sample LS19. Nos.: IG MR/LS19-8a, b.

*Occurrence.* — USSR, northern Siberia: lower Olenekian, Hedenstroemia hedenstroemi Zone (lower Smithian); southern Primorie Olenekian Anasibirites nevolini Zone (upper Smithian). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus dieneri* Sweet, 1970

(pl. 29: 9, 13, 15—17)

1970a. *Neospathodus dieneri* Sweet: 9, pl. 1: 17.1984. *N. dieneri* Swett; Dagens: 27, pl. 6: 4—7.

*Material.* — 19 well preserved specimens from samples LS15 and 18. Nos.: IG MR/LS15-1a, b, c, d, e, f, IG MR/LS18-2a, b, c, IG MR/LS18-34, IG MR/LS18-109, a, b, IG MR/LS18-110a, b, c, d, e.

*Occurrence.* — Asia and North America: lower part of the Lower Triassic (?upper Griesbachian, Dienerian to the middle part of the Smithian—Sweet *et al.* 1971) Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus discreta* (Müller, 1956)

(pl. 30: 6, 7, 12, 14)

1956. *Ctenognathodus discreta* Müller: 821, pl. 95: 24, 28.1979. *Neospathodus discreta* (Müller); Buriij: 52, pl. 7: 1—6.

*Material.* — 17 variously preserved specimens from samples LS16 and 19. Nos. IG MR/LS16-7a, b, c, d, e, IG MR/LS18-4a, b, c, d, e, 8a, b, c, d, e, g, h.

*Occurrence.* — USA, Nevada: Lower Triassic (lower Smithian, Meekoceras Zone.) USSR, Primorie: Olenekian (Anasibirites nevolini Zone: upper Smithian). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus exelsus* Wang et Wang, 1976

(pl. 31: 5)

1976. *Neospathodus exelsus* Wang et Wang: 412, pl. 3: 14—16.

*Material.* — 5 specimens from sample LS15. Nos.: IG MR/LS15-5a, b, c, d, e.

*Occurrence.* — China: the highest part of the Lower Triassic. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus homeri* (Bender, 1968)

(pl. 29: 12; pl. 31: 15, 16)

1970b. *Neospathodus homeri* (Bender); Sweet: 245, pl. 1: 2, 3, 9, 10.

*Material.* — 25 variously preserved specimens from samples LS18 and 19. Nos.: IG MR/LS18-4a, b, c, d, e, f, 34a, b, d, e, f, 35a, b, c, d, e, f, 95a, b, c, IG MR/LS19-3a, b, c, d.

*Occurrence.* — USA (Nevada) and Pakistan: the highest part of the Lower Triassic — conodont zones from platyvillosus to *Neospathodus timorensis* (Spathian—Sweet *et al.* 1971). USSR, southern Primorie, the highest Smithian (nevolini Zone — Buriij 1979) and Spathian; see also Kozur and Mostler (1972). China: Lower Triassic (Wang 1982). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus regularis* sp. n.

(pl. 30: 13)

*Holotype*: Specimen LS16-69: pl. 30: 13.*Type horizon*: Bac Thuy Formation, Lower Triassic, two meters beneath the Beds with *Paranorites* (after Vu Khuc 1984).*Type locality*: Section near railway station Bac Thuy in the province of Lang Son.*Derivation of the name*: The form has regularly spaced denticles, uniform in shape.*Diagnosis*. — Comb-like conodont; lower edge mostly straight, only at the back slightly curving upwards, at 15–20°. It has 8 pointed denticles. The nearly equidistant denticles are set vertically in the base. Basal cavity and central rib are poorly developed.*Material*. — 4 specimens from sample LS16. Nos.: IG MR/LS16-69a, b, c, d.*Description*. — Comb-like conodont, denticles almost equal in size, only the cusp is slightly larger than the others, and the foremost denticle is lower than the others. Base is rather high. All denticles are pointed, and circular in cross-section. Only the two last denticles are somewhat fused at the base. The central side rib is poorly visible and the basal cavity is weakly developed. The lower margin under the cusp is slightly bent upwards at 15–20°.*Remarks*. — The species differs from *Neospathodus kummeli* Sweet, 1970 in its smaller number of denticles, and in having the denticles not fused.*Occurrence*. — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.*Neospathodus triangularis* (Bender, 1968)

(pl. 29: 1, 2, 5, 6)

