Cretaceous Research xxx (2017) 1–29

Contents lists available at ScienceDirect

Cretaceous Research

journal homepage: www.elsevier.com/locate/CretRes

Ammonite taxonomy and biostratigraphy for the upper Aptian-lower Albian (Lower Cretaceous) of Cerro Chino, Chihuahua State, northeast Mexico

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ARTICLE INFO

Article history:
Received 25 November 2016
Received in revised form
3 October 2017
Accepted in revised form 8 October 2017
Available online xxx

Keywords:
Ammonites
Aptian
Albian
Cretaceous
Chihuahua
Mexico

ABSTRACT

In this paper we study the ammonoid taxonomy and biostratigraphy from the upper Aptian to the lower Albian of the Cerro Chino area, with an emphasis on an accurate taxonomic characterization of the American endemic forms *Kazanskyella*, *Quitmanites*, *Immunitoceras* and *Huastecoceras*. These genera are important because they are characteristic of the unique ammonite fauna of the Central Atlantic province. In a critical taxonomic study of these endemic forms, we review numerous holotypes and other specimens that are currently housed in several collections in the United States and Mexico. Based on our analysis, we propose a local zonation from the upper Aptian to the lower Albian, with three ammonoid zones (*Kazanskyella minima*, *Hypacanthoplites* sp. and *Douvilleiceras* sp.), based on the Cerro Chino sections. This newly proposed zonation constitutes a step forward in the development of the standard Central Atlantic province ammonoid zonation, particularly because biostratigraphic data for this province during this time span are very scarce. In general, the uppermost Aptian ammonoid record worldwide is scarce and/or condensed, and so the fauna preserved at this location is significant, making the contribution here even more important. In this work, we are not able to pin down the position of the Aptian/Albian boundary based solely on the ammonoids from these sections.

1. Introduction

A standard ammonite zonation for the Central Atlantic province is currently being developed through the study of the Mexican ammonoid record (Moreno-Bedmar et al., 2013, 2015). This faunal province will most likely include Mexico, the southern United States, all countries in Central America, and probably countries in the northern part of South America (Reboulet et al., 2014). The current work uses the results of the Bachelor's thesis of the first author (O.-F.), whose work identified numerous taxonomic problems related to the abundance of poorly known endemic forms.

In order to clarify these taxonomic issues, a rigorous comparative study was carried out with the material herein studied using diverse collections, such as the Type Collection at the University of Texas at Austin. These endemic taxa are particularly important because they define the distinctive taxonomic and phylogenetic character of the Central Atlantic province. Only when the taxonomy was thoroughly revised could a proper biostratigraphic analysis be carried out. In this work, we propose a local biozonation and compare it to previous studies of the same province, as well as from the Tethys and the Boreal Realms (Reboulet et al., 2014 and Casey, 1961a,b, respectively).

These new biostratigraphic data are of critical importance because in Mexico the ammonoid record of the upper Aptian-lower

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https://doi.org/10.1016/j.cretres.2017.10.007
0195-6671/

Albian interval is poorly known. Work by Scott (1940) and Young (1974) in the southern United States (Texas) constitute the best record of this biostratigraphic interval in the Central Atlantic province, but these data are more than forty years old, and are in serious need of being reviewed and updated. The uppermost Aptian record in Europe (e.g. United Kingdom, Hungary, France, Spain) is generally scarce and/or condensed (e.g. Casey, 1961a,b; Szives et al., 2007 and personal observations), thus making the contribution here ever more important.

As far as we know in Mexico, the uppermost Aptian ammonoid record is restricted to only two of the thirty-one states of the country: Chihuahua and Sonora. In both states, the sections of this age are expanded and contain a scarce quantity of ammonoids located in just a few strata, as is also in the case of the Cerro Chino sections where we collected 57 specimens. Despite the limited material, the fact that these sections are among the few places around the world where an ammonoid record of this age is preserved makes a biostratigraphical analysis of the Cerro Chino sections critical to the development of the standard Central Atlantic province zonation.

2. Previous work on the Aptian-lower Albian ammonites

Published reports on the Lower Cretaceous ammonoids of northern Mexico are numerous. The earliest contributions were made by Burckhardt in the early 20th Century (1906, 1912 and 1925), who described many Jurassic and Cretaceous species in the states of Durango and Zacatecas. Böse (1910) also described several Albian ammonoids and other mollusks from the Cerro de Muleros, Chihuahua State. Later, Böse and Cavins (1928) reviewed the Cretaceous and Tertiary of the states of Nuevo León and Coahuila, as well as part of Texas, and provided a generalized ammonoid zonation scheme for the Cretaceous of the region (p. 16–17). In a companion monograph, Böse (1928) also described several ammonoids from the Cretaceous (Albian to Maastrichtian) of the region. Burckhardt (1930) also published a comprehensive review of the biostratigraphy and facies of the Mesozoic geological record in Mexico.

During the mid-30's to late 40's, Imlay and Humphrey conducted field research on the Aptian deposits of Mexico. Imlay (1936 and 1937) described the La Peña Formation in the western and central part of the Sierra de Parras in the State of Coahuila, and alluded to some Aptian ammonoids. Later, he made two contributions (1938, 1944) focused on the stratigraphy of northern Mexico and other countries in Central America, listing some Aptian-Albian ammonoids. Subsequently, Humphrey (1949) worked in the Sierra de los Muertos (states of Coahuila and Nuevo León), amending the concept of the La Peña Formation and describing a large number of Aptian ammonoids. During this time, important work was being done on equivalent strata in the southern United States (Scott, 1940).

