# Ammonite taphonomy in the Albarracinites beds (Lower Bajocian, Iberian Range, Spain)

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Ammonites of the Ovale and Laeviuscula zones (Lower Bajocian, Middle Jurassic) are scarce in the Iberian Range due to gaps in the geological record. Nevertheless, several ammonite fossil-assemblages from Sierra de Albarracin (Teruel, Castilian Branch) show abundant specimens of these zones, including very scarce microconchs and macroconchs of the characteristic genus *Albarracinites*. The beds containing specimens of this distinctive stephanoceratid can be called Albarracinites beds. Masada Toyuela outcrop, around 600 m south of Masia de Toyuela and 6 km north of Albarracin, is the type locality of *Albarracinites albarraciniensis* Fernandez-Lopez, the type species of the genus. Over 1500 ammonite specimens from the type horizon of this species have been studied. The main purpose of the present work is to interpret from a taphonomic point of view these beds in the Masada Toyuela Section, in order to test and improve the available data for taphonomy, palaeoenvironmental setting and sequence stratigraphy.

The Albarracinites beds, generally 1 to 1.5 m thick, from the Ovale and Laeviuscula zones in Albarracin area, belong to the lower part of El Pedregal Formation (Chelva Group). They are made up of yellow-brown, wackestone to packstone limestones (with microfilaments, echinoderms, foraminifera, ostracods and pellets) ranging in thickness from 10 to 40 cm and interbedded with discontinuous to lenticular bioclastic marls. Limestone intervals may correspond to simple or complex beds, comprising several amalgamated beds, and show sharp boundaries. Textures and structures of bioturbation are common (*Zoophycos*, *Chondrites* and *Thalassinoides*, in particular) indicating soft- to firmgrounds. Macrofossils comprise ammonites, bivalves, crinoids, belemnites, gastropods, brachiopods, nautiloids, echinoids, bryozoans, serpulids, sponges and solitary corals. Several isolated and fragmentary bones, of decimetric or centimetric size, have been found in the lowest beds, whereas very few carbonized plant macro-remains occur in the highest beds.

Ammonite remains are dominated by shells, whereas aptychi are very scarce and less than 1%. Fragmentary bodychambers and incomplete phragmocones are abundant, whereas complete shells with peristome are scarce and commonest among the smallest ammonites. Ammonite shells are recorded as internal moulds that rarely exceed 300 mm in diameter. Reworked elements (i.e. resedimented and reelaborated elements) are dominant. Accumulated elements (showing no evidence of reworking after laying on the marine seafloor, such as the presence of fractures or sedimentary infill in the body chamber) are absent. Reelaborated internal moulds (i.e. exhumed and displaced before their final burial) are dominant, showing distinctive white or reddish colour, structural discontinuity with the sedimentary matrix, and original shape lacking extensive compaction. In contrast, resedimented shells (i.e. displaced on the seafloor before their burial) can be locally common in the highest beds, lacking structural or textural discontinuity with the sedimentary matrix and showing deformation by diagenetic compaction. The degree of reworking or removal (i.e. the ratio of reelaborated and resedimented elements to total recorded elements) reach 100% in all the beds. The degree of taphonomic heritage (i.e. the ratio of reelaborated elements to total recorded elements) decreases upwards and can be less than 50% in the highest stratigraphic interval. The degree of taphonomic condensation (i.e. mixture of fossils of diverse chronostratigraphic units) reaches the highest values in the lowest beds.

Biostratinomic processes of biodegradation-decomposition in oxic conditions were intense and ammonite shells usually lost the soft parts, aptychus and periostracum before burial. Aptychi have hardly ever been found within the ammonite shells. Also siphuncular tubes are generally disarticulated. Shells bearing signs of encrusting organisms (such as serpulids, bryozoans, oysters or crinoids) are common. Biogenic borings and remains of epilithic organisms commonly occur on reelaborated concretionary internal moulds.

Internal moulds of shells completely filled with heterogeneous sediments are common, indicating low rate of sediment accumulation. Shells with incomplete sedimentary infill (i.e., hollow ammonites) are common among the smallest ammonites. Internal moulds showing asymmetrically preserved flanks, varying in clay content, are commonest in the highest beds. Internal moulds with a local infill channel on the ventral region are very scarce. Processes of synsedimentary mineralization were intense and indicative of low rate of sedimentation. Ammonites are generally preserved as calcareous concretionary internal moulds of shells. Phosphatized or glauconitic concretionary internal moulds are locally common. Calcareous half-concretions or asymmetrically compressed concretions of ammonite shells occur.

Traces of abrasion on shells and internal moulds are abundant. Truncation facets occur preferentially among the largest-size ammonites, whereas abrasion roll facets are relatively common among the smallest specimens. Concretionary internal moulds of phragmocones with calcitic septa are the dominant fossils. Hollow phragmocones (i.e. shells without septa) are scarce, usually compressed by sedimentary loading during early diagenesis, and preferentially located on the highest stratigraphic levels. Aragonitic walls of the shells were dissolved during later diagenetic processes than septa. Moldic porosity resulting from dissolution processes of shells and septa has been partially filled by spar cement.

Ammonites commonly appear scattered in the deposits, but locally show patterns of imbricated or encased regrouping and normal grading. Concretionary internal moulds can show vertical attitude, especially in lower terms of the beds. The degrees of ammonite packing and the ammonite stratigraphic-persistence display very high and maximum values, respectively. Taphonic populations of type 3 are dominant, whereas types 2 or 1 are very scarce and virtually absent, respectively. These taphonic populations of type 3 show uni- or polymodal and asymmetric distribution of size frequencies, with negative skew. Shells of juveniles are absent and adults are predominant. However, adult microconchs are quite common. Taphonic populations of type 1, dominated by juveniles and indicative of eudemic taxa and autochthonous biogenic production, have not been recognized.

Therefore, the Albarracinites beds in Masada Toyuela outcrop correspond to a condensed section, developed in the open-marine External Castilian carbonate Platform, showing reduced sedimentation. The sharp, irregular bases of beds and the normal grading of reworked elements suggest tractive currents, scouring and redeposition affecting carbonate deposits. The limestone beds represent event sedimentation by tempestites, whereas the local marly intervals and scours represent background-sedimentation time-intervals by winnowing on the sea bottom. This condensed section is composed of at least four, decimetric or centimetric, expanded-deposit intervals, stacked with an overall thinning upward during two biochrons. Taphonomic data, such as dominance of taphonic populations of type 3, composed by reelaborated, heterogeneous concretionary internal moulds and hollow ammonites, bearing signs of abrasion, bioerosion and encrusting organisms, are indicative of both low rate of sedimentation and low rate of sediment accumulation, due to winnowing and sediment bypassing in shallow-water environments. Taphonomic results also confirm the development of an incipient-deepening phase, which represents the first episode within a deepening half-cycle of third order, in Albarracin area of Castilian Platform during the Ovale and Laeviuscula biochrons (Early Bajocian).

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