1970b. *Neospathodus triangularis* (Bender); Sweet: 253, pl. 1: 7, 8.1983. *N. triangularis* (Bender); Matsuda: 93, pl. 3: 5–9.*Material*. — 9 well preserved specimens from samples LS16 and 18. Nos.: IG MR/LS16-82a, b, c, IG MR/LS18-3a, b, c, d, e, f.*Remarks* — According to Sweet (1970b) this species has 4–11 denticles, but Masuda (1983) observed up to 14 denticles in specimens from Pakistan. Central edge is variously shaped, but the specimens from Kashmir and those from the author's collection have the central edge poorly developed; not only in juvenile, but also in adult forms.*Occurrence*. — *N. triangularis* occurs in the upper part of the Lower Triassic (Smithian and Spathian) in many places in the world (Nazarevich and Zawidzka 1981). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.*Neospathodus waageni*, 1970

(pl. 29: 3, 4, 8, 11)

1970b. *Neospathodus waageni* Sweet, 260, pl. 1: 11, 12.*Material*. — 21 variously preserved specimens from samples LS15 and 20. Nos.: IG MR/LS15-2a, b, c, d, e, f, g, 4a, b, c, d, e, f, g, IG MR/LS20-94a, b, c, d, e, f.

*Occurrence.* — Europe, Asia, and North America: upper part of the Lower Triassic (Smithian — Sweet *et al.* 1971). Vietnam, section at Bac Thuy: (Smithian), Bac Thuy. Fm.

*Neospathodus aff. cristagalli* (Huckriede, 1958)

(pl. 30: 1)

*Material.* — 13 specimens from samples LS15 and 16. Nos.: IG MR/LS-105a, b, c, IG MR/LS16-69a, b, c, d, e, IG MR/LS16-71a, b, c, d, e.

*Description.* — Conodonts with 8—10 pointed denticles, slightly inclined backwards. The denticles are fused up to about 1/3 of their height. The cusp is the greatest and the highest. Other denticles are successively shorter towards the front.

The base is bent upwards at 10°, beginning with the 1/3 of the lower edge. W:H:L ratio is 1:3:4.

*Remarks.* — The described conodont differs from *N. cristagalli* in having all denticles pointed, and nearly equal in size, while *N. cristagalli* has some smaller denticles behind the cusp (Huckriede 1958).

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neospathodus gondolellaeformis* sp. n.

(pl. 30: 4, 5)

*Holotype:* Specimen IG MR/LS19-24; pl. 30: 4.

*Type horizon:* Bac Thuy Formation, Olenekian (Beds with *Paranorites* after Vu Khuc 1984).

*Type locality:* Section near the railway station Bac Thuy in the province of Lang Son.

*Derivation of the name:* The form resembles in side view the conodonts of the genus *Gondolella*.

*Diagnosis.* — Blade-shaped conodont, height to width ratio from 1: 2.7 to 1: 3.3. Basal furrow present on aboral side, basal cavity poorly developed. Conodont base wider than the blade, developed as a platform-like structure, attaining somewhat more than 3/4 of the conodont length, as measured from the back. Central rib absent.

*Material.* — 15 variously preserved specimens from samples LS18 and 19. Nos.: IG MR/LS18-22, a, b, c, d, e, IG MR/LS19-24, a, b, c, d, 102, a, b, c.

*Description.* — Blade-like form with 11 to 15 denticles. Most of them are nearly equal in length, only the denticles in the front are shorter than the others. They are ovate in cross-section. The denticles are fused over almost their whole length, only their pointed terminations are free. The form is about three times longer than high. The denticles are inclined backwards at 40—50°. The lower edge is more or less straight.

The lower surface is widened, beginning from the back, by more than 3/4 of the length of the form. The widening is absent in the front and a free blade is present. The basal cavity is small and poorly developed. Basal furrow is present.

*Remarks.* — The new species differs from *N. timorensis* (Nogami, 1968) in the complete lack of the central side rib, which in the other species is always well developed (cf. Nogami 1968; Sweet 1970; Mc Tavish 1973; Goel 1977; Matsuda 1983; Hatleberg and Clark 1984).

*Occurrence.* — As for the holotype.

*Neospathodus* sp.

(pl. 29: 7)

*Material.* — 11 specimens from samples LS16, LS18 and 20. Nos.: IG MR/LS16-20a, b, c, IG MR/LS18-35a, b, c, d, e, IG MR/LS20-92a, b, c.

*Description.* — The conodont has a rather wide base with 9—11 pointed, fused denticles. The denticles are ovate in cross-section.

The cusp is situated in 1/4 of the form length, as measured from the back. One small denticle, strongly inclined backwards, occurs behind the cusp. Under the cusp a distinct basal cavity is present.

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Ellisonia* Müller, 1956*Ellisonia* sp.

(pl. 34: 6, 7)

*Material.* — 7 specimens from samples LS19 and 20. Nos.: IG MR/LS19-11a, b, IG MR/LS19-28a, b, c, d.

