

Sweetospathodus n. gen. and *Triassospathodus* n. gen., Two Important Lower Triassic Conodont Genera

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Abstract

Two new Lower Triassic conodont genera, *Sweetospathodus* n.gen. and *Triassospathodus* KOZUR n.gen., are described. *Sweetospathodus* is a transitional form between the platform-bearing gondolellid *Clarkina* and the platformless *Neospathodus*. *Triassospathodus* was formerly included into *Neospathodus*, but is clearly distinguished by the outline of the lower side (lower side of the basal cavity not upward curved as in all *Neospathodus* species).

1. INTRODUCTION

The classification of the Lower Triassic conodonts needs to be thoroughly revised. The two described new genera will be discussed in detail in a later comprehensive paper about the Lower Triassic and lower Anisian conodonts of the Sosio Valley in western Sicily (KOZUR et al., in prep.). However, the two genera *Sweetospathodus* n.gen. and *Triassospathodus* KOZUR n.gen. are stratigraphically important forms that have already been used in stratigraphic tables, papers and abstracts (KOZUR, a, b in press). These two genera will be described herein to avoid the use of nomina nuda. Most of the assigned species were described in previous papers and assigned mostly to the genus *Neospathodus*. A new *Triassospathodus* species will be described together with the Lower Triassic conodonts of the Sosio Valley.

2. SYSTEMATIC PALAEOLOGY

Genus *Sweetospathodus* n. gen

Type species: *Neospathodus kummeli* SWEET, 1970.

Derivatio nominis: In honour of Prof. W.C. SWEET, Columbus, Ohio.

Diagnosis: The Pa element has a low to moderately high blade with 9-16 uniform, long, discrete, erect, denticles. Exceptionally, the denticles are uniformly very slightly inclined (transitional forms to *Neospathodus*). The indistinct to distinct cusp is slightly posteriorly inclined. At the base of the denticles a thickening, a midlateral rib or a narrow, rudimentary platform may be present. The posterior end of the blade is straight or laterally deflected, rarely bifurcated. The lower side of the blade is straight or downwardly convex. The basal furrow is broad, the pit is subterminal to terminal.

Assigned species:

Neospathodus kummeli SWEET, 1970

Synonym: *Neospathodus praekummeli* BHATT, JOSHI & ARORA, 1981

Sweetospathodus n.sp. (will be described in KOZUR et al., in prep.)

Occurrence: Basal Gandarian (= basal Dienerian) Substage of the Brahmanian ("Induan") Stage. *S. kummeli* Zone. Tethys, Perigondwana, North America.

Remarks: A rapid evolution of the gondolellids can be observed during the Lower Triassic. Some of the platform-bearing gondolellids lost their platform, and platformless gondolellids (neospathodids) developed a platform. At the base of the Gandarian (= base of the Dienerian) one lineage of *Clarkina* with very high denticles rapidly reduced and lost its platform and changed finally into the platformless *Neospathodus* MOSHER, 1968. *Sweetospathodus* n.gen. is a transitional form between these two genera.

At the base of the Olenekian, transitional forms of *Neospathodus* to *Paragondolella* MOSHER, 1968 are present. Also in this level the change from forms with very reduced platform to forms with a well developed platform is very rapid. At the Olenekian-Anisian boundary advanced representatives of platformless neospatho-

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did conodonts (*Triassospathodus* KOZUR n.gen.) again developed a platform (*Neogondolella* stock).

KOZUR (1990) introduced the genus *Pseudogondolella* for transitional forms from *Neospathodus* to *Paragondolella* which was replaced in 1994 by *Chengyuania* KOZUR (KOZUR, 1994) because of the homonymy with the hybodont fish teeth *Pseudogondolella* YANG in YANG et al. (1984). For transitional forms between neospathodid conodonts and *Neogondolella* BENDER & STOPPEL, 1965 the genus *Chiosella* KOZUR, 1990 was created.

