Ryszard MYCZYŃSKI

CARIBBEAN AMMONITE ASSEMBLAGES FROM UPPER JURASSIC - LOWER CRETACEOUS SEQUENCES OF CUBA

(Figs 1 - 3; Pl. I)

Abstract. Late Jurassic and Early Cretaceous ammonite assemblages of Western and Central Cuba belong to the paleobiogeographical Caribbean Province. This province existed during the Late Jurassic (since Middle Oxfordian) and the earliest Cretaceous (to the Hauterivian). The ammonites of the Caribbean Province occur in the Upper Jurassic and lowermost Cretaceous sequences of Cuba, northeastern and central Mexico and in the southern United States. Strong biogeographical links between Cuba, Colombia and the Mediterranean Province were established during the Barremian.

Key words: paleobiogeography, ammonites, Cuba, Caribbean Province, Upper Jurassic, Lower Cretaceous.

INTRODUCTION

The opinions expressed in the present paper have been formulated on the basis of the present author's study of ammonites collected in Western Cuba, and on data published by other authors. Paleobiogeographical links of the Cuban Late Jurassic and Early Cretaceous ammonite assemblages were partly analysed in the author's earlier papers (Myczyński, 1976a, 1976b, 1977, 1989; Myczyński & Pszczółkowski, 1990; Myczyński & Triff, 1986). The author gratefully acknowledges the help offered by Ing. J. Triff, from the Institute of Geology and Paleontology MINBAS in Havana, during field work in Cuba. The author expresses his gratitude to Ing. M.A. Iturralde-Vinent (National

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Fig. 1 Location map of the Upper Jurassic - Lower Cretaceous sequences in Cuba

$J_3$ – ammonite-bearing Upper Jurassic deposits of Sierra de los Organos and Sierra del Rosario (SR) in Cordillera de Guaniguanico in the Pinar del Rio Province, Western Cuba; $K_1$ – ammonite-bearing Lower Cretaceous deposits of Sierra del Rosario; CA – ammonite-bearing Upper Jurassic and Lower Cretaceous deposits of the Camajuaní sequence in the Matanzas Province and Central Cuba; PL – ammonite-bearing Upper Jurassic and Lower Cretaceous deposits of the Placetas sequence in the Matanzas Province and Central Cuba; ES – Upper Jurassic metamorphosed rocks in the Escambray massif (Central Cuba)
Museum of Natural History in Havana) and Prof. A. Pszczółkowski for critical review of the manuscript.

Paleobiogeographical differentiation of ammonites has been discussed by many authors (Imlay, 1965; Khudoley, 1974; Enay, 1972, 1973; Cariou, 1973; Cariou et al., 1985). It is explained by faunal provinciality, which depended on eco-environment and presence of physical barriers, such as uplifted areas, shallow marine zones, water chemistry and temperature restricting free migration of ammonites. According to Scott (1984) rift zones and related volcanic activity could also act as barriers. By restricting migration, these factors caused differentiation of fauna, and eventually resulted in appearance of endemic ammonite assemblages (e.g. Cariou, 1973; Cariou et al., 1985; Imlay, 1965, 1980; Enay, 1972, 1973, 1980; Enay & Mangold, 1982; Hallam, 1981, 1983; Pozaryńska & Brochwicz-Lewiński, 1975; Westermann, 1984; Westermann & Riccardi, 1976, and others).

The paleobiogeographical links between the Cuban ammonite assemblages and ammonites of other areas which belonged to the Caribbean Province during the Late Jurassic and Early Cretaceous, will be shown against background of the Mesozoic sequences of Cordillera de Guaniguanico in Western Cuba, and the Camajuani, Placetas and Escambray sequences in Central Cuba (Fig. 1). During the Jurassic and Early Cretaceous, these sequences were located in the northwestern part of the Proto-Caribbean basin, along the eastern margin of the Yucatán block (Cordillera de Guaniguanico and Escambray sequences) and the southern edge of the Florida-Bahamas platform (Camajuani and Placetas sequences) (Fig. 2). Figure 3 shows distribution of the ammonite genera recognized in the Late Jurassic and Early Cretaceous of Cuba against their worldwide distribution.

JURASSIC ZOOGEOGRAPHICAL PROVINCES

For the Upper Jurassic and Lower Cretaceous, Uhlig (1911) distinguished the following provinces and subprovinces: Boreal Province, North-Andean Subprovince, South-Andean Province, Mediterranean -Caucasian Province, Himalayan Province, Ethiopian Subprovince, Maorian Subprovince and Japan Province. At present, there is a distinct tendency to recognize only two realms: Boreal and Tethyan. Within the Tethyan Realm, Enay (1980) distinguished the following zoogeographical provinces: Mediterranean, Caribbean, Far East (Japan), Indopacific (with Ethiopian and southwest Pacific subprovinces) and Andean. This subdivision implies strong expansion and endemic differentiation of the Tethyan fauna during the Jurassic. Currently, Enay's (1980) subdivision is followed by many authors (Enay & Mangold, 1982; Cariou et al., 1985; Meléndez et al., 1988).
Fig. 2 Reconstruction of the Caribbean and adjacent areas for the Lower Tithonian after Pszczółkowski (1987) and also partly after: Viniegra-O, 1971; Geyer, 1973; Le Pichon et al., 1977; Buffler et al., 1980; Dickinson & Coney, 1980; Imlay, 1980; Ross & Scotese, 1988; Salvador & Green, 1980; Jansa & Wiedmann, 1982; Anderson & Schmidt, 1983; Fourcade et al., 1991