*Description.* — Conodont with two bars, the posterior being much longer than the anterior one; both bars form an obtuse angle. The cusp is much larger than other denticles and it is situated at the junction of the two bars.

Three to four not fused, pointed denticles occur on the anterior bar, and a greater number (6—9) of denticles of similar form are situated on the posterior bar.

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Cratognathodus* Mosher, 1968*Cratognathodus robustus* Wang et Wang, 1976

(pl. 30: 2, 3)

1976. *Cratognathodus robustus* Wang et Wang: 397, pl. 3: 21—25.

*Material.* — 7 variously preserved specimens from samples LS15, LS16 and 18. Nos.: IG MR/LS15-5a, IG MR/LS16-6a, b, IG MR/LS18-21a, b, c, d.

*Occurrence.* — China: Lower Triassic. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Cratognathodus* sp. A

(pl. 32: 8; 5: 11)

*Material.* — 6 specimens from samples LS19 and 20. Nos.: IG MR/LS19-101, a, IG MR/LS20-52, a, b, c.

*Description.* — The conodont has the cusp and 3—4 denticles strongly inclined backward. The cusp is a few times higher and greater than other denticles and it is situated in 1/3 of the conodont length, as measured from the back. The basal cavity is distinct, inflated laterally.

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Diplododella* Ulrich et Bassler, 1926*Diplododella magnidentata* (Tatge, 1956)

(pl. 32: 1, 2, 5, 9)

1968. *Diplododella magnidentata* (Tatge); Mosher: 924, pl. 113: 31.1979. *Diplododella magnidentata* (Tatge); Metcalfe et al.: 742, pl. 97: 25, 26.

*Material.*—27 well preserved specimens from samples LS15 and 20. Nos.: IG MR/LS15-19a, b, c, d, IG MR/LS15-104a, b, IG MR/LS20-81a, b, c, d, e, IG MR/LS20-82a, b, c, d, e, f, IG MR/LS20-83a, b, c, d, e, f, IG MR/LS20-84a, b, c, d.

*Occurrence.* Nort America: common in the upper Scythian. Europe: widely distributed in the Middle and Upper Triassic (Metcalfe et al. 1979). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Diplododella meissneri* (Tatge, 1956)

(pl. 30: 8)

1979. *Diplododella meissneri* (Tatge); Trammer in: Malinowska: 146, pl. 38: 12.

*Material.*—2 specimens from sample LS19. Nos.: IG MR/LS19-81, 85.

*Occurrence.*—Asia and Europe: Scythian and Norian. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Enantiognathus* Mosher et Clark, 1965*Enantiognathus* aff. *ziegleri* (Diebel)

(pl. 34: 5)

*Material.*—8 specimens from sample LS20. Nos.: IG MR/LS20-51a, b, c, d, e, 55, 53a, b.

*Description.*—The main bar is long and has 8 or more denticles. The cusp is 2—3 times longer than other denticles. The side bar has 4—5 denticles; the latter denticles are twice as short as those in the main bar. In the side-bar, the base is twice as high as the denticles in the main bar, it equals to the height of denticles.

*Remarks.*—The form differs from *Enantiognathus ziegleri* (Diebel) in having the cusp shorter, as well as shorter denticles in the main bar, and the higher base of bar (cf. Kozur and Mostler 1972).

*Occurrence.*—Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Hadrodontina* Staesche, 1964*Hadrodontina* sp.

(pl. 30: 9, 10)

*Material.*—9 specimens from samples LS16 and 18. Nos.: IG MR/LS16-76a, IG MR/LS18-18a, b, c, d, e, f.

*Description.*—Symmetrical, bar-type conodont, having lower edge arcuately bent upwards.

The cusp is situated in the middle part of this form and it is the largest and longest one; 3—4 smaller denticles occur both, in front and behind it. All denticles

are rounded or ovate in cross-section, and pointed. The denticles are loosely spaced, with gaps in between.

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Hibbardella* Bassler, 1925

*Hibbardella* aff. *triassica* (Müller, 1956)

(pl. 32: 10)

*Material.* — 1 specimen from sample LS20. No.: IG MR/LS20-42.

*Description.* — Bar-type conodont, with the cusp strongly curved backwards, large, ovate in cross-section. Two side bars join in the rear part a nearly right angle. Three minute denticles are present on each side bar.

*Remarks.* — The described specimen has many features of *H. triassica*, but has only 3 denticles of the main branch (cf. Kozur Mostler 1972).