BUDUROV et al. (1988) assigned all Lower Triassic and lower Anisian gondolellids with a strongly reduced platform to *Kashmirella*, both transitional forms from platform-bearing forms to platformless forms and vice versa. Therefore, *Kashmirella* contains different groups of conodonts (among them also *Sweetospathodus*) that are not closely related to each other. The type species of *Kashmirella*, *K. albertii* BUDUROV, SUDAR & GUPTA, 1988 has a typical *Neospathodus* blade, with diverging denticles that become larger toward the posterior third, and with an upwardly directed lower margin of the basal cavity. The difference to *Neospathodus* is the presence of a midlateral rib and the platform-like widening in the posterior part that bears a lateral denticle. To this form fits *Neospathodus novaehollandiae* McTAVISH, 1973 and *Neospathodus svalbardensis* TRAMMER, 1975 (in BIRKENMAJER & TRAMMER, 1975; this species was originally not included in *Kashmirella*). These species have the same lateral outline of the blade and a midlateral rib that is sometimes widened to a very narrow platform. *Kashmirella* is restricted to these three species. *N. zaksi* BURIJ, 1979 that was also assigned to *Kashmirella* by BUDUROV et al. (1988) is a poorly preserved and poorly illustrated form that may belong to *Kashmirella*.

N. spathi SWEET 1970, a further form assigned to *Kashmirella* by BUDUROV et al. (1988) is at least partly a juvenile *Paragondolella*.

The further group of *Kashmirella* species belongs to *Chiosella* that evolved in the uppermost Olenekian from *Triassospathodus*. Therefore, they cannot belong to *Kashmirella* with a far older, Lower Scythian, type species. Also morphologically, it is a distinctly different group and has no *Neospathodus* type of blade.

Finally, *Sweetospathodus kummeli* (SWEET) and *Chengyuania nepalensis* (KOZUR & MOSTLER) were also assigned to *Kashmirella* by BUDUROV et al. (1988), but these two species are also totally different from the *Kashmirella* type species, both in denticulation and in lateral outline. In *Chengyuania*, the posterior end is downwardly directed, the denticles are very high in the anterior third, and become gradually lower toward the posterior end.

Sweetospathodus n.gen. is distinguished from *Kashmirella* by the high, erect, discrete denticles that are all of the same length (with the exception of the commonly occurring small denticle at the anterior and posterior ends). Moreover, the lower side in adults is often some-

what convex, and a distinctly and abruptly upward directed lower margin of the basal cavity is absent.

The most closely related genus to *Sweetospathodus* is *Chengyuania* KOZUR, 1994. Despite the fact that both genera are separated by the *N. dieneri* Zone, in which only *Neospathodus*, but no *Sweetospathodus* and no *Chengyuania* occur, it is probable that *Sweetospathodus* is the forerunner of *Chengyuania*.

All *Neospathodus* of the *N. dieneri* Zone have a distinctly upwardly directed lower margin of the basal cavity, a rather short high blade and denticles that, in the anterior part of the blade are distinctly shorter than in the posterior part of the blade. It is very difficult to connect *Chengyuania* with a long, low blade, highest denticles in the anterior part and a slightly downward directed posterior end, with these *Neospathodus* from the *N. dieneri* Zone. However, it is rather easy to connect *Chengyuania* with advanced *Sweetospathodus* that have a long, rather low blade with a straight lower side of the blade and its posterior end is a little downward directed. These forms have no midlateral rib or platform rudiments. The denticles are discrete and very long and have the same size throughout the blade. By reduction of their length in the posterior part, and by development of a midlateral rib or very narrow platform, *Chengyuania* may easily evolve from these advanced *Sweetospathodus*.

Genus *Triassospathodus* KOZUR, n. gen.

Type species: *Spathognathodus homeri* BENDER, 1970

Derivatio nominis: According to the occurrence in the Triassic and the spathodid shape.

Diagnosis: The blade is long to short, always high. The 4-17 denticles are posteriorly inclined, mostly with increasing inclination toward the posterior end or with diverging inclination, rarely with nearly constant inclination. The denticles are of subequal length, largest mostly at the beginning of the posterior end, and smallest close to the posterior end; rarely are the middle denticles the largest. The cusp is typically not distinguished from the adjacent denticles by its length and width. The lower side is either straight and at the posterior end downward curved or slightly concave. The flaring basal cavity occupies the posterior third to more than half of the lower side. Its lower side is towards the posterior end curved downwards. Towards the anterior end a broad basal furrow is present. The subterminal pit consists of two tiny groves connected by a narrow furrow. The posterior end of the lower margin of the basal cavity is always downward curved.

