

DISCUSSION

COMMENTS ON: A REVIEW OF THE EVOLUTION, BIOSTRATIGRAPHY, PROVINCIALISM AND DIVERSITY OF MIDDLE AND EARLY LATE TRIASSIC CONODONTS

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CHEN *et al.* (2016) reviewed and re-evaluated the taxonomy, diversity, evolutionary lineages and stratigraphical distributions of Middle and early Late Triassic conodonts. A total of 24 genera were assigned to 2 families and 7 subfamilies. In that paper, the family Gladigondolellidae was described as monotypic, consisting of the subfamily Gladigondolellinae. Within the family Gondolellidae, new views were presented concerning the subfamilies Cornudininae, Epigondolellinae, Neogondolellinae, Novispathodinae, Paragondolellinae and Pseudofurnishiinae. The latter, which is synonymous with Sephardiellinae, comprises the genera *Pseudofurnishius*, *Sephardiella* and *Mosherella*, and forms an important lineage that characterizes the interval of the late Anisian to earliest Julian. *Pseudofurnishius murcianus* van den Boogaard, 1966 plays an important role in defining the extent of the Sephardic province (Hirsch 1972). While *Pseudofurnishius* was originally restricted to the Southern Tethys, *Sephardiella* and *Mosherella* achieved a worldwide distribution, thus having significant importance in establishing the biostratigraphy and palaeobiogeography of this period.

Here we highlight some differences of opinion with the work by Chen *et al.* (2016) concerning: (1) biostratigraphical ranges at the specific level within the genus *Pseudofurnishius*; (2) biostratigraphy, age and palaeobiogeography of ammonoids, in particular of the genus *Eoprottrachyceras*; and (3) systematics and nomenclature of the subfamily Sephardiellinae.

DISCUSSION

Sephardiella truempyi

Chen *et al.* (2015, p. 9) discussed the close stratigraphical ranges of two distinct species they assigned to the genus *Budurovignathus*: *B. hungaricus* and *B. truempyi*.

Metapolygnathus hungaricus (Kozur & Vegh in Kozur & Mock, 1972) was described from the lower part of the Longobardian of the Balaton Plateau (Hungary). There are, however, no grounds for a specific separation between '*M.*' *hungaricus* and '*M.*' *truempyi* Hirsch, 1971, as even Kozur 1974 wrote that the close relation and flowing passage between them make any delimitation difficult. This fact led Carillat *et al.* (1999) to regard '*Cari-nella*' *hungarica* as a junior synonym of '*C.*' *truempyi*. Bagnoli *et al.* (1985) claimed that '*Epigondolella*' *truempyi* was indicative of the upper Curionii Zone (upper part of the Fassanian) in north-western Sardinia: at Punta del Lavatoio, near Alghero, and at Contrada Renuzzo, south-east of Monte di Santa Giusta. Cherchi & Schroeder (1985) quoted Bartusch (1985), who in two intervals on the Monte di Santa Giusta identified *Metapolygnathus truempyi*, known from the upper part of the Fassanian of Provence (southern France), and *Metapolygnathus hungaricus* from the lower part of Longobardian of the Balaton Plateau (Hungary). According to Cherchi & Schroeder (1985), 'Bartusch has shown at the Monte Santa Giusta that the ranges of *M. truempyi* and

M. hungaricus overlap considerably, so that the two species do not seem to be always suitable for identifying the boundary between Fassanian and Longobardian'. In fact, in this paper it is demonstrated that the two species should be considered as synonyms. Species identified from Monte di Santa Giusta are *Gondolella constricta* (Mosher & Clark, 1965), *Carinella truempyi* and *Carinella japonica* (Hayashi, 1968). Kovacs & Kozur (1980) considered *Carinella truempyi* to be the index fossil of the Truempyi-range-Zone.

The morphological similarity between *hungaricus* and *truempyi* was noted by Chen *et al.* (2016), as was the similarity in their stratigraphical ranges. Since *hungaricus* and *truempyi* are the same species, they have the same range within the upper Curionii and lowermost Gredleri Zones. The references cited make it clear that *truempyi* appears in the Curionii Zone of the Fassanian (Kovacs & Kozur 1980; Bagnoli *et al.* 1985), and may range into the lowermost Longobardian, but not into the upper Longobardian (Kovacs & Kozur 1980).