*Occurrence.* — Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Hindeodella* Bassler, 1925

Subgenus *Hindeodella* (*Metaprioniodus*) Huddle, 1934

*Hindeodella* (*Metaprioniodus*) *langsonensis* sp. n.

(pl. 34: 1, 2; fig. 7)

*Holotype.* — Specimen IG MR/LS16-31: pl. 34: 2.

*Type horizon:* Bac Thuy formation, Olenekian (Beds with *Paranorites* after Vu Khuc 1984).

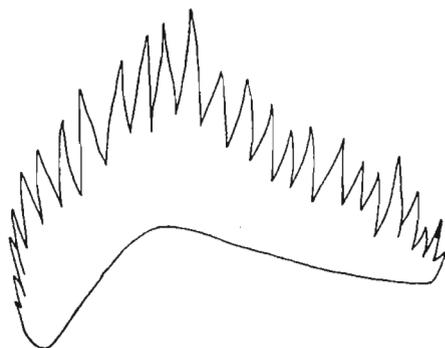


Fig. 4. *Hindeodella* (*Metaprioniodus*) *langsonensis* sp. n. in lateral view, schematically.

*Type locality:* Section near the railway station Bac Thuy province of Lang Son.

*Derivation of the name:* The conodonts were found in the province of Lang Son.

*Diagnosis.* — *Hindeodella* (*Metaprioniodus*) having very high base of the bar denticles fused on most part of their height, and the cusp equal in height to other denticles or slightly higher.

*Material.* — 9 variously preserved specimens from samples LS16 and 19. Nos.: IG MR/LS16-31 and 62, IG MR/LS19-97a, b, c, d, e.

*Description.* — The form consists of the cusp and two bars. The cusp is proximally slightly thicker than other denticles but only slightly higher, of the same height. The bars join at an angle of 110–130°. The base is very high. The bar

denticles are fused for at least 3/4 of their height. Denticle terminations are free and pointed. One of the bars has 14 denticles, the other 10—11. The basal cavity is small and shallow.

*Remarks.*— The species differs from other species of *Hindeodella* (*Metaprioniodus*) (cf. Kozur and Mostler 1972) in the features listed in the diagnosis.

*Occurrence.*— As for the holotype.

Genus *Neohindeodella* Kozur, 1968  
*Neohindeodella budorovi* (Buriij, 1979)  
(pl. 31: 6, 13)

*Material.*— 9 specimens from sample LS16. Nos.: IG MR/LS16/21, a, b, c, d, e, f, IG MR/LS16-31a, b.

*Occurrence.*— USSR, southern Primorie: Olenekian, upper Smithian, Anasibirites nevolini Zone (Buriij, 1979). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neohindeodella nevadensis* (Müller, 1956)  
(pl. 33: 6, 10, 12)

1956. *Hindeodella nevadensis* Müller: 826, pl. 96: 2, 3.

*Material.*— 12 well preserved specimens (some damaged during investigation) from samples LS18 and LS19. Nos.: IG MR/LS18-63a, b, c, d, e, f, g, h, IG MR/LS19-108a, b, c, d.

*Occurrence.*— Europe and Asia: Lower Triassic and Lower Anisian (Kozur and Mostler 1972). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neohindeodella triassica* (Müller, 1956)  
(pl. 33: 1—5)

1956. *Hindeodella triassica* Müller: 826, pl. 96: 4—5.

1972. *Neohindeodella triassica* (Müller); Kozur and Mostler: 23, pls. 1: 24; 2: 14—19; 4: 16; 7: 12, 13; 8: 22, 24, 26; 13: 10.

*Material.*— 23 variously preserved specimens (some damaged during investigation) from samples LS19 and 20. Nos.: IG MR/LS19-25 and 27, IG MR/LS20-40a, b, c, d, e, 41a, b, c, d, e, f, g, 45a, b, c, d, e, f, g, 80 and 103.

*Occurrence.*— Cosmopolitan in the Scythian and Norian (Kozur and Mostler 1972). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Neohindeodella vietnamica* sp. n.  
(pl. 33: 8; fig. 8)

*Holotype:* Specimen IG MR/LS20-28c; pl. 33: 8.

*Type horizon:* Bac Thuy Formation, Olenekian (Beds with *Paranorites* after Vu Khuc 1984).

*Type locality*: Section near the railway station Bac Thuy in the province of Lang Son.

*Derivation of the name*: first found in Vietnam.

*Diagnosis*:— A species of the genus *Neohindeodella*, built symmetrically and having the lower edge arcuately curving upwards.

*Material*.— Holotype only.

*Description*.— The form consists of the cusp and two side bars. The base is high, and its lower edge is arcuately curved upwards. The cusp is only slightly higher than other denticles.

