

## Review of some Aptian ammonites collected by Gaston ASTRE in Lleida Province, Catalonia, Spain

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**Abstract:** We study the three best preserved ammonites collected by ASTRE in 1924-1925 in Lleida Province, Catalonia, Spain, in order to assess their taxonomic assignment. We also include images of these ammonoids since they were not illustrated in ASTRE's original 1934 work. This taxonomic review allows us to identify these lower Aptian ammonites as *Pseudohaploceras liptoviense*, *Deshayesites* sp. and *Dufrenoyia* sp.

**Key Words:** Ammonites; ASTRE; Aptian; Catalonia; Spain.

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**Résumé :** *Révision de quelques ammonites aptiennes récoltées par Gaston ASTRE dans la Province de Lérida (Catalogne, Espagne).*- Nous avons étudié les trois ammonites les mieux préservées parmi celles récoltées par ASTRE en 1924-1925 dans la Province de Lérida (Catalogne, Espagne) afin d'en ré-évaluer plus sûrement l'attribution taxinomique. Nous figurons ces ammonoïdes puisqu'il n'y avait aucune illustration dans la publication originale de ASTRE en 1934. Ce ré-examen taxinomique nous permet d'attribuer ces trois ammonites de l'Aptien inférieur à *Pseudohaploceras liptoviense*, *Deshayesites* sp. et *Dufrenoyia* sp.

**Mots-clefs :** Ammonites ; ASTRE ; Aptien ; Catalogne ; Espagne.

**Resumen:** *Revisión de algunos ammonites aptienses colectados por Gaston ASTRE en la Provincia de Lérida, Cataluña, España.*- Se estudian los tres ammonites mejor conservados colectados por ASTRE en 1924-1925 en la Provincia de Lérida, Cataluña, España, con la finalidad de mejorar su asignación taxonómica. También incluimos imágenes de estos ammonites ya que no se figuraron en el trabajo original de ASTRE, 1934. Esta revisión taxonómica nos permite identificar los ammonites del Aptiense inferior: *Pseudohaploceras liptoviense*, *Deshayesites* sp. y *Dufrenoyia* sp.

**Palabras clave:** Ammonites; ASTRE; Aptiense; Cataluña; España.

**Resum:** *Revisió d'alguns ammonits aptians recollits per Gaston ASTRE a la Província de Lleida, Catalunya, Espanya.*- S'estudien els tres ammonits millor conservats recollits per ASTRE en 1924-1925 a la Província de Lleida, Catalunya, Espanya, per tal d'avaluar la seva assignació taxonòmica. També s'inclouen imatges d'aquests ammonits ja que no s'il·lustren en l'obra original d'ASTRE del 1934. Aquesta revisió taxonòmica ens permet identificar aquests ammonits de l'Aptià inferior com: *Pseudohaploceras liptoviense*, *Deshayesites* sp. i *Dufrenoyia* sp.

