Short communication

*Sulcusina iberica* n. ichnogen., n. ichnosp., a new crustacean microcoprolite from the Upper Cretaceous of Spain

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**Abstract**

The new crustacean microcoprolite *Sulcusina iberica* n. ichnogen., n. ichnosp., is described from the Upper Cretaceous Alarcón Formation (?uppermost Cenomanian to ?lower Coniacian) of the Southern Iberian range. The new ichnogenus is characterized by rod-shaped bodies with parallel-running longitudinal canals (without interconnecting lines) of rounded transverse sections within the symmetry plane. Characteristic is the presence of a central longitudinal furrow (or canal) that extends to the middle of the microcoprolite, without any connection to the laterally grouped canals of usually lower diameter. The latter display a circular outline in transverse sections. *Sulcusina* n. ichnogen. can be compared to some extant with both *Helicerina* Brönnimann & Masse and *Lercarina* Senowbari-Daryan. The new microcoprolite occurs in monotypic grainstones together with some thin-walled miliolids and ostracods ascribed to a peritidal facies.

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1. Introduction

Internally structured crustacean coprolites are widely reported from Cretaceous shallow-water carbonates (Brönnimann and Masse, 1969; Vialov, 1978; Senowbari-Daryan and Grötsch, 1992; Senowbari-Daryan and Kuss, 1992; Fenninger and Hubmann, 1994; Blau et al., 1997; Senowbari-Daryan et al., 2009; Kietzmann and Palma, 2014). In the last decade, they have repeatedly been reported also from the neighborhood of hydrothermal vent systems (Bujtor, 2011, 2012). Although the ichnotaxonomy and glossary of terms for description are well established, the stratigraphic ranges of the individual ichnospecies are still poorly constrained (see compilation of Blau, 2013). A new ichnotaxon of crustacean microcoprolite, *Sulcusina iberica* n. ichnogen., n. ichnosp., is described from the Late Cretaceous Alarcón Formation in southern Spain.

2. Geological setting and age

2.1. Sampling site

Sample ALC-67, which contains the new ichnogenus, was retrieved form the uppermost part of the Alarcón Formation in its type section (stratotype according to Vilas et al., 1982), located close to the village of Alarcón (Cuena Province, Spain), in the gorges of the Júcar River (coords.: X: 578768; Y: 4378323; Z: 761. Time zone: 30) (Fig. 1). This site is located in the southernmost part of the Iberian Ranges, in the so-called La Mancha sector. Here, the lithostratigraphic unit is 36 m thick and consists of thinly bedded limestones and scarce marlstones (Muñoz-Moreno et al., 2015). As mentioned, the sampled strata are located in the upper part of the unit (Fig. 2), in the levels that reflect the gradational passage to the overlying Sierra de Utiel Formation, which also consists of limestones, but thicker bedded (Fig. 3).

2.2. Age of the Alarcón Formation

The Alarcón Formation is a regional unit that appears in both the southern part of the Iberian Ranges and the northern part of the Prebetic. It has quite homogeneous lithological and stratigraphic characteristics in all the area. Previous biostratigraphic and sequence stratigraphic works on this unit show that, despite its relatively small thickness, it comprises part of the uppermost Cenomanian, the Turonian and part of the Coniacian (Martín-Chivelet and Giménez, 1993). The unit is characterized by the presence of multiple paleosoil levels and reduced net sedimentation rates everywhere. On the basis of those regional works and
stratigraphic position, the sampled strata are attributed to the lower Coniacian.

2.3. Paleogeography and paleoenvironments

The Alarcón Formation was deposited in a very shallow carbonate marine settings, characterized by a mosaic of subenvironments (Fig. 3). These range from shallow subtidal to supratidal, and include vegetated areas, salt-marshes, restricted ponds, and protected lagoons. Typical subtidal deposits consist of peloidal wackestone or packstone and bioclastic facies, accumulated under low-energy conditions. Fossil remains include abundant but mostly poorly preserved green algae, gastropods, some rudists and other bivalves, as well as miliolids (often thin-walled forms) and other small benthic foraminifera (e.g., Cuneolina). Some levels are characterized by the abundance of the microproblematicum Thaumatoporella parvovesiculifera (Raineri). Ostracod and charophyte remains are also frequent (Muñoz-Moreno et al., 2014).

These shallow marine environments covered wide areas of the southwestern part of Iberia, in both the Iberian Basin and the Betic Continental Margin (Fig. 4). During the latest Cenomanian to early Coniacian interval, these areas were characterized by very low subsidence rates, related probably to the flexural response of the Iberian lithosphere to the opening (sea-floor spreading) of the Bay of Biscay (e.g., Martín-Chivelet et al., 2002).