The form is symmetrical. Each bar has eight similarly developed denticles. A small denticle is present on each side of the cusp. The size of denticles increases with increasing distance from the cusp, but both bars terminate with a small denticle. Basal lamellae are present at the base in the central part of the form.

*Remarks*.— The new species differs from other species of *Neohindeodella* (*Metaproniodus*) in its symmetrical form and arcuate curvature of the lower edge of the base.

*Occurrence*.— As for the holotype.

### Genus *Ozakordina* Branson et Mehl, 1933

#### *Ozakordina* aff. *saginata* Huckriede, 1958

(pl. 34: 3)

*Material*.— One specimen from sample LS19. No. IG MR/LS19-88.

*Description*.— The specimen has the characteristic features of the genus *Ozakordina*. The cusp is the thickest, but not the longest denticle; four fairly thick denticles occur additionally, which are inclined backwards, not fused and pointed. A small basal cavity is present.

*Remarks*.— The described specimen is related to *Ozakordina saginata* Huckriede. The latter, however, has the cusp much longer than other denticles.

*Occurrence*.— Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

#### *Ozakordina gigantea* sp. n.

(pl. 31: 10, 14; fig. 6a—b)

*Holotype*: Specimen No. IG MR/LS20-89a; pl. 31: 10.

*Type horizon*: Bac Thuy Formation, Olenekian (beds with *Paranorites* after Vu Khuc 1984).

*Type locality*: Section near the railway station Bac Thuy in the province of Lang Son.

*Derivation of the name*: Because of exceptionally large size as for *Ozakordina*.

*Diagnosis*.— A species of *Ozakordina* with exceptionally great (inflated) basal cavity and central side rib.

*Material*.— 5 specimens from sample LS20. Nos. IG MR/LS20-89a, b, c, 99a, b.

*Description*.— The base is arcuately curved, upwards, and the posterior bar is bent laterally (see pl. 31: 10, 14, fig. 5). The central side rib is distinct. Anterior branch has 9—13 denticles, which are partly fused. They are short, inclined backwards. The posterior branch has two small denticles, inclined backwards.

The cusp is the thickest and the longest denticle. The basal cavity is large, inflated, heart-like. A narrow basal furrow runs along the whole length of the anterior branch.

*Remarks.*—*O. gigantea* sp. n. is somewhat similar to *O. saginata* Huckriede, 1968 but differs from the latter species in its great basal cavity, smaller cusp, and

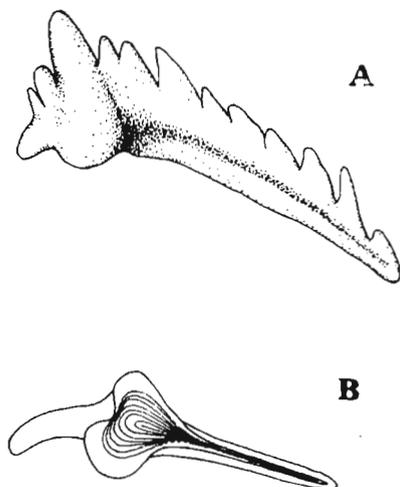


Fig. 5. *Ozakordina gigantea* sp. n. in lateral (A) and ventral (B) views, schematically.

more numerous denticles on the anterior bar. Moreover, in the new species only the denticle terminations are free, while in *O. saginata* the denticles are free over the most of their length.

*Occurrence.*—As for the holotype.

### Genus *Pachycladina* Staesche, 1964

#### *Pachycladina multispinosa* sp. n.

(pl. 31: 11)

*Holotype:* Specimen no. IG MR/LS20-77; pl. 31: 11.

*Type horizon:* Bac Thuy Formation, Olenekian (Beds with *Paranorites* after Vu Khuc 1984).

*Type locality:* Section near the railway station Bac Thuy in the province of Lang Son.

*Derivation of the name:* Because of many small denticles.

*Diagnosis.*—Fan-shaped conodont of the genus *Pachycladina*. The cusp is the highest and the longest one, and is situated in the center of the conodont.

*Material.*—Holotype only.

*Description.*—Fan-shaped bar-type conodont. The basal part is fairly high. The cusp is situated at the center of the platform: it is the highest and the longest. The remaining seven denticles are situated on the platform on both sides of the cusp. All denticles are circular on the platform on both sides of the cusp. All denticles are circular in cross-section.

*Remarks.*—The new species differs from other species of *Pachycladina* in its shape, number of denticles, the mode of their placement in the platform, and their

size. *P. multispinosa* sp. n. is closest to *P. tricuspidata* Staesche, but the latter has much larger denticles.

*Occurrence.*—As for the holotype.

