

NOTA BREVE

A NEW DECAPOD BURROW SYSTEM FROM THE NW MEDITERRANEAN PLIOCENE

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ABSTRACT

A new ichnofossil, *Sinusichnus sinuosus* ichnogen. nov. ichnosp. nov., is described from the marine Pliocene of the northwestern Mediterranean. It is a branching burrow system comprising horizontal and regularly sinuous elements. It is interpreted as the feeding-dwelling burrow of a deposit-feeder crustacean. The new trace fossil is very similar in both configuration and function to the well-known ichnogenus *Thalassinoides*.

Key words: *Sinusichnus sinuosus*, burrow system, ichnology, Pliocene, NW Mediterranean.

RESUMEN

Se describe un nuevo icnofósil, *Sinusichnus sinuosus* ichnogen. nov. ichnosp. nov., del Plioceno marino del Mediterráneo noroccidental. Se trata de un sistema ramificado de galerías caracterizado por la sinuosidad y regularidad de los elementos que lo componen. Se interpreta como una estructura de habitación-alimentación de un crustáceo detritívoro. El nuevo icnogénero es similar a *Thalassinoides*, tanto morfológicamente como en lo que respecta a su funcionalidad.

Palabras clave: *Sinusichnus sinuosus*, sistema de galerías, icnología, Plioceno, Mediterráneo noroccidental.

INTRODUCTION

The NW Mediterranean Pliocene has been the subject of abundant publications dealing with paleontology and geology during the last twenty years (see Martinell, 1988 and Clauzon *et al.*, 1990 for further references). The outcrops are located in isolated marginal basins along the Catalan and French Mediterranean coast. The ichnological study of the marine units has been carried out recently (Gibert and Martinell, 1993, 1995a; Gibert 1995). As a result of this study, a new ichnotaxon, corresponding to a sinuous branching burrow system has been brought to light (Gibert and Martinell, 1995b). This new ichnofossil, *Sinusichnus sinuosus*, is very common in the Baix Ebre basin (NE Spain) and it is also present in the Baix Llobregat (NE Spain) and Var (SE France) basins (Fig. 1). So, it is a common and very characteristic trace fossil in the NW Mediterranean Pliocene.

The purpose of this paper is to describe and name the new ichnogenus and ichnospecies, and to offer a preliminary discussion on its construction, ethology and tracemaker identity.

SYSTEMATIC ICHNOLOGY

Sinusichnus ichnogen. nov.

Derivatio nominis: From the Latin *sinus* (curve, bend) and from the Greek *ikhnos* (trace, track).

Diagnosis: Horizontally developed burrow systems with sinusoidal elements and multiple branching.

Type-ichnospecies: *Sinusichnus sinuosus* ichnosp. nov.

Sinusichnus sinuosus ichnosp. nov.
Plate I, figs. 1-5

Derivatio nominis: From the Latin *sinuosus* (sinuous, winding).

Holotype: Specimen IC/034 (Plate I, fig. 1) hosted in the Paleontological Collection of the Facultat de Geologia (Universitat de Barcelona).

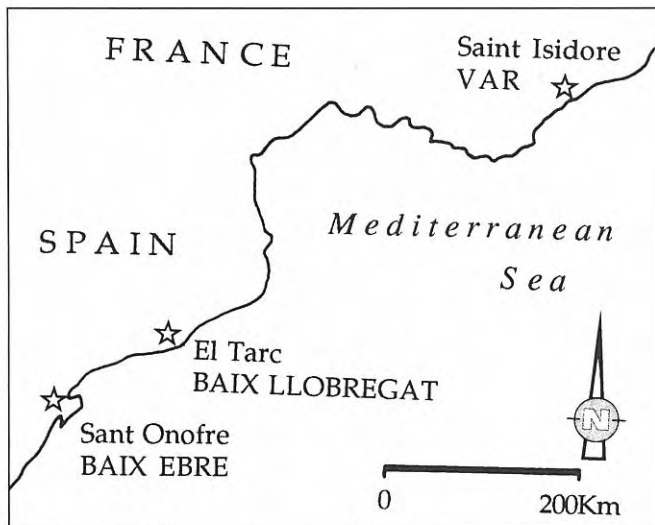


Figure 1. Geographic location of the three Pliocene outcrops (Saint Onofre, El Tarc and Saint Isidore) where *Sinusichnus sinuosus* ichnogen. nov. ichnosp. nov. has been found.

Paratypes: Specimens IC/025 to IC/033 and IC/035 to IC/037 hosted in the same collection as the holotype.

Type locality and stratotype: Sant Onofre (Baix Ebre basin). The outcrop is located at Km 9 of the road C-235 between L'Aldea and Tortosa (Tarragona province, NE Spain) on the ancient site of the Sant Onofre hermitage. Accurate descriptions of the stratigraphy of the outcrop can be found in Arasa (1990) and Gibert (1995). *Sinusichnus sinuosus* occurs in the Campredó Blue Clays Unit (*sensu* Arasa, 1990), specifically in its upper part corresponding to the Upper Sandy Clay Unit (*sensu* Gibert, 1995).