3. Material and repository

The new microcoprolite was found in sample ALC 67, from which three thin-sections were prepared (ALC−67, −A, and −B). These are stored at the Bayerische Staatssammlung für Paläontologie und Geologie, Munich, under the official numbers SNSB-BSPG 2016 I 37 to 39.

4. Systematic description

Ichnofamily Favreinidae Vialov, 1978
Sulcusina n. ichnogen.

Type species: Sulcusina iberica n. ichnosp.
Derivatio nominis. Sulcus, Latin for fissure, crack; referring to the longitudinal furrow (or median canal).

Diagnosis. Rod-shaped coprolite, rounded to slightly oval in transverse sections (sometimes with a small concave dorsal depression), displaying a bilateral symmetric pattern of rounded shaped canals. In the symmetry plane, a comparably thick longitudinally furrow (or median canal), cylindrical to claviform in section, is present. Interconnecting lines or fissural spaces between canals or connections between the latter and the median furrow are absent.

Remarks. With its rounded transverse sections of the canals, Sulcusina can generally be compared with Favreina Brönnimann, but differs from it by its median furrow. Helicerina Brönnimann & Masse displays a median canal but of different shape expressed by its spine-like dorsal extension connected to the surface (Brönnimann and Masse, 1969; Schweigert et al., 1997). Moreover, the triangular or diamond-shaped canals in Helicerina are connected by a system of fissural spaces. Another form with a...
longitudinal canal connected to the surface is *Lercarina* Senowbari-Daryan with the type-species *L. tintinnicanalis* from the Early Permian of Sicily, Italy (Senowbari-Daryan, 1988). In *Lercarina* this canal is dividing into two side canals displaying small spine-like protrusions on both sides. There are no other canals except this dividing median canal. In conclusion, the morphology of the latter observed in *Sulcusina* is different from both *Helicerina* and *Lercarina* (Fig. 5).

*Sulcusina iberica* n. ichnosp.

Figs. 6–7

*Derivation nominis.* For its occurrence in the Iberian Basin of Spain, making up a large part of the Iberian Peninsula (or Iberia).

*Holotype.* The specimen illustrated in 6P; thin-section SNSB-BSPG 2016 I 37 (ALC 67).

*Paratypes.* Specimens in Figs. 6A–B, E–O, 7A–C, F–N.

*Horizon and locality.* Upper Cretaceous Alarcón Formation in its type-section located close to the village of Alarcón (Cuena Province, Spain), in the gorges of the Júcar River (coords.: X: 578768; Y: 4378323; Z: 761. Time zone: 30) (Fig. 1).

*Diagnosis.* See diagnosis of the monotypic ichnogenus.

*Description.* *Sulcusina iberica* is a rod-like microcoprolite represented by different random sections. Transverse sections are rounded to slightly oval. In some specimens a shallow concave depression can be observed at the entrance of the median canal. The microcoprolite is homogeneous micritic without showing any further differentiation of the material/texture (e.g., “ventral cap”). Twenty longitudinal canals are observed. The number of canals is always constant independently from the size of the microcoprolite. They display circular transverse sections without showing any connections to adjacent canals and are arranged in bilateral symmetry. Eight canals (four on each side) are arranged in a straight
line, parallel and close to the median furrow. The diameter of the canals is variable (see dimensions), but within the same microcoprolite rather constant. The median rows of canals are straight, whereas the exterior ones follow more or less the outline of the microcoprolite.

**Dimensions.**

Diameter: 0.18–0.4 mm (mostly around 0.3 mm)  
Length: up to 0.8 mm.  
Diameter of canals: 0.015–0.03 mm  
Width median furrow: 0.015–0.1 mm (mostly around 0.03 mm)

**Remarks.** Number of canals is always constant independently from the size of the microcoprolite. Note that this ichnospecies may display ontogenetic development with number of canals increasing with diameter (e.g., *Favreina belandoi* Fels, 1997).

5. **Conclusive remarks**

The new ichnotaxon of crustaceous microcoprolite, *Sulcusina iberica* n. ichnogen., n. ichnosp., is described from the Upper Cretaceous Alarcón Formation of the southern Iberian Basin and the northern part of the Prebetic (Spain). With its median canal it can be compared with *Helicicina Brönnimann & Masse and Lercaria Senowbarg-Daryan. Sulcusina iberica* n. ichnogen., n. ichnosp. appears in marginal carbonate platform environments at the upper levels of the Alarcón Formation (shallow subtidal to supratidal), which gradually passes to the Sierra de Utiel Formation (shallow subtidal), reflecting a gradual marine transgression.

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**References**

Favreina belandoi Fels, 1997).