Genus *Platyvillosus* Clark, Sincavage et Stone, 1964

*Platyvillosus costatus* (Staesche, 1964)

(pl. 31: 4, 7—9)

1964. *Eurygnathodus costatus* Staesche: 270, pls. 28: 1—6; 32: 3, 4.

1977. *Platyvillosus costatus* (Staesche); Goel: 1098, pl. 2: 15—21.

1984. *Platyvillosus costatus* (Staesche), 1964; Matsuda: 128, pl. 6: 6—10.

*Material.*—5 well preserved specimens from sample LS18. Nos. IG MR/LS11-27a, b, c, d, e.

*Occurrence.*—Sweet *et al.* (1971) considered, on basis of the sections in Nevada and Tyrol, that *P. costatus* occurs only in the lower Spathian. Tirolites Zone and they established the zone 10 (*platyvillosus* Zone) for this time interval. However, later Goel (1977) found *P. costatus* in India and Kashmir in the Smithian rocks (see also Kozur and Mostler 1972; Matsuda 1984). Vietnam, section at Bac Thuy: Olenekina (Smithian), Bac Thuy Fm.

Genus *Prioniodina* Ulrich et Bassler, 1926

*Prioniodina scolosculptura* (Mosher, 1968)

(pl. 32: 3, 6, 7)

1968. *Cypridodella scolosculptura* Mosher: 921: pl. 113: 13, 22.

1972. *Prioniodina scolosculptura* (Mosher); Kozur and Mostler: 30.

*Material.*—13 specimens from samples LS19 and LS20. Nos.: IG MR/LS19-93a, b, c, d, IG MR/LS20-99a, b, c, d, 100a, b, c, d, e.

*Occurrence.*—Hitherto known from the Anisian and Ladinian of Europe and North America (Kozur and Mostler 1972). Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Subgenus *Prioniodina* (*Cypridodella*) Mosher, 1968

*Prioniodina* (*Cypridodella*) *muelleri* (Tatge, 1956)

(pl. 31: 1, 2)

1972. *Prioniodina* (*Cypridodella*) *muelleri* (Tatge); Kozur and Mostler: 30, pl. 6: 8, 9; pl. 8: 23; pl. 9: 24; pl. 10: 8—10.

*Material.*—21 variously preserved specimens from samples LS15 and 20. Nos.: IG MR/LS15-9a, b, c, d, e, f, g, 10a, b, c, d, e, 11a, b, c, d, e, f, g, IG MR/LS20-80.

*Occurrence.*—Permian—Norian: cosmopolitan. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Prioniodina* sp. A

(pl. 31: 12)

*Material.*—9 specimens from samples LS19 and 20. Nos.: IG MR/LS19-83a, b, c, IG MR/LS20-96a, b, c, d, e, f, g.

*Description.*—Forms of *Prioniodina* having curved cusp and thick but short denticles in both bars.

*Remarks.*—The fragmentary preservation of the specimens prevents the detailed study of their morphology.

*Occurrence.*—Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Prioniodina* sp. B

(pl. 31: 3)

*Material.*—5 specimens from samples LS18 and LS20. Nos.: IG MR/LS18-22a, b, c, IG MR/LS20-57a.

*Description.*—The base of the bar very high. The cusp is the longest and highest of the denticles. One bar has three fairly long denticles, with marked spaces in between. The other bar has five denticles; fairly long ones alternate with small, short ones. No basal furrow or basal cavity was observed.

*Remarks.*—The specimens are preserved as fragments, which prevents the detailed study of their morphology. The forms are somewhat similar to the representatives of *Parachirognathus*, with which they have in common the form of the denticles.

*Occurrence.*—Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

*Prioniodina* sp. C

(pl. 33: 9)

*Material.*—7 variously preserved specimens from sample LS16. Nos.: IG MR/LS16-61, a, b, c, d, e, f, g.

*Description.*—The form has the cusp and two bars. The cusp is thick and long. The bars join at an angle close to the right angle. The base is high. The denticles in the bar are partly fused, and their pointed terminations are free. There are 8 denticles in one bar. The other bar—probably shorter, but never preserved completely—has 2–3 denticles. The form is exceptionally large in comparison with other representatives of the same genus.

*Occurrence.*—Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Prioniodella* Ulrich et Bassler, 1926*Prioniodella ctenoides* Tatge, 1956

(pl. 33: 7)

1976. *P. ctenoides* Tatge; Wang et Wang: 391, pl. 1: 2–4, fig. 1.

*Material.*—7 specimens from sample LS 20. Nos.: IG MR/LS20-64, a, b, c, d, e, f.

*Occurrence.*—In Germany, known in the Lower and Middle Triassic. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

Genus *Xaniognathus* Sweet, 1970  
*Xaniognathus expansus* Mosher, 1973  
(pl. 34: 4)

1973. *Xaniognathus expansus* Mosher: 176, pl. 20: 22—24.

1984. *Xaniognathus expansus* Mosher; Dagis: 34, pl. 9: 2—5.

*Material.*—15 variously preserved specimens from sample LS20. Nos.: IG MR/LS20-39, IG MR/LS20-107a, b, c, d, e, f, g, 103a, b, c, d, e, f, g.

*Remarks.*—The author's specimens differ from those of Mosher (1973) and Dagis (1984). They are finer and lack the distinctly developed central side rib.

*Occurrence.*—In Canada: Smithian, Euflemingites romunderi and Wasatchites tardus Zone. In north-central Siberia: Olenekian, Hedenstromia hedenstroemi Zone. Vietnam, section at Bac Thuy: Olenekian (Smithian), Bac Thuy Fm.

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BUI DUC THANG

## DOLNOTRIASOWE KONODONTY Z PÓŁNOCNEGO WIETNAMU

## Streszczenie

W 5 próbkach wapieni i wapieni ilastych, należących do górnej części formacji Bac Thuy (fig. 1—4), po raz pierwszy w Wietnamie znaleziono triasowe konodonty. Występują one z otwornicami, głowonogami, łuskami i zębami ryb.

Opisano 37 gatunków konodontów należących do 16 rodzajów (pls. 29—34), w tym 6 gatunków nowych.

Na podstawie obecności głowonogów (Vu Khuc 1984) i zbadanych tutaj konodontów określono wiek części profilu zawierającej konodonty na smit (fig. 5, 6)

## EXPLANATIONS OF PLATES 29—34

All specimens from Bac Thuy section, Lower Triassic, Olenekian

## Plate 29

- 1, 2, 5, 6. *Neospathodus triangularis* (Bender, 1968): 1 upper view, IG MR/LS16-82a,  $\times 90$ ; 2 lower view, IG MR/LS18-3b,  $\times 135$ ; 5 upper view, IG MR/LS18-3c,  $\times 135$ ; 6 lower view, IG MR/LS  $\times 135$ .
7. *Neospathodus* sp.: lateral view, LS20-92,  $\times 90$ .
- 3, 4, 8, 11. *Neospathodus waageni* Sweet, 1970, all specimens in lateral view,  $\times 90$ : 3 IG MR/LS15-2a; 4 IG MR/LS15-4b; 8 IG MR/LS20-94c; 11 IG MR/LS20-94a.
- 9, 13, 15—17. *Neospathodus dieneri* Sweet, 1970; all specimens in lateral view: 9 IG MR/LS18-109a,  $\times 90$ ; 13 IG MR/LS18-108a,  $\times 90$ ; 15 IG MR/LS15-19,  $\times 135$ ; 16 IG MR/LS18-109b,  $\times 90$ ; 17 IG MR/LS18-110a,  $\times 90$ .
10. *Neospathodus bransoni* (Müller, 1956): lateral view, IG MR/LS16-82c,  $\times 90$ .
- 12, 14. *Neospathodus homeri* (Bender, 1968), both  $\times 90$ : 12 lateral view, IG MR/LS18-34a; 14 lateral view, IG MR/LS18-3b.

## Plate 30

1. *Neospathodus* aff. *cristagalli* (Hucriede, 1968): lateral view, IG MR/LS16-69a,  $\times 90$ .
- 2, 3. *Cratognathodus robustus* Wang et Wang, 1976, both  $\times 90$ : 2 lateral view, IG MR/LS15-5a; 3 lower view, IG MR/LS16-6b.
- 4, 5. *Neospathodus gondolellaeformis* sp. n.: 4 lateral view, IG MR/LS19-24,  $\times 135$ , holotype; 5 lateral view, IG MR/LS19-102,  $\times 90$ .
- 6, 7, 12, 14. *Neospathodus discreta* (Müller, 1956); all specimens in lateral view: 6 IG MR/LS16-7d,  $\times 90$ ; 7 IG MR/LS19-4a,  $\times 70$ ; 12 IG MR/LS19-8b,  $\times 90$ ; 14 IG MR/LS16-7c,  $\times 90$ .
8. *Diplododella meissneri* (Tatge, 1956): lateral view, broken specimen, IG MR/LS19-81,  $\times 90$ .
- 9, 10. *Hadrontina* sp., both in lateral view,  $\times 90$ : 9 IG MR/LS16-76; 10 IG MR/LS18-18.