**Paraules clau:** Ammonits; ASTRE; Aptià; Catalunya; Espanya.

### Introduction

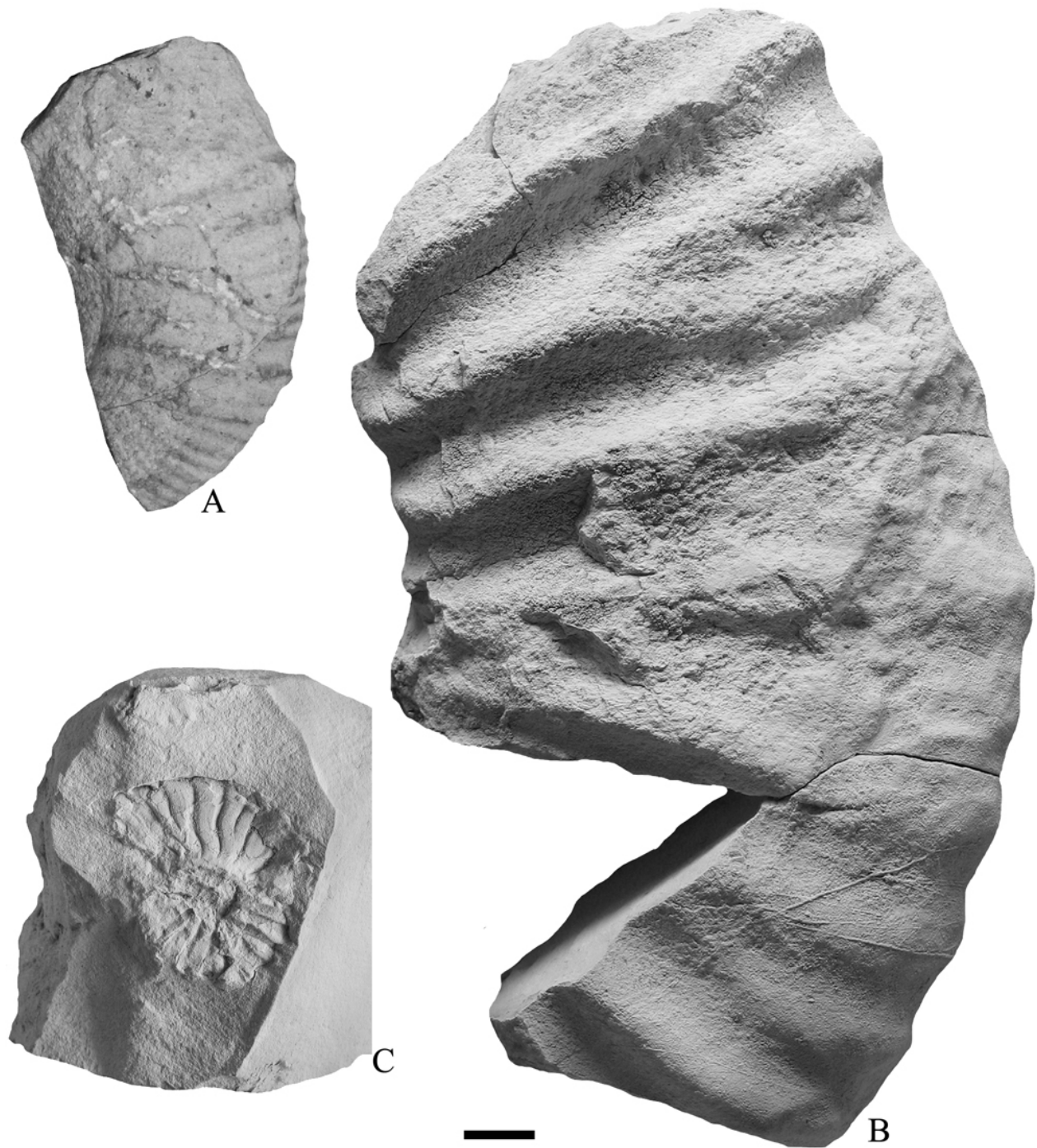
In 1922, under the supervision of Charles JACOB and Paul FALLOT, Gaston ASTRE began his doctoral studies of the geology along the south side of the Pyrenees (BILOTTE, 2010, p. 66; BILOTTE & ARAGONÈS, 2010, p. 28). During his field work in 1924 and 1925, he found some Aptian ammonites in the Segre River region, Lleida Province, Catalonia. Although he never completed his PhD (BILOTTE, 2010, p. 66), in 1934 he published a short paper describing two of these ammonites. However, he did not include any illustrations or figures to accompany

his detailed descriptions and comparisons with closely related taxa. Fortunately, these specimens are still housed in the collections of the Université Paul Sabatier of Toulouse, France (= UPS collection). We were able to locate ASTRE's published material, as well as two additional unpublished specimens. In this work, we review these four ammonites, three of which are illustrated for the first time. Our reexamination of these ammonites sheds light on the work of ASTRE (1934) and contributes to the general knowledge of the Aptian ammonites of Catalonia. Recently in one area of Lleida Province, the Organyà Basin, the stratigraphy, sedimen-

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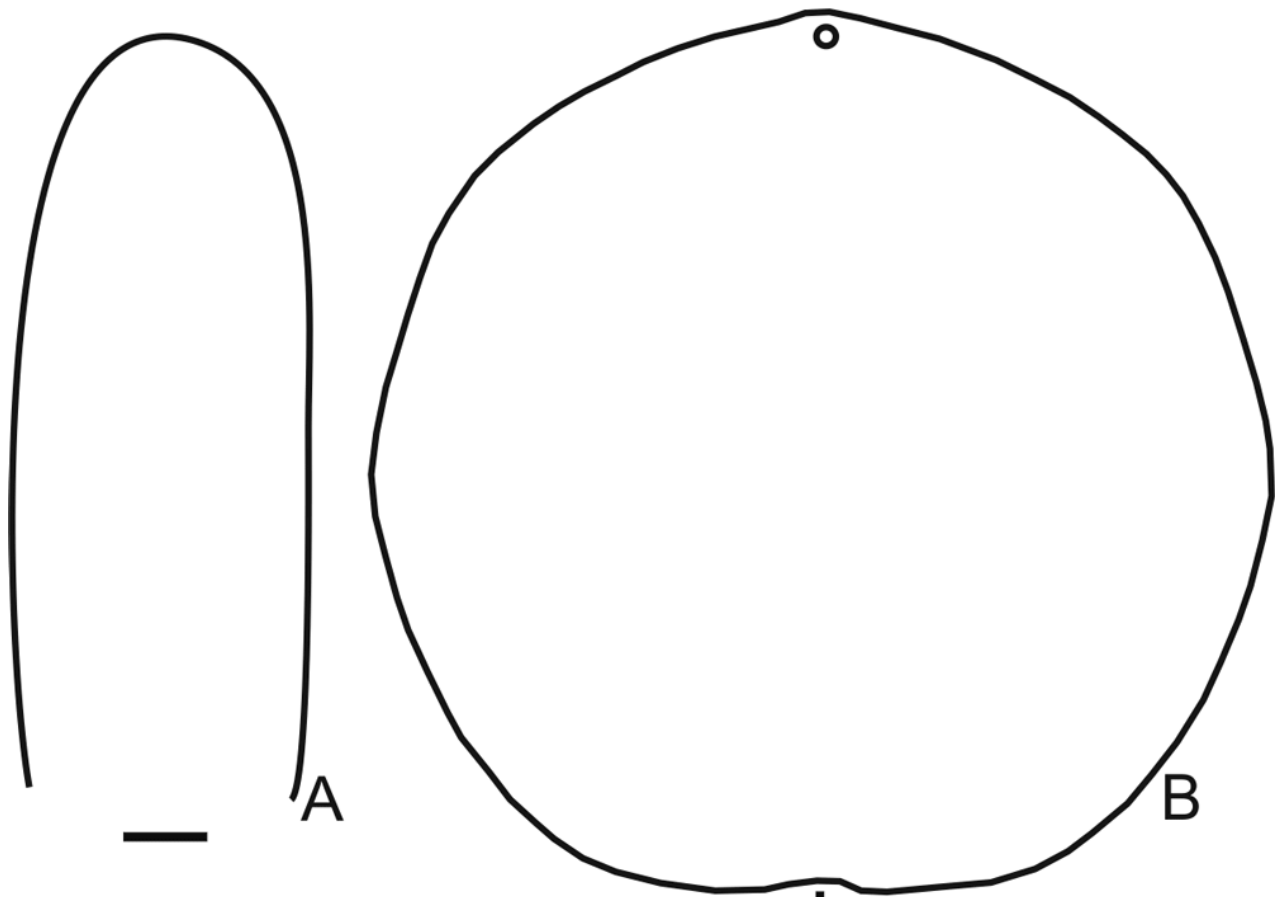
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**Figure 1:** **A.** *Pseudohaploceras liptoviense* (ZEUSCHNER, 1856) (= *Puzosia liptoviensis* ZEUSCHNER.- ASTRE, 1934), lateral view of UPS-GA1934-01-BP-7. **B.** *Deshayesites* sp. (= *Ammonitoceras* cf. *Lahuseni* SINZOW.- ASTRE, 1934), lateral view of UPS-GA1934-02. **C.** *Dufrenoyia* sp. (*Parahoplites furcatus* SOWERBY (Type *Dufrenoyi*).- ASTRE'S specimen label), lateral view of UPS-GA1934-03. Scale bar is 10 mm.

tology and geochemical record of the uppermost Barremian-lowermost Aptian hemipelagic sediments has been investigated (SANCHEZ-HERNANDEZ & MAURASSE, 2014; SANCHEZ-HERNANDEZ *et al.*, 2014). The current study of the ammonoid record will be useful in esta-

blishing a precise age determination of these hemipelagic sediments. It is part of a broader examination of the ammonoid record of the uppermost Barremian-Aptian of Lleida Province.



**Figure 2:** **A.** Whorl section of *Deshayesites* sp. (= *Ammonitoceras* cf. *Lahuseni* SINZOW.- ASTRE, 1934), specimen UPS-GA1934-02. **B.** Whorl section of the holotype of *Ammonitoceras ucetiae* DUMAS, 1876, type species of the genus *Ammonitoceras*. Modified from Figure 2 of DELANOY and CONTE (2011). Scale bar is 10 mm.

***Pseudohaploceras liptoviense***  
**(ZEUSCHNER, 1856)**  
**(= *Puzosia liptoviensis* ZEUSCHNER.-**  
**ASTRE, 1934, p. 221)**

ASTRE (1934, p. 223) identified the first specimen as *Puzosia liptoviensis* (Fig. 1.A, UPS-GA1934-01-BP-7), collected in 1924 by ASTRE himself between Gosol and la Collada de Molas. This taxon is currently assigned to the genus *Pseudohaploceras* as *Pseudohaploceras liptoviense* (ZEUSCHNER, 1856). *P. liptoviense* has a distinctive rib pattern that consists of small, flexuous, fold-like primary and secondary ribs, interrupted at irregular intervals by bifurcations and much larger primaries that are frequently paired with constrictions (see WRIGHT *et al.*, 1996, Fig. 52, 3a). In *P. liptoviense*, the larger primaries are often strongly pronounced towards the umbilicus, especially on the juvenile whorls (BUSNARDO & GRANIER, 2011, Pl. 1, figs. 1-5). Due to the poor preservation of the specimen, its identification is difficult. However, ASTRE's original assignment seems to be

correct. The irregularity in the rib pattern separates *P. liptoviense* from other similar species, such as *P. matheroni* (ORBIGNY, 1841), which has a more regular rib pattern, consisting of groups of 8-14 finer ribs, interrupted by larger, cord-like primaries. In *P. matheroni*, these larger ribs are frequently paired with one wide and one narrow constriction on each side. The robust costation of the specimen studied here also allows us to distinguish ASTRE's specimen from the more weakly ornamented *P. douvillei* (FALLOT, 1920) (see: DELANOY, 1992, Pl. 4, figs. 1-6; GAUTHIER *et al.*, 2006, p. 53-54). *P. ramosum* (BOGDANOVA, 1991) is a more closely related taxon that belongs to the *P. liptoviense* group (BOGDANOVA & HOEDEMAKER, 2004). The differences between the two taxa are subtle, *P. ramosum* having fewer secondary ribs and thicker whorls. Another species that shows some similarities is "*Pseudohaploceras*" *angladei* (SAYN, 1890) but this ammonite has a thicker whorl section, which may even be depressed, and probably belongs to the genus *Valdedorsella*.

***Deshayesites* sp.**

(= *Ammonitoceras* cf. *Lahuseni*  
SINZOW.- ASTRE, 1934, p. 223)

ASTRE's specimen (Fig. 1.B, UPS-GA1934-02) is a fragment of a large shell. ASTRE (1934, p. 223) wrote that this fragment is 17 cm long and 9 cm high and suggested that the ammonite could have been as large as 30-40 cm in diameter. The fragmentary ammonite has a tall, elliptical whorl section with a rounded ventral region (Fig. 2.A). The costation consists of slightly sigmoidal primary ribs, accompanied by scarce secondary ribs that can be intercalated or bifurcated about the middle of the flank.

*Ammonitoceras lahuseni* has a circular to depressed whorl section as does any other species of *Ammonitoceras* (WRIGHT *et al.*, 1996, p. 221; DELANOY & CONTE, 2011, Figs. 1-2). This important feature allowed us to rule out the assignment of the fragmentary specimen to the genus *Ammonitoceras*. ASTRE commented on this apparent difference, comparing the whorl section of his specimen to those of *Ammonitoceras ucetiae* DUMAS, 1876, which were collected in Santander, Cantabria, northern Spain by MENGAUD (1920, p. 140) and identified by Wilfrid KILIAN. ASTRE (1934) commented that the whorl section of this specimen is very similar to that of MENGAUD's material. However, we also have access to two gypsum casts of MENGAUD's specimens. One of them is slightly crushed, having a whorl section similar to ASTRE's specimen, but the second uncrushed specimen clearly has a circular whorl section. In our opinion, ASTRE's specimen is not crushed, and its whorl section matches that of *Deshayesites* but certainly not that of *Ammonitoceras* (Fig. 2). The rib pattern of the ammonoid studied here is consistent with the ontogenic development of *Deshayesites*, where the progressive loss of secondary ribs and slight straightening of both the primaries and the secondaries are particularly characteristic of the adult macroconch specimens (CASEY, 1964, Pl. 43, fig. 1a, and Pl. 54, fig. 1a; MORENO-BEDMAR *et al.*, 2010, electronic appendix Fig. VC). In addition the large size of the fragment suggests that it belongs to an adult macroconch of *Deshayesites*. Based on the weight of evidence, we conclude that this ammonite is a fragment of an adult macroconch of *Deshayesites*, which we report here as *Deshayesites* sp., since there is not enough information to make a specific determination.