1 - shallow water seaway; 2 - continental deposits (undivided); 3 - clastic deposits and calcareous clays; 4 - dolomites and evaporites; 5 - dolomites; 6 - shelf limestones; 7 - marine sediments of the South American and African continental shelf and slope; 8 - oceanic crust; 9 - metamorphic and/or plutonic basement; 10 - active faults (continuous lines) and inactive fractures (dashed lines); 11 - hypothetical routes of ammonite migration; AF - Africa; NA - North America; SA - South America; CA - Central Atlantic; Cb - Tithonian deposits of Western Cuba; CH - Chortis Plate; Y - Yucatan; GM - Gulf of Mexico; PC - Proto-Caribbean basin; IT - Istmo de Tehuantepec; FB - Florida-Bahamas Platform; FP - Farallon Plate; PB - Portal de Balsas (Guerrero) strait

The Caribbean Province was proposed by Westermann (1984) and Taylor et al. (1984) for the Middle Jurassic. The name “Caribbean Province” refers to the Caribbean region and should not be confused with the Pacific Caribbean plate. Myczyński (1989), based on Tithonian ammonite assemblages, suggested that the Caribbean Province also existed during Late Jurassic and Early Cretaceous times. The Late Jurassic expansion of the Tethyan fauna was clearly the result of the opening of the Proto-Atlantic seaway, named “the Hispanic corri-

Contrasting opinions were expressed on provenance of the Late Jurassic ammonites in the Caribbean Province: due to migration from either the Pacific (Imlay, 1965; Khudoley, 1974), or the Western Tethys (Enay, 1972; Cariou et al., 1985).

Pessagno & Blome (1986) and Pessagno et al. (1987a, 1987b) distinguished three Late Jurassic zoogeographical realms: Austral, Tethyan and Boreal. From the Upper Jurassic of central Mexico (San Pedro del Gallo), these authors recorded a faunal assemblage consisting of radiolarians (Parvicingula), bivalves (Buchia) and infrequent ammonites characteristic for the Boreal regions. They suggest that some Mexican tectonic terranes were tectonically displaced from the Southern Boreal Province located at 30° of northern latitude. According to Pessagno & Blome (1986) and Pessagno et al. (1987a, b, 1993), the Southern Boreal province was a part of the Boreal Realm, and not of the Tethyan one. However in Cuba, the Late Jurassic and Early Cretaceous ammonites of Boreal character are unknown, and only Boreal-type bivalves Buchia do occur in the Tithonian sediments of Western Cuba (Myczyński, 1989; Myczyński & Pszczółkowski, 1990).

According to Iturralde-Vinent (1981, 1988), Mesozoic sequences of the Cordillera de Guaniguanico belonged to the Caribbean microcontinent, for which he has recently introduced the name “Guaniguanico Terrane” (Iturralde-Vinent, 1994). In his plate-tectonic reconstruction for the Oxfordian (op. cit., fig. 8), this terrane is located along the eastern margin of the Yucatán block, thus following earlier opinions by Pszczółkowski (1987) and Piotrowska (1992, 1993).

**CUBAN AMMONITE ASSEMBLAGES**

**Oxfordian**

(1) The earliest ammonite assemblages in Cuba have been described from the Middle Oxfordian deposits of the Sierra de los Organos and Sierra del Rosario in the Cordillera de Guaniguanico (Nuez, 1972, 1974; Kutek et al., 1976; Myczyński, 1976a, b; Myczyński & Pszczółkowski, 1976; Wierzbowski, 1976). These ammonite-bearing deposits are underlain by deltaic sediments of the San Cayetano Formation (Haczewski, 1976). During the Middle Oxfordian, the supply of terrigenous material ceased, probably as a result of the sea-level rise and marine transgression, and was replaced by carbonate deposits (Haczewski, 1976; Pszczółkowski, 1978, 1981). The earliest ammonite fauna was found in the uppermost part of the San Cayetano Formation of Sierra del Rosario (Myczyński & Pszczółkowski, 1976). It is similar to the slightly younger ammonite assemblages occurring in the
Zacarías Member (Nuez, 1972, 1974; Wierzbowski, 1976) and in the Jagua Vieja Member of the Jagua Formation (Wierzbowski, 1976), as well as in the Francisco Formation of Sierra del Rosario (Kutek et al., 1976; Myczyński, 1976a).

The Middle Oxfordian ammonite assemblages are dominated by Perispinctidae (Vinalespinctes and related genera) and Ochoceratinæ, while Euaspidoceratinae and Oppeliidae are less frequent. Some of the taxa characteristic for Western Cuba do also occur in Mexico and Chile (Wierzbowski, 1976). According to this author, Cuban and European Perispinctidae may represent related parallel lineages. Meléndez (in Meléndez et al., 1988) presented a hypothesis on relatively rapid evolution of the European Perispinctidae, which migrated to the Proto-Caribbean and Andean regions.

Oloriz (in Oloriz et al., 1990) claims, that the ammonites belonging to the subgenus Praeataxioceras Atrops are closely related to the Caribbean ammonites included in the genus Discospinctes Dacqué ("D." caribbeanus Jaworski = P. (Planites) virgulatus Quenstedt var. caribbeanum n. var. Jaworski). However, assignment of these ammonites to the genus Discospinctes is questionable (see Wierzbowski, 1976 and Meléndez & Myczyński, 1987).

Atrops (1982) created the subgenus Praeataxioceras of the genus Orthospinctes for the European ammonites known as Orthospinctes virgulