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## **A new ichnospecies of *Asteriacites* from the Triassic of Tarragona (Spain)**

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*ABSTRACT.- A new ichnospecies named Asteriacites obtusus is described from Triassic beds of the Alcover's Stone ("Pedra d'Alcover") between the villages of Mont-ral and Alcover (Tarragona province, Spain). This new ichnospecies increases the diversity of the rich fauna which has been found and described in this outcrop and also constitutes the first record of this ichnogenus in the Spanish late Triassic. A possible inclusion in the new ethological group Thanatoichnia proposed by Martins-Neto & Gallego (2006) is suggested.*

*RESUMEN.- Se describe una nueva icnoespecie de Asteriacites. Se llama Asteriacites obtusus y procede de las capas del Ladinense de la "Pedra d'Alcover", entre las localidades de Mont-ral y Alcover (Provincia de Tarragona). La nueva icnoespecie aumenta la diversidad de la rica fauna de este yacimiento y es la primera cita de este icnogénero en el Triásico superior español. Se sugiere una posible inclusion en el nuevo grupo etológico Thanatoichnia propuesto por Martins-Neto & Gallego (2006).*

**KEY WORDS** – Paleontology, ichnology, *Asteriacites*, new ichnospecies, trace fossil, Thanatoichnia, Triassic, Ladinian, Spain.

### **INTRODUCTION**

*Asteriacites* is an ichnogenus, preserved from the Cambrian to Recent, in marine facies. This star-shaped ichno is interpreted as the infillings of shallow excavations or as resting traces made by asterozoans. After sedimentological data, here this ichnogenus comes from an hypersaline environment. So, another hypothesis for the origin of this ichnospecies is suggested.

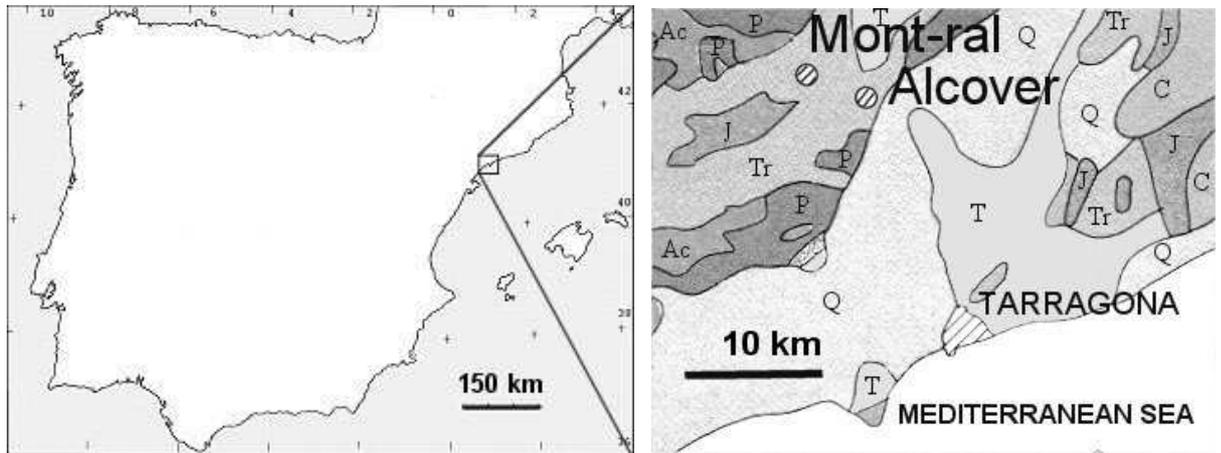


Fig. 1. Location of the deposit in the Iberian peninsula, and geologic regional map. Q: Quaternary. T: Tertiary. C: Cretaceous. J: Jurassic. Tr: Triassic. P: Paleozoic. Ac: Acidic plutonic stones.