11. *Neospathodus curtus* Dagus, 1982: lateral view, IG MR/LS19-8a,  $\times 90$ .  
 13. *Neospathodus regularis* sp. n.: lateral view, IG MR/LS16-69b,  $\times 90$ , holotype.

## Plate 31

- 1, 2. *Prioniodina* (*Cypridodella*) *muelleri* (Tatge, 1956): 1 lateral view, IG MR/LS15-9,  $\times 90$ ; 2 lateral view, IG MR/LS20-80,  $\times 70$ .  
 3. *Prioniodina* sp. B: lateral view, IG MR/LS20-57,  $\times 90$ .  
 4, 7—9. *Platyvillosus costatus* (Staesche, 1964), all specimens  $\times 112$ ; 4 lateral view, IG MR/LS18-27c; 7 upper view, IG MR/LS18-27d; 8 lower view, IG MR/LS18-27d; 9 upper view, IG MR/LS18-27a.  
 5. *Neospathodus exelsus* Wang et Wang, 1976: lateral view, IG MR/LS15-5b,  $\times 90$ .  
 6, 13. *Neospathodus budorovi* Buriij, 1976, both in lateral view,  $\times 90$ : 6 IG MR/LS16-31; 13 IG MR/LS16-21.  
 10, 14. *Ozakordina gigantea* sp. n., both  $\times 90$ : 10 lateral view, IG MR/LS20-89a, holotype; 14 lower view, IG MR/LS20-99b.  
 11. *Pachycladina multispinosa* sp. n.: lateral view, IG MR/LS20-77,  $\times 90$ , holotype.  
 12. *Prioniodina* sp. A.: lateral view, IG MR/LS19-83,  $\times 90$ .  
 15, 16. *Neospathodus homeri* (Bender, 1968), both in lateral view,  $\times 135$ : 15 IG MR/LS18-95b; 16 IG MR/LS18-95c.

## Plate 32

- 1, 2, 5, 9. *Diplododella magnidentata* (Tatge, 1956), all specimens in lateral view,  $\times 90$ : 1 IG MR/LS20-19b; 2 IG MR/LS15-104a; 5 IG MR/LS20-81a; 9 IG MR/LS20-81b.  
 3, 6, 7. *Prioniodina scolosculptura* (Mosher, 1968), all specimens in lateral view,  $\times 90$ : 3 IG MR/LS20-99; IG MR/LS19-93b; 7 IG MR/LS19-93a.  
 4, 11. *Prioniodella* sp., both in lateral view, IG MR/LS19-66,  $\times 54$ .  
 8. *Cratognathodus* sp. A: lateral view, IG MR/LS20-52,  $\times 90$ .  
 10. *Hibbardella* cf. *triassica* (Muller, 1956): lateral view, IG MR/LS20-42,  $\times 70$ .

## Plate 33

- 1—5. *Neohindeodella triassica* (Müller, 1956), all specimens in lateral view: 1 IG MR/LS20-80,  $\times 70$ ; 2 IG MR/LS19-27,  $\times 90$ ; 3 IG MR/LS19-25,  $\times 90$ ; 4 IG MR/LS20-45,  $\times 90$ ; 5 IG MR/LS20-40,  $\times 90$ .  
 6, 10, 12. *Neohindeodella nevadensis* (Müller, 1956), all specimens in lateral view: 6 IG MR/LS18-32a,  $\times 90$ ; 10 IG MR/LS19-108,  $\times 90$ ; 12 IG MR/LS19-84,  $\times 70$ .  
 7. *Prioniodella ctenoides* Tatge, 1956: lateral view, IG MR/LS20-64,  $\times 90$ .  
 8. *Neohindeodella vietnamica* sp. n.: lateral view, IG MR/LS20-28c,  $\times 90$ , holotype.  
 9. *Prioniodina* sp. C: lateral view, IG MR/LS16-61,  $\times 90$ .  
 11. *Cratognathodus* sp. A: lateral view, IG MR/LS19-50,  $\times 90$ .

## Plate 34

- 1, 2. *Hindeodella* (*Metaprioniodus*) *langsonensis* sp. n., both in lateral view,  $\times 90$ : 1 IG MR/LS16-62; 2 IG MR/LS16-31, holotype.  
 3. *Ozakordina* aff. *saginata* Huckriede, 1958: lateral view, IG MR/LS19-88,  $\times 70$ .  
 4. *Xaniognathus expansus* Mosher, 1973: lateral view, IG MR/LS20-39,  $\times 90$ .  
 5. *Enantiognathodus* aff. *ziegleri* (Diebel, 1956): lateral view, IG MR/LS20-39,  $\times 90$ .  
 6, 7. *Ellisonia* sp.