***Dufrenoyia* sp.**

(= *Parahoplites furcatus* SOWERBY  
(Type *Dufrenoyi*).-  
ASTRE's specimen label)

At the end of his paper, ASTRE (1934, p. 225) wrote that he also found better known and arguably less important species of cephalopods in Lleida Province, including ammonites similar to *Parahoplites furcatus* and *Parahoplites dufrenoyi* (= *Dufrenoyia* spp.). We have found another partially crushed specimen at Organyà, Lleida Province (Fig. 1.C, UPS-GA1934-03), the third one examined here, labeled as "*Parahoplites furcatus* SOWERBY (Type *Dufrenoyi*)" (Fig. 3). The ornamentation of this specimen consists of paired sigmoidal primary and secondary ribs (Fig. 1.C), which are typical of the rib pattern of *Dufrenoyia*. However, an abrupt thinning of the whorl is also present along the last third of the flank and ventral margin, which is typical of crushed specimens of *Dufrenoyia*. We therefore conclude that this is a specimen of *Dufrenoyia*. This genus is characterized by a costal section with a flat venter and by the interruption of the ribs across the midline in early ontogenetic stages. The more common European species *Dufrenoyia furcata* (SOWERBY, 1836) and *Dufrenoyia dufrenoyi* (ORBIGNY, 1840), can be distinguished because in *D. furcata* the ribs cross the venter earlier during ontogenic development (GARCÍA & MORENO-BEDMAR, 2010). Since the venter of UPS-GA1934-03 is not preserved well enough to make a specific determination, we report it here as *Dufrenoyia* sp.

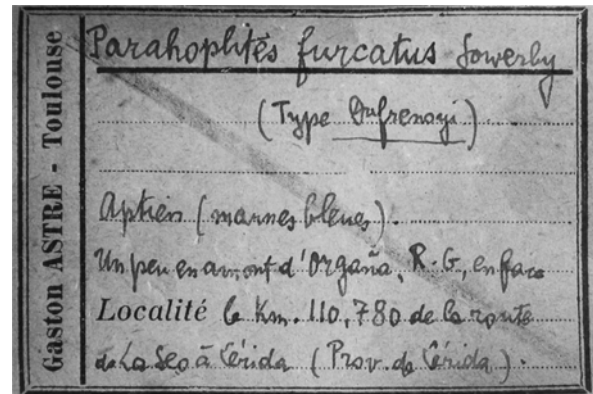


Figure 3: Original label of *Dufrenoyia* sp., UPS-GA1934-03.

In the UPS Collection we also found a very small pyritic specimen (6 mm max. diam.) without ribs that was labeled as "*Parahoplites furcatus*". In our opinion, it is impossible to identify this ammonite, even at the generic level.

### Age assignment

*Deshayesites* and *Dufrenoyia* are index genera of the lower Aptian. *Deshayesites* ranges through almost all of the lower Aptian, except the uppermost part, at which point the genus *Dufrenoyia* first appears and replaces *Deshayesites*. The specimen of *Deshayesites* sp. Collected by ASTRE is too poorly preserved to place it securely within the biostratigraphical divisions founded on genus *Deshayesites* within the lower Aptian.

*Dufrenoyia*, in turn, characterizes the *Dufrenoyia furcata* Zone and disappears at the lower-upper Aptian transition. ASTRE (1934, p. 221) reported his *Pseudohaploceras liptoviense* from the Gargasian, an old term that has an ambiguous chronostratigraphic meaning today, but which encompasses strata of the uppermost lower Aptian to the lowermost upper Aptian in southeast France. This age corresponds to the *Dufrenoyia furcata* (lower Aptian) and *Epicheloniceras martini* (upper Aptian) ammonite zones of the standard ammonite zonation of REBOULET *et al.* (2011, 2014). However, *Pseudohaploceras* disappears at the lower-upper Aptian transition, and is succeeded by the upper Aptian desmoceratid *Caseyella* (MORENO-BEDMAR *et al.*, 2012). We conclude then that all of ASTRE'S specimens reviewed here are lower Aptian without further refinement.

### Conclusions

Our review of the three best preserved specimens collected by ASTRE in 1924-1925 allows us to identify and illustrate for the first time the ammonoid taxa, *Pseudohaploceras liptoviense*, *Deshayesites* sp. and *Dufrenoyia* sp., all of which are early Aptian in age.

This contribution will facilitate continuing study of the Aptian ammonoid record of the Lleida Province.

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