The Aptian of Mexico continued to be an active area of research in the latter part of the 20th Century. In his doctoral thesis Cantú Chapa, A. (1963) correlated the upper part of the La Peña Formation with the French Clansayesian horizon based on a faunistic ammonoid correlation. Peña Muñoz (1964) characterized 25 species of ammonoids in the State of Durango belonging to the Upper Jurassic and Lower Cretaceous, including one Aptian ammonoid. Charleston (1966), in his Master's thesis, documented the Aptian-Albian ammonoid record of the La Peña Formation in the states of Coahuila and Durango. Thereafter, Cantú Chapa, C.M. (1968) studied the ammonoids of two localities in the State of Michoacán belonging to the Aptian-Albian range. Young (1969) reviewed the Cretaceous formations located in the northern State of Chihuahua, and was especially focused on the Aptian-Albian stages, proposing a preliminary biozonation for this and other levels, which he later correlated with his central Texas Aptian-Albian zones (1974). Campa et al. (1974) studied in detail a stratigraphic sequence in the State of Guerrero, finding one upper Aptian ammonoid. Also, Cantú Chapa, C.M. (1976) conducted a biostratigraphic analysis of the Aptian ammonoid record of the La Peña Formation in Nuevo León State and described two genera: *Caseyella* and *Huastecoceras*. Contreras y Montero (1977) carried out a biostratigraphic study of pre-Aptian age (Valanginian-Hauterivian) ammonoids in the La Goleta section of Coahuila and Aptian ammonoids of the La Peña Formation in the Minillas section of Nuevo León. Cantú-Chapa, A. (1989) and Cantú Chapa, A. (1992) presented two papers on the ammonoids of the La Peña Formation, using core samples from several wells in northern Mexico. Herrera et al. (1984) studied the area of Lampazos, Sonora, finding several upper Aptian and Albian ammonoids and other mollusks. Later, Mora Villalobos (1998), in his Bachelor's thesis, conducted a study of Lampazos and Cerro de las Conchas, Sonora, finding eight different genera of ammonoids from the Aptian-Albian.

The stratigraphic groundwork for the development of a standard Central Atlantic province ammonoid zonation was first carried out in the late 1990's early 2000's by Barragán. In his Ph. D. thesis (2000), Barragán focused on the Francisco Zarco Dam section of Durango, and proposed four biozones based on the Aptian ammonoids from northern Mexico. Barragán (2001) also reviewed the microfacies and geochemistry characterizing the marine transgression of the La Peña Formation (on the Cupido Platform), and used the ammonites from the formation to calibrate the age of this marine transgression. Méndez Franco (2003), in his Bachelor's thesis, made a detailed review of the microfacies, taxonomy and biostratigraphy of the ammonoids belonging to the Aptian stratigraphic sequence of Cañon de la Huasteca, Nuevo León. Lawton et al. (2004) subsequently reported ammonoids from the Aptian in the Mural Formation of Sonora. Barragán-Manzo and Méndez-Franco (2005) proposed four formal ammonoid biozones for the upper part of the lower Aptian and the upper Aptian, with the aim of developing a standard biostratigraphic framework for more accurate correlations with that developed in England and the Mediterranean area. Avila Licona (2005), in his Bachelor's thesis, focused on the study of the Cañon de la Boca ammonoids in Nuevo León, reporting index species from the lower and middle Aptian of the La Peña Formation. Barragán and Szives (2007) worked in the Cañon de la Huasteca in Nuevo León, finding several specimens of Aptian ammonites, including the discovery of *Mathoceras* in Mexico. They described two new species: *Mathocerass celestinae* and *Mathoceras neoleonensis*. Barragán and Maurrasse (2008) studied the lowermost part of the La Peña Formation at Cañon de la Huasteca in Nuevo León, where numerous Aptian index ammonoids were found.

More recent work by Moreno-Bedmar et al. (2012) correlated the lower Aptian transgression reported in Mexico with the Tethys transgression reported in Spain based on the biostratigraphic distribution of the genus *Dufrenoyia* and the co-occurrence of the transgressive event. Moreno-Bedmar and Delanoy (2013) reviewed the generic assignment of the species *Megatyloceras casei* from the Aptian of Coahuila, initially described by Humphrey, and concluded that this species should be assigned to the genus *Epicheloniceras*. In the same year, Moreno-Bedmar et al. (2013) presented a detailed zonation of ammonoids in the Francisco Zarco Dam section of Durango, with: *Dufrenoyia justinae*, *Gargasiceras*? *adkinsi* zones for the lower Aptian and *Caseyella aguilerae* Zone with *Huastecoceras trispinosoides* Biohorizon for the upper Aptian. Additionally, these authors argued that the development of a standard ammonoid zonation for the faunistic Atlantic Central province was necessary.

Please cite this article in press as: Ovando-Figueroa, J.R., et al., Ammonite taxonomy and biostratigraphy for the upper Aptian-lower Albian (Lower Cretaceous) of Cerro Chino, Chihuahua State, northeast Mexico, Cretaceous Research (2017), https://doi.org/10.1016/j.cretres.2017.10.007