Other localities: *Sinusichnus sinuosus* has also been found in two other Pliocene basins in the NW Mediterranean margin. It is a common trace fossil in the El Tarc outcrop (Baix Llobregat basin) (specimens IC/015 to IC/024) located in the town of Molins de Rei (Barcelona province, NE Spain) and it occurs occasionally in the Saint Isidore outcrop (Var basin) placed in the Northern part of the city of Nice (Alpes-Maritimes department, SE France) (further details about basins and outcrops can be found in Gibert, 1995).

Diagnosis: The same as for the ichnogenus.

Description: *Sinusichnus sinuosus* is composed of sinusoidal tunnels showing frequent branching and very few

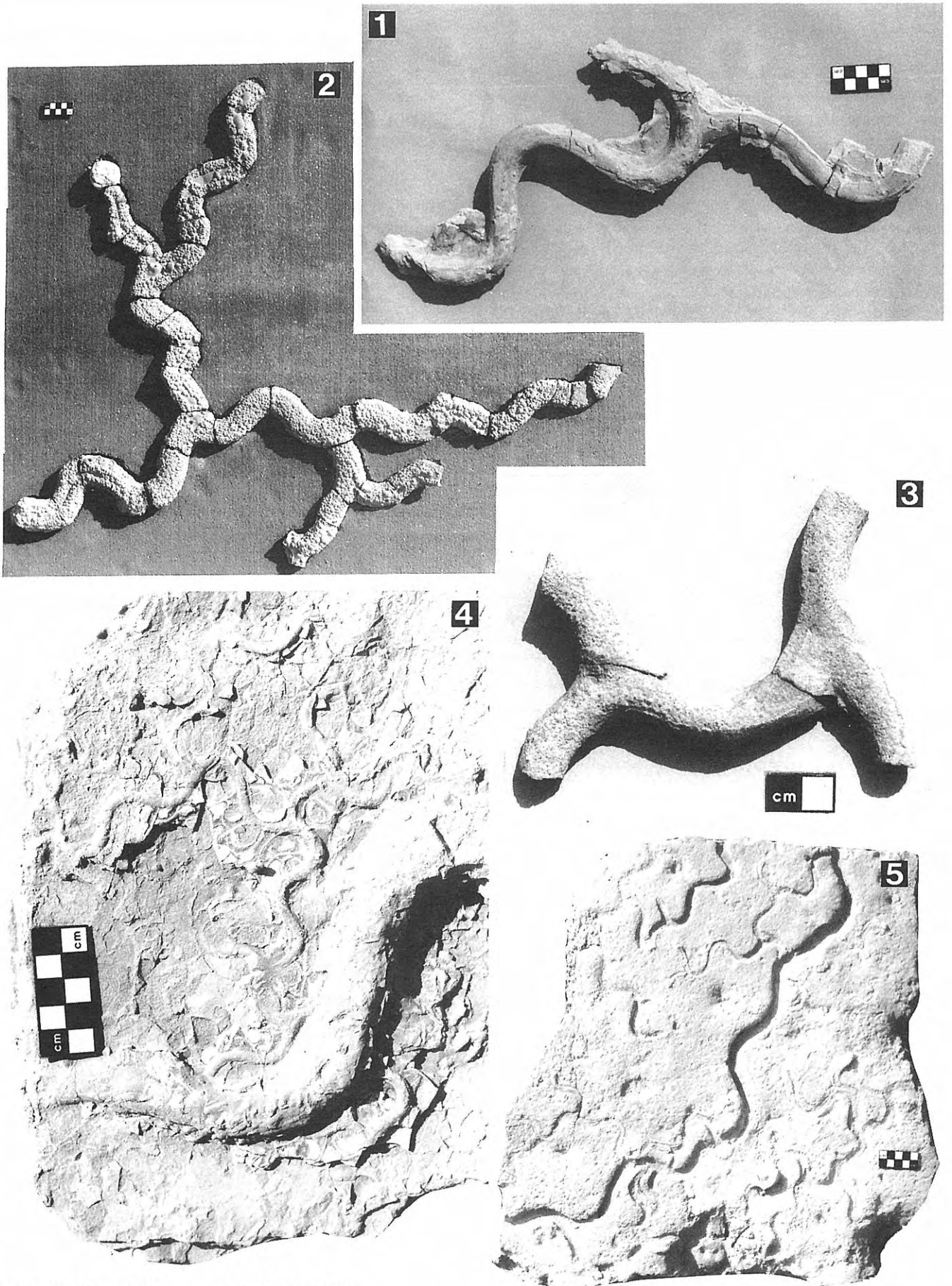
short shafts. The tunnels are regular sinusoids, irregular sinusoids or, more rarely, almost straight. The smallest specimens show a higher regularity. The regular sinusoids are common and show a very constant amplitude / wavelength ratio around 0.16-0.17. The amplitude ranges from 0.6 to 3.5 cm and the wavelength from 3.5 to 18.5 cm. The most frequent values are around 2.3 and 16 cm, respectively. Transversal sections are usually ovoidal, as a result of compression. Tunnel widths vary between 0.2 and 2.5 cm with the most common size around 1-1.5 cm. Diameter is constant in each burrow system. Branching is frequent in the horizontal elements. The most common branching points are constituted by three converging tunnels 120° distant from each other in a three-arm-helix-like configuration. Sometimes branching is less regular and up to four elements may converge. Simultaneous branching (*sensu* Bromley, 1990) is the most common but it may be obscured by the presence of spreiten. The spreiten are retrusive and sometimes indicate a small lateral displacement combined with the vertical migration. At the branching points, spreiten are unbranched and follow alternatively one or other of the converging tunnels. Because of this, the true branching resembles apparently false branching in spreiten-bearing specimens. The specimens from the Baix Llobregat do not show any spreiten but in most of the specimens from the Baix Ebre and the Var basins they are well-developed. Small networks never show any spreite. Walls are smooth and lack any evidence of a clearly biogenic lining. Only a diagenetic limonitic lining occurs. It is usually thin (1 mm) except in those burrows from the Baix Llobregat where it can be up to 1.5 cm thick. *Sinusichnus sinuosus* can be preserved as full reliefs or as hypo or epireliefs in sand layers.