## SEDIMENTOLOGICAL SETTING

The Alcover's stone (= Pedra d'Alcover) from Triassic (230-227 Ma) has given an abundant fauna very rich in fishes, cephalopods, reptilia, decapoda, cnidaria etc. This outcrop can be considered as a paradigm of the best deposits of Spain (Calvet, & Trucker, 1995). Its lithology is clearly marine (dolomitic). There are singular taxa and their excellent conservation is explained by the taphonomy. This checklist fauna is registered by Beltan et al. (1989). The presence of holothurians, jellyfishes, limulids, fishes and also insects is pointed out.

According to Esteban et al. (1977) the "Alcover's stone" is a laminated dolomitic. The uniformity of the lamination, the fine-grained, the absence of general structures type ripple and eudrehal halite crystals, suggest a depositional ambient very calm and hypersaline. Also, these authors suggested the following depositional sequence:

- 1.- The "Alcover's Stone" was deposited in a deep basin, calm down and anoxic, affected by sporadic currents (of density?) and evolving to hypersaline conditions (fig.2).
- 2.- It settled among preexisting depressions due to former bioherms reef (fig. 2).
- 3.- The deposit was caused for decanting from muddy suspensions.

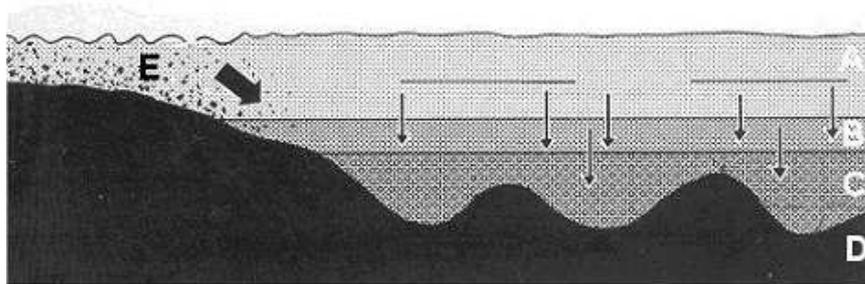


Fig 2. Sedimentologic interpretation. After Esteban et al. (1977). A: Normal salinity. B: Increasing salinity. C: Hypersalinity. D: Bioherms. E: Terrigenous and dolomicritic supply.

## SYSTEMATIC ICHNOLOGY

Ichnogenus *Asteriacites* von Schlotheim, 1820

*Type species.*—*Asteriacites lumbricalis* von Schlotheim, subsequent designation by Seilacher (1953, p. 93).

1975 *Asteriacites* Schlotheim 1820, Häntzschel, p. W42 (with synonymy)

*Diagnosis.*— Stellate trace fossils in the form of asteroid or ophiuroid echinoderms; often but not always transversely sculptured arms.

*Asteriacites obtusus* n. ichnosp.

(Plate 1, figs. 1-3)

*Taxonomic remarks* – The holotype is the figured epirelief specimen (Plate 1, fig.1 ) and stored in the Geological Museum of Seminary of Barcelona (= MGSB), with the number 26498. It comes from Ladinian of Alcover-Mont-ral, (Tarragona province, Spain). Its name was taken from Latin *obtusus* referring to the arms which end in a blunt form.

*Diagnosis.*- *Asteriacites* starfish-shaped, with thick and relatively short arms, ending in an obtuse form. Their surface are smooth.

*Material and measurements* – Three slabs were picked up for separates, so the slabs would be able to belong to different beds but from the same layer. The holoype (*vide supra*) and also two the paratypes registered with the number 26497 (Plate 1, fig. 2, epirelief) and the 77472 (Plate 1, fig. 3, hyporelief) are been studied

To interpret the data in the table is advisable to consult the fig.3.

Specimen	Radius (R)	Maximum width of the	Coefficient w/R	Radius of
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		arms (w)		central zone (r)
26498	15,00	7,50	0,5	7,50
26497	15,00	7,50	0,5	7,50
77472	12,50	-	-	-

Table. 1 . Biometric data in mm (see fig. 3).

The radius is measured from the center of the fossil to the end of the arms. The maximum width of the arms is in the proximal part. The length and maximum width of the arms are similar.

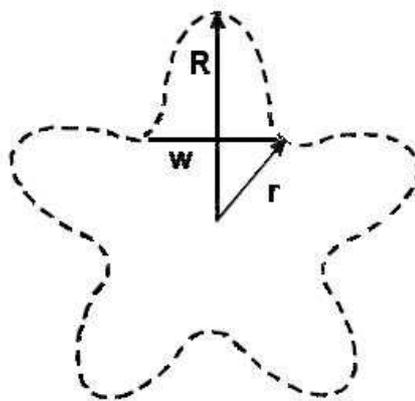


Fig. 3. Idealized outline in *Asteriacites obtusus*.

*Description* – Starfish-shaped, preserved in concave epirelief and convex hyporelief with five arms projecting from a wide central zone. This central zone has an irregular sink in the center, in case of the concave epirelief, or a central small and irregular knob in case of the convex hyporelief. The width of the arms decreasing weakly distally. The arms are thick and short: The maximum width of the arms is 1/2 of the radius of the fossil and its length is about half of the fossil radius. The arms ending in a obtuse form and the entire surface is smooth.

*Taphonomic interpretation* - Figure 4 shows a taphonomic interpretation of *Asteriacites*. The origin of the specimens 26498MGSB (Plate 1, fig. 1, holotype, epirelief) and the specimens 26497MGSB (Plate 1, fig. 2, ParaType, epirelief) corresponds to fig. 4-3b, and the specimens 77472MGSB (Plate 1, fig. 3 hyporelief) to the figure 4-3a. The epireliefs provide more morphological information than hyporeliefs.

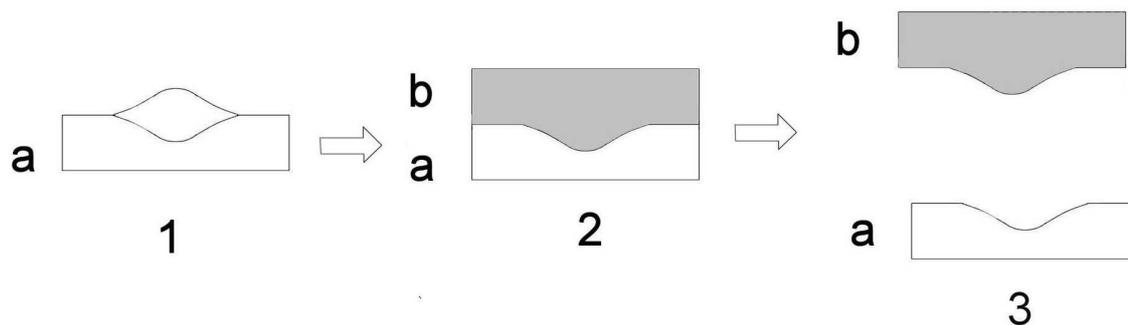


Fig. 4.- (a) On a dolomitic muddy bottom an asterozoan makes a resting trace (1a, 2a, 3a). Later the dolomitic - terrigenous supply makes a mold or epirelief (2b-3b).

*Different from other species* – There is not possible confusion with other ichnospecies. However, succinct diagnosis of the other ichnospecies are given below. The following data were taken partly from Sequeira et al. (2005).

*Asteriacites lumbricalis* Schlotheim, 1820. Arms vermiform relatively narrow.

*Asteriacites quinquefolius* Quenstedt, 1876. Arms would look "hairy". It looks generally the larger form with broader arms.

*Asteriacites stelliforme* (Miller & Dyer, 1878). The arms are ornamented with irregular and regular striations, closely spaced and arranged in chevron, pointing to the interior.

*Asteriacites gugelhupf* Seilacher, 1983. Five arms with conical shape and a median groove in each arm (the shaped evokes a german cake).

*Asteriacites aberensis* Crimes & Crossley, 1991. Small prints star-shaped with large central area comparable to the length of the radius.

*Discussion* - *Asteriacites* is generally classified as resting traces (Cubichnia) of ophiuroids or asteroids (Seilacher 1953). We have not found morphological evidence to deduct an ophiuroid as producer of this trace fossil, like features reflecting the anatomy or slender and vermiform arms.

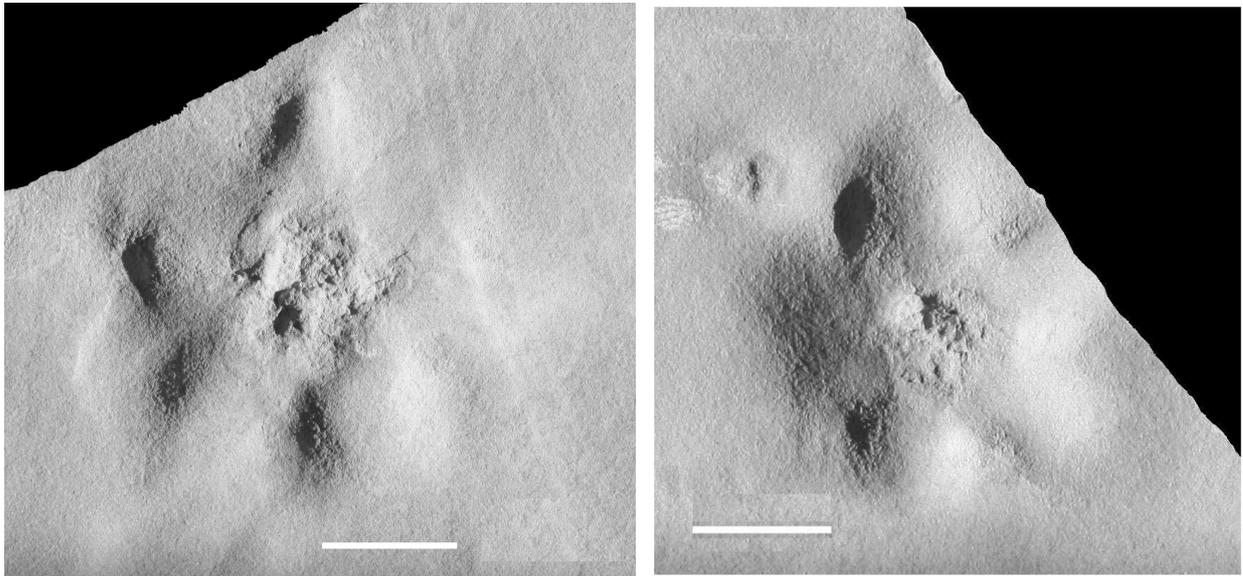
There is the conventional view about *Asteriacites* like an indicator of normal marine salinity. Some studies of these organisms point out to tolerate reduced salinities, but not fresh water (Ladd 1951; Segerstrale 1957). However, owing to the depositional environment of the specimens, with high salinity (*vide supra* in geological context), it can be assumed that certain asterozoans, were trapped in this hypersaline environment and could have been responsible of *Asteriacites obtusus*.

Another possible hypothesis about the origin of this ichnospecies would be a deposition and sudden death due to the anoxic hypersalinity. So the proposed new term Thanatoichnia (Martins-Neto & Gallego, 2006) would be consistent to *Assteriacites obtusus*.

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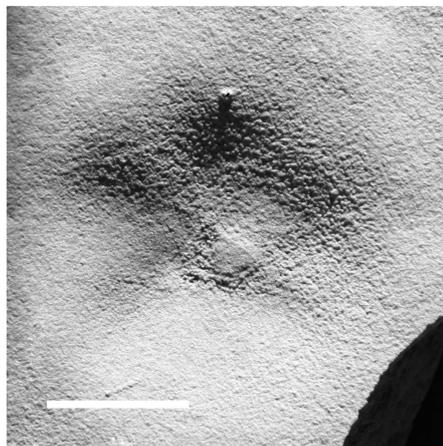
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2



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Fig. 1: *Asteriacites obtusus* n. ichnosp. 1 Holotype (26498MGSB), 2: Paratype (26497MGSB (epirelief) and 3: Paratype 77472MGSB (hyporelief). Scale bar = 1 cm.

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