Coincidence of *S. truempyi* with *constricta* and *japonica* indicates an upper Fassanian age for *truempyi* in the Monte di Santa Giusta section (Carillat *et al.* 1999).

Finally, the alleged palaeogeographical preferences make no sense, since *Sephardiella truempyi* occurs in the Southern Alps (Brack *et al.* 2005), Briançonnais (Baud *et al.* in press), the Catalan Pyrenees (Plasencia 2009), Sardinia (Carillat *et al.* 1999) and South China (Leherman *et al.* 2015). According to Assereto & Monod (1974), the Tarasci section (Turkey) ranges from early to late Ladinian (Hirsch 1977). Concerning the generic attribution, we follow the opinion of Sudar (1989).

Israelites

The ammonite genus *Israelites* was identified and defined by Parnes 1962 in the lower Ladinian of Ramon (Israel), together with *Eoprotrachyceras curionii ramonensis*, and it has never been cited in upper Ladinian (see Parnes 1962; Assereto & Monod 1974; Parnes 1986; Goy 1995; Pérez-Valera 2005; and Pérez-Valera 2015, among others). On the other hand, the presence of the genus *Protrachyceras* (at this systematic level) does not imply a late Ladinian age. For example, *Protrachyceras margaritosum* (Mojsisovics, 1882) indicates the later part of the early Ladinian in Tethys Province (see Balini *et al.* 2010). In Tarasci (Turkey), Assereto & Monod (1974) collected the ammonites *Thanamites* sp., *Iberites* sp., *Protrachyceras* cf. *archelaus* (Laube, 1865) and *P. cf. ladinum* (Mojsisovics, 1882), and the bivalve *Daonella lommeli* (Wissmann, 1841), in a horizon higher than the level with *Israelites*. This last association (that does not include *Israelites*) would be compatible with a late Ladinian age.

Eoprotrachyceras curionii

'The presence of *Eoprotrachyceras curionii* in Spain is questionable because similar ... ammonoids ... with which it may be confused ... range well into the late Ladinian (LK unpub. data)' (Chen *et al.* 2016, p. 11).

Initially Schmidt 1935 identified two specimens of *Eoprotrachyceras curionii* (Mojsisovics, 1882) in Spain (Menorca Island) and more recently, another one from Menorca was figured by Goy (1995). In the Iberian Peninsula, Goy *et al.* (1996) identified this species for the first time in the Calasparra Section (Betic Cordillera, Southern Spain). Later, seven specimens assigned to *E. curionii ramonensis*, were studied and four figured by Pérez-Valera (2005) from this same section. In a short stay in Zurich in 2006, one of us (JAPV) under the supervision of Dr Peter Brack (Swiss Federal Institute of Technology) and Prof. Hugo Bucher (University of Zurich) examined some of these specimens and compared them with alpine forms of *E. curionii* stored in the Zurich Palaeontological Institute. The conclusion was that there are only a few intra-specific differences between Alpine and Sephardic forms of *E. curionii*.

Recently, Pérez-Valera found 26 specimens of *E. curionii* in southern Spain. These are figured in Pérez-Valera (2015). In this study it appears that, due to morphological characters of the shell (relatively big size, moderately involute and ceratitic suture line with few elements), *E. curionii* cannot be confused with other upper Ladinian trachyceratid ammonites that are present in the Sephardic Province. For example, in *Protrachyceras hispanicum* (Mojsisovics, 1882) is smaller, more compressed, and its suture line is clearly subammonitic. Moreover, there is no doubt that the *E. curionii* specimens illustrated by Pérez-Valera (2005, 2015) from the Calasparra and other sections, are older representatives of the *Eoprotrachyceras* genus, and its chronology must necessarily be lower Ladinian as indicated by Brack *et al.* (2005). Therefore, the presence of *Eoprotrachyceras curionii* in Spain has been corroborated.

On the other hand, several zones are present in the Calasparra section, the Curionii Zone being the lowest (Pérez-Valera 2005, 2015). This section encompasses at least 10 carbonate levels that yield ammonoids and nautiloids (Pérez-Valera *et al.* 2016), among them several levels belonging to the Curionii Zone, containing *Israelites ramonensis* Parnes, 1962, *Negebites zaki* Parnes, 1962, and the first appearance of *Eoprotrachyceras curionii*. Pérez-Valera (2005) initially recorded the presence of *Paraceratitoides brotzeni* (Avnimelech, 1978), indicative of the Brotzeni Zone below the Curionii Zone, with specimens classified as var. *compressa* (Parnes, 1975). However, later findings revealed these to belong to *Israelites ramonensis*, a species belonging irrefutably in the Curionii Zone

(Pérez-Valera 2015). At Seydischir, Fassanian-aged strata containing *Israelites ramonensis* are present in the Tarasci Formation (Assereto & Monod 1974). Krystyn & Tatzreiter (1991) referred to a possible *Gevanites* of Longobardian age.

A summary of the ammonite biozones in the South Iberian Triassic, compared with the stratigraphical ranges of Ladinian conodonts in the Iberian Peninsula is shown in Figure 1.

Gevanites

‘They co-occur in Israel with the ammonoids *Israelites* and *Gevanites*, genera that are chronostratigraphically well constrained to the upper Ladinian in the Himalayas ... and Turkey ...’ (Chen *et al.* 2016, p. 11).

Israelites has never been cited from upper Ladinian strata, nor have most species of *Gevanites*. Only *Gevanites epigonus* Parnes, 1975 may occasionally range higher up and the Spanish species *G. archei* Goy, 1995, occurs stratigraphically higher in the upper Ladinian (Pérez-Valera 2015). Wang & He (1976) apparently wrote their book before having access to the publication of Parnes (1975), so they could not mention the taxon *Gevanites*. However, some specimens may belong to *Gevanites*, for example specimens 7 and 8 in their plate 12, the morphotypes of

which these authors assigned to *Israelites*. The alleged *Israelites kagangensis* Wang & He, 1976, and *I. minor* Wang & He, 1976, are from the Middle Formation of the Tulong Group (Wang & He 1976, pp. 314–316), generally Ladinian, without early or late Ladinian specification (Wang & He 1976, pp. 228–229). In their remarks about the genus *Israelites*, Wang & He (1976, p. 13, pl. 4, figs 1, 2) suggested that *Ceratites narsingha* Diener, 1908, from the Western Himalaya Spiti area, may be merged with the genus *Israelites*. In their comparison with *Israelites kagangensis*, judging from Diener’s (1908) description and figuration, *Ceratites narsingha* differs from the real *Ceratites*, and could be assigned to *Israelites*. Since the comparison was rendered difficult due to absence of a clear suture in the Spiti specimens, their more planar surface and lateral protuberances are remarkably similar to *Israelites kagangensis* Wang & He.

Pseudofurnishius murcianus

‘This genus ranges from the Ladinian to the lowest Julian ... Although *Ps. murcianus* is cited from the early Ladinian *Eoprotrachyceras curionii* zone of Spain ... we follow here the view of Ramovs (1977), Nicora (1981), and Gullo & Kozur (1991) who treat the species as late Ladinian.’ (Chen *et al.* 2016, p. 11).

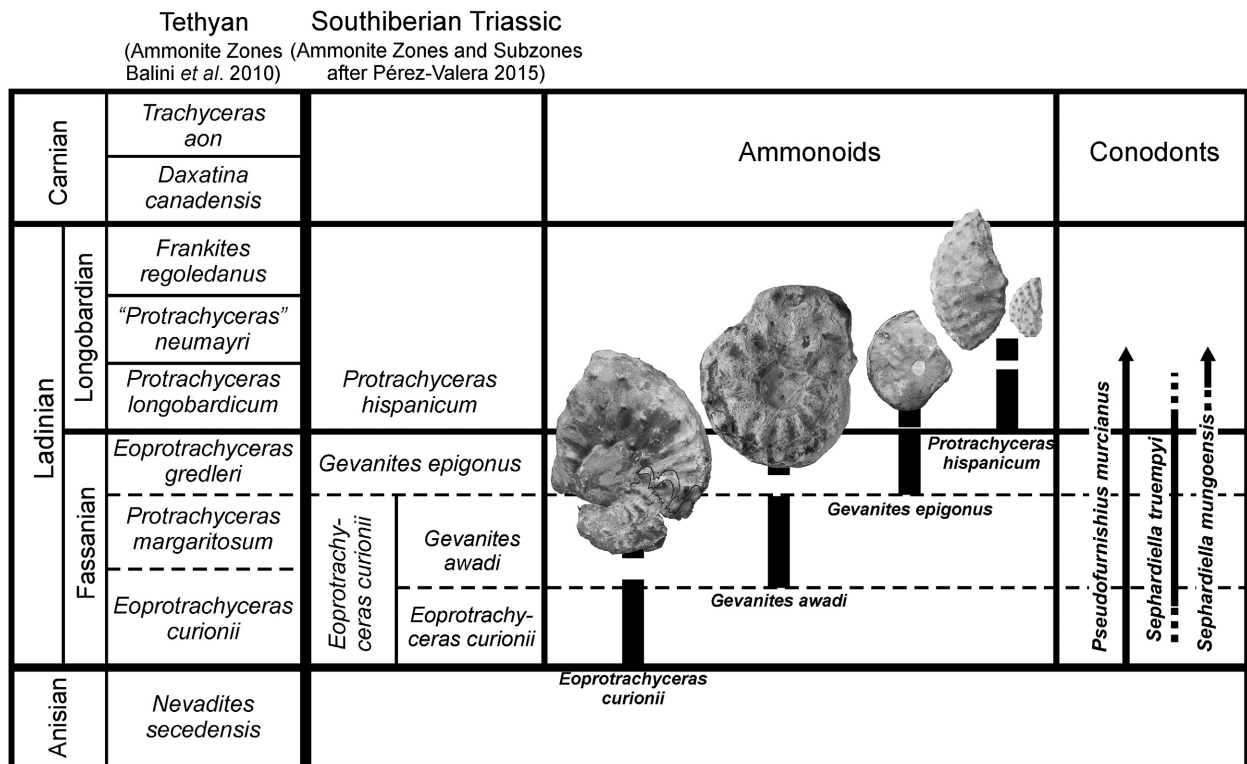


FIG. 1. Biostratigraphy of the Triassic in south-eastern Spain.

Nicora (1981) found *Pseudofurnishius murcianus* in levels of Longobardian–Cordevolian age in a level overlying an early Ladinian horizon with *Israelites ramonensis* (Assereto & Monod 1974, pp. 174–177). The presence of *P. murcianus* in late Ladinian localities (Ramovs 1977; Nicora 1981; Gullo & Kozur 1991; Plasencia 2009; Escudero-Mozo *et al.* 2015) is in agreement with the long biostratigraphical range of the species as proposed by Hirsch (1972), Hirsch & Gerry (1974) and Plasencia *et al.* (2015). Ramovs (1977, pp. 396–397) who discussed the age polemic of *P. murcianus* between Hirsch and Kozur, concluded that ‘It is likely that *Pseudofurnishius murcianus*-bearing strata already start in the early Ladinian (Fassanian), even if not yet confirmed palaeontologically.’ Such age confirmation is found at Calasparra, where *Pseudofurnishius murcianus* appears through the whole section that starts from the Curionii Zone and extends upwards into the Epigonus and Hispanicum zones. This indicates that *P. murcianus* clearly ranges from the early Fassanian to the late Longobardian and corroborates the findings in Israel and Jordan (Hirsch 1972; Hirsch & Gerry 1974; Bandel & Waksmundzki 1985).

The species *Pseudofurnishius huddlei* van den Boogaard & Simon, 1973 preceded *P. murcianus* in the evolutionary scheme of Chen *et al.* (2016), following the scheme of Gullo & Kozur (1991). According to Gullo & Kozur (1991) ‘*huddlei*’ lost its outer platform and gradually changed into *P. murcianus*. However, Gullo & Kozur (1991) provided no stratigraphical section or chart showing the number of specimens studied. Where there are large enough collections, such as those studied by Bandel & Waksmundzki (1985) and Plasencia *et al.* (2015), the gradual morphological variability within *P. murcianus* encompasses *P. ‘huddlei’*, which simply represents mature specimens of a single species: *P. murcianus*.

We also emphasize that not only are bi-platform elements found with mono-platform *murcianus* in the Fassanian, but they are also present at the top of the Ladinian or base of the Carnian (Bandel & Waksmundzki 1985), suggesting that the ranges of *murcianus* and ‘*huddlei*’ are almost identical.

Pseudofurnishius shagami

‘*Ps. siyalaensis* and *Ps. priscus* Sadeddin, 1990 were recently stratigraphically readjusted ... on the basis of a mere lithostratigraphic correlation ... We view the Ladinian age assignment of Sadeddin (1990) as better corroborated.’ (Chen *et al.* 2016, p. 11).

Due to the regional sub-Cretaceous denudation that prograded at a rate of 13 mkm⁻¹ in a SSE direction, Jurassic and older deposits are gradually truncated down

to the Precambrian basement. Moreover, the Dead Sea sinistral reverse fault has displaced the East bank by about 110 km to the north since Oligocene times (Druckman 1974; Hirsch 1998; Benjamini *et al.* 2005). As a result, to the west of the Dead Sea Rift (DSR), Early Cretaceous sandstones (Kurnub) rest unconformably directly on the Carnian at Makhtesh Ramon and on Anisian at Har Arif, while east of the DSR, the Kurnub clastics unconformably overly Carnian deposits at Wadi Zarqa, Ladinian deposits at Wadi Naur, and Anisian deposits at Wadi Hisban and Wadi Siyala. The samples with *Pseudofurnishius siyalaensis* Sadeddin & Kozur, 1992 and *Ps. priscus*, sampled in Wadi Siyala by Sadeddin (1990) are from the base of the Mukheiris Formation (= Gevanim Fm in the Negev). This Mukheiris Formation has a middle–late Anisian age (Bandel & Khoury 1981), yields late Anisian palynomorphs (Abu Hamad 2004; Abu Hamad *et al.* 2013) and directly underlies the Early Cretaceous unconformity. Consequently, the late Anisian to early Ladinian age assumed by Sadeddin (1990) and Sadeddin & Kozur (1992) overlaps with the late Anisian to Ladinian Iraq Al-Amir Formation, only exposed in Wadi Naur, where it is dated by different conodonts (Bandel & Waksmundzki 1985).

Subfamily PSEUDOFURNISHIINAE Ramovs, 1977

‘*Pseudofurnishius* ... is interpreted to have given rise to the Carnian segminate genera *Mosherella*, *Neocavitella* and *Misikella*. Here we follow Plasencia *et al.* (2007) in assigning these genera to one subfamily but use instead of their newly introduced Sephardiellinae the valid older term Pseudofurnishiinae ...’ (Chen *et al.* 2016, p. 6).

Sephardiellinae (Plasencia *et al.* 2007) was established as a subfamily within the family Gondolellidae, whereas the family Pseudofurnishiidae (Ramovs 1977) lies at the same taxonomical level as Gondolellidae. If placed within family Gondolellidae, the subfamily Pseudofurnishiinae (Chen *et al.* 2016) becomes thus the junior synonym of subfamily Sephardiellinae (Plasencia *et al.* 2007). An essential point to consider is that for Ramovs (1977) the genera *Pseudofurnishius* and *Sephardiella* (*Carinella*) were not considered on a par, as they are in subfamily Sephardiellinae, both descending from a common ancestor, as shown in the phylogeny of the subfamily by Plasencia *et al.* (2015).

The concept of Pseudofurnishiinae as used by Chen *et al.* (2016) is not equivalent to a transcription of Pseudofurnishiidae as used by Ramovs (monogeneric *Pseudofurnishius*). Perhaps a new name should have been suggested for the subfamily by Chen *et al.* (2016), but it is not synonymous with Sephardiellinae.

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