Taxonomic discussion: *Sinusichnus sinuosus* is like *Thalassinoides suevicus* (Rieth, 1932), a horizontal network with multiple Y-branching points (Bromley and Frey, 1974), but tunnels in *T. suevicus* are mainly straight. Sinuous mazes with a similar configuration to *S. sinuosus* were figured by Frey *et al.* (1978) as *Ophiomorpha irregulaire* Frey, Howard & Pryor, 1978. The difference between these is the presence of a peculiar knobby lining in the latter. *Teichichnus flexuosus* (Schneider, 1962) is a horizontal sinuous spreite burrow but differs from *S. sinuosus* in being unbranched (Schneider, 1962; Fillion and Pickerill, 1990). *Cochlichnus* Hitchcock, 1858, another sinusoidal burrow, is also unbranched (Fillion and Pickerill, 1990). Finally, the small specimens of *S. sinuosus* very much resemble the graphoglyptid *Protopalaeodyction incompositum*, described by Książkiewicz

Plate I

Sinusichnus sinuosus ichnogen. nov. ichnosp. nov.

- 1 Bottom view of the holotype (specimen IC/034) from the Sant Onofre outcrop (Baix Ebre).
- 2 Branching system with thick diagenetic limonitic lining, from El Tarc (Baix Llobregat) (specimen IC/015). The knobby texture is diagenetic, not biogenic.
- 3 Specimen from El Tarc (Baix Llobregat) exhibiting clearly simultaneous branching (specimen IC/019).
- 4 Small network, showing high regularity, associated with a bigger *Sinusichnus* burrow, from Sant Onofre (Baix Ebre) (specimen IC/028, paratype).
- 5 Several burrow systems of different sizes, preserved as concave epireliefs on the top of a sand bed from the Sant Onofre locality (Baix Ebre) (specimen IC/035, paratype).



wicz (1970), but lack the short blind apical elements present in *Protopalaeodyction* (Książkiewicz, 1970).

Paleobiology and paleoenvironmental significance:

Sinusichnus sinuosus is very similar to *Thalassinoides* Ehrenberg, 1944 except for the sinuosity of the horizontal elements and hence, ethology and function of both ichnotaxa should have been the same or very similar. *Sinusichnus sinuosus* was the dwelling-feeding burrow of a deposit-feeder, which obtained food from excavation of new galleries and re-excavation of pre-existent ones producing spreiten. On the other hand, similarity between small *Sinusichnus* networks and the graphoglyptid *Palaeodyction* also suggest a behavioural resemblance. A trapping and/or gardening function, as suggested in graphoglyptids (Seilacher, 1977), could have been present in the burrows of, at least, the juvenile individuals that constructed small *Sinusichnus*.

As suggested from its similarity with *Thalassinoides* and *Ophiomorpha*, and also with present-day decapod burrows (Bromley, 1990), a deposit-feeder crustacean, probably a decapod, is the most feasible tracemaker for *Sinusichnus* burrows. The regularity of the elements indicates a highly specialized behaviour, maybe characteristic of a species or group of decapod species explaining its restricted stratigraphic and geographic distribution.

Sinusichnus sinuosus occurs in both shallow bay deposits -Baix Llobregat and Baix Ebre basins (Martinell and Domènech, 1984; Martinell and Marquina, 1984; Arasa, 1990; Gibert and Martinell, 1993; Gibert 1995)- and relatively "deep" ria deposits -Var (Irr, 1984; Gibert, 1995)-, always in rather quiet settings with clay deposition and event sedimentation of sands by turbiditic flows.

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