Assigned species:

Spathognathodus homeri BENDER, 1970

Spathognathodus triangularis BENDER, 1970

Spathognathodus hungaricus KOZUR & MOSTLER, 1970

Neospathodus pakistanensis SWEET, 1970
Neospathodus abruptus ORCHARD, 1995
Neospathodus brevissimus ORCHARD, 1995
Neospathodus brochus ORCHARD, 1995
Neospathodus clinatus ORCHARD & SWEET, 1995 (in ORCHARD, 1995)
Neospathodus curtatus ORCHARD, 1995
Neospathodus crassatus ORCHARD, 1995
Neospathodus pusillus ORCHARD, 1995
Neospathodus symmetricus ORCHARD, 1995
Neospathodus sosioensis KOZUR, KRÄNER & MOSTLER, 1997

Occurrence: Rare in the Lower Olenekian, very common in the upper Olenekian and lowermost Anisian. World-wide.

Remarks: *Triassospathodus* KOZUR n. gen. comprises mainly the *homeri*- and *triangularis* groups that were first assigned to the Palaeozoic form-genus *Spathognathodus* BRANSON & MEHL, 1941 (junior synonym of the multielement-genus *Ozarkodina* BRANSON & MEHL, 1933), and subsequently to *Neospathodus* MOSHER, 1968. These species groups were subdivided into several species mainly by ORCHARD (1995). *Triassospathodus* is easily distinguished from *Neospathodus* MOSHER, 1968 which displays an upwards directed lower margin of the basal cavity. Moreover, the blade is mostly short and high and the denticles typically increase considerably from the anterior end towards the beginning of the posterior end.

Chiosella KOZUR, 1990 evolved from *Triassospathodus* by the development of a midlateral rib at the base of the denticles that widens in advanced forms to a very narrow platform.

Kashmirella BUDUROV, SUDAR & GUPTA, 1988 emend. (see above) has an upwardly directed lower side of the basal cavity and a midlateral rib that sometimes widens to a very narrow platform.

In *Chengyuania* KOZUR, 1994 (= *Pseudogondolella* KOZUR, 1990, non ! *Pseudogondolella* YANG, 1984) the anterior denticles are very high and become gradually shorter towards the posterior end.

Stratigraphic value of *Sweetospathodus* and *Triassospathodus*

The first appearance of *Sweetospathodus* defines the base of the Gandarian (= Dienerian) and *S. kummeli* is the index species of the lowermost Gandarian.

Most index species of the Upper Olenekian (Spathian) belong to *Triassospathodus* species (Fig. 1).

3. REFERENCES

- BENDER, H. (1970): Zur Gliederung der Mediterranen Trias II. Die Conodontenchronologie der Mediterranen Trias.- Ann. Géol. Pays Helleniques, 19, 465-540, Athene.
- BENDER, H. & STOPPEL, D. (1965): Perm-Conodonten.- Geol. Jb., 82/3, 331-364, Hannover.
- BHATT, D.K., JOSHI, V.K. & ARORA, R.K. (1981): *Neospathodus praekummeli* - a new species of conodont from Lower Triassic of Spiti.- J. Geol. Soc. India, 22/9, 444-447, Bangalore.
- BIRKENMAJER, K. & TRAMMER, J. (1975): Lower Triassic conodonts from Hornsund, South Spitsbergen.- Acta Geol. Polonica, 25/2, 299-308.
- BUDUROV, K.J., SUDAR, M.N. & GUPTA, V.J. (1988): *Kashmirella*, a new Early Triassic conodont genus.- Bulletin of the Indian Geol. Assoc., 21, 107-112, Chandigarh.
- BURIJ, G.I. (1979): Niznetriasovye konodonty Juzhno-go Primorja.- Nauka, Moskva 143 p.
- KOZUR, H. (1990): The taxonomy of the gondolellid conodonts in the Permian and Triassic.- Cour. Forsch.-Inst. Senckenberg, 117, 409-469.
- KOZUR, H. (1994): *Chengyuania*, a new name for *Pseudogondolella* KOZUR, 1988 (Conodonta) non *Pseudogondolella* YANG, 1984 (hybodont fish teeth).- Paläont. Z., 68/3-4, 529-530.
- KOZUR, H. (in press a): Aspekte der Wende Perm/Trias.- In: HAUSCKE, N & WILDE, V. (eds.): Europa am Beginn des Erdmittelalters. Wissenschaftlicher Verlag Dr. Friedrich Pfeil, München.
- KOZUR, H. (in press b): The correlation of the Germanic Buntsandstein and Muschelkalk with the Tethyan scale.- International Symposium on the Epicontinental Triassic, Abstracts, Halle.
- KOZUR, H., KRÄNER, K. & MOSTLER, H. (1997): *Neospathodus sosioensis* n.sp., a new conodont species from the late Olenekian (uppermost Scythian) of western Sicily, Italy.- In: YAO, A. (ed.): Proceedings of the Fifth Radiolarian Symposium. News of Osaka Micropaleontologists, Spec. Vol., 10, 109-113, Osaka.
- KOZUR, H., KRÄNER, K. & MOSTLER, H. (in prep.): Biostratigraphy and facies of the Lower Triassic to middle Anisian slope to basin sequence south of Pietra dei Saracini SW of Palazzo Adriano, Sosio Valley (western Sicily).- Will be submitted to Geol. Croatica.
- KOZUR, H. & MOSTLER, H. (1970): Neue Conodonten aus der Trias.- Ber. nat. med. Ver. Innsbruck, 58, 429-464.
- McTAVISH, R.A. (1973): Triassic conodont faunas from western Australia.- N. Jb. Geol. Paläont. Abh., 143/3, 275-303.
- MOSHER, L.C. (1968): Triassic conodonts from western North America and Europe and their correlation.- J. Paleont., 42/4, 895-946, Tulsa.

