

RÉPLICAS DE ARTÍCULOS

NON-MARINE INVERTEBRATE TRACE FOSSILS FROM THE TERTIARY CALATAYUD-TERUEL BASIN, NE SPAIN. REPLY

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We thank the comments of Dr Calzada. We think that this kind of discussions is very healthy to the Paleontology and it would be necessary to do it more frequently, so that thanks again for your example. It is true that some of the descriptions of ichnofossils in our work need further discussion and comments, but when we analysed several poorly-preserved specimens (such as the so-called *Spongeliomorpha* isp.) we preferred to make a quick introduction and describe them in open nomenclature. It was beyond the scope of our paper to make a revision of the ichnogenus with this kind of material, but we hope that Calzada's comments and our reply will improve some ideas concerning the ichnogenus *Spongeliomorpha*.

1. It is true that we have forgotten to report in our (brief) introduction of the ichnogenus the work of Calzada (1981), who make a key revision of the type material of *Spongeliomorpha*. There was no place for a deep discussion because literature on marine *Spongeliomorpha* is abundant (e.g., Mayer, 1957, 1958; Kennedy 1967; Chiplonkar and Badve, 1970; Marcinowski and Wierzbowski, 1975; Richardson, 1975; Frey *et al.*, 1984; Bromley and Allouc, 1992; D'Alessandro and Bromley, 1995; Kim *et al.*, 1995; Asgaard *et al.*, 1997; Muñiz *et al.*, 1998; Ruffel and Wach, 1998) and problems of this ichnogenus are very extensive.

2. This is a point of disagreement. One ichnogenus can occur both in marine and continental environments. Its environmental occurrence is not a diagnostic character (ichnotaxobases) for defining ichnotaxons, but a consequence of their study. Different (bio)taxa can produce the same ichnotaxon, e.g. marine and non-marine *Cruziana* ichnospecies. Even for some simple trace fossils it is not possible to differentiate between marine and non-marine ichnospecies, such as *Planolites* and *Palaeophycus*. Therefore, the sentence "*Spongeliomorpha* proviene de ambientes continentales" (point 4) mixes diagnostic features and interpretations. In addition, the example of mixing insect nests with mollusc borings is not adapted to the situation, considering the big differences between both cases, such as *Celliforma* and *Gastrochaenolites*.

3. Concerning the interpretation of crustaceans as trace-makers of *Spongeliomorpha*, of course, we have found no crustacean remains within the trace fossil, but only organisms with a series of strong appendages can produce such scratches. Arthropods fit very well to this kind of organisms. In marine environments, crustaceans have been found in the ichnogenera *Thalassinoides* and *Ophiomorpha*,

which display gradual transitions to *Spongeliomorpha*. In our conclusions, we rather suggested insects as trace-markers for our *Spongeliomorpha* isp., so that it would be better to refer the ichnogenus to arthropods. On the other hand, regarding its development in 'firm substrates', fine scratch marks can be only produced in firm substrates. These marks are not imprints of a body surface, but scratch marks because it is a fossil burrow.

4. Yes, our figure 4B is very similar to *Spirographites ellipticus* Astre, 1937 (Mayoral and Calzada, 1998), but as well to *Oikobesalon* Thomas and Smith, 1998 and *Keilorites* Allan, 1927, described by Thomas and Smith (1998). Are they synonyms? We would need to determine the presence or absence of a wall in the specimen of Fig. 4B because *Spirographites* (*Keilorites*?) has it, but it was not easy to differentiate it and the material is, at present-day, housed in Spain.

In summary, we preferred to avoid a deep description of both specimens (named *Spongeliomorpha* isp.), because their degree of preservation was not optimal. It would be better to name them *Spongeliomorpha*? isp., and we would need better specimens of the area (that the two studied in our work) to go on clarifying the concept of this kind of trace fossils. The material is housed in the Museo Paleontológico of the University of Zaragoza and we will be very pleased to show the section of Terrer to Dr Calzada or other interested research workers in order to continue with our useful discussion in the field. For Alfred, it would be a new opportunity to see the Spanish blue sky, for Javier, to come back home.

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