Stage/Substage		Ammonoid Zone/Subzone		Conodont Zone				
M I D D L E A n i s i a n T R I A S S I C	Illyrian	Kellnerites felsoeoersensis	K. felsoeoersensis L. pseudohungaricum	Neogondolella mesotriassica				
		Paraceratites trinodosus	Asseretoc. camunum	Neogondolella constricta				
			Semiorn. aviticus					
			Schreyerites abichi	Paragondolella bifurcata				
	Pelsonian	Schreyerites binodosus		N. shoshonensis	Nicoraella germanica- N. kockeli			
		Balatonites balatonicus	B. balatonicus					
			B. shoshonensis					
	Nevadisculites taylori							
	Bythinian	Aghdarbandites ismidicus		Paragondolella bulgarica		Nicoraella germanica-		
		NICODESMITES OSMANI						
		Lenotropites caurus						
		Silberlingites muelleri						
	Aegean	Pseudokeyserlingites guexi		Neogondolella ? regalis				
		Japonites welteri		Chiosella timorensis				
	L O W E R T R I A S S I C = S C Y T H I A N	Late Olenekian (Spathian)	Neopopanoceras haugi		Chiosella gondolelloides			
			Triassospathodus sosioensis					
Prohungarites-Subcolumbites			Triassospathodus triangularis					
Procolumbites			Triassospathodus homeri					
Columbites parisianus			Icriospathodus collinsoni					
Tirolites cassianus		Triassospathodus hungaricus						
Early Olenekian (Smithian)		Anasibirites kingianus		N. waageni - Scythogondol. milleri				
		Flemingites flemingianus			N. waageni - Scythogondolella meeki			
					Chengyuania nepalensis			
Gandarian (Dienerian)		Prionolobus rotundatus		Neospathodus dieneri				
	Pleurogyronites planidorsatus		Sweetospathodus kummeli					
Gangetian			Clarkina postcarinata					
	Ophiceras tibeticum			C. carinata	Hindeodus postparvus - Hindeodus sosioensis			
				Isarcicella isarcica				
	Otoceras woodwardi-Ophiceras bandoi		Hindeodus parvus					
	Otoceras fissisellatum	T. pascoei						

Fig. 1 Lower Triassic and Anisian ammonoid and conodont zonations.

- ORCHARD, M.J. (1995): Taxonomy and correlation of Lower Triassic (Spathian) segminate conodonts from Oman and revision of some species of *Neospathodus*.- *J. Paleont.*, 69/1, 110-122, Lawrence.
- SWEET, W.C. (1970): Uppermost Permian and Lower Triassic conodonts of the Salt Range and Trans-Indus Ranges, West Pakistan.- In: KUMMEL, B. & TEICHERT, C (eds.): Stratigraphic boundary problems: Permian and Triassic of West Pakistan. University of Kansas, Department of Geology, Spec. Publ., 4, 207-275, Kansas.
- YANG, S., WANG, X. & HAO, W. (1984): New knowledge of the Lower Triassic of Zoudeng, Tiandong county of Guangxi province.- In: Contribution to the 60th anniversary of Professor Yue Senxun being engaged in geology and education, 105-108, Geological Publishing House, Beijing (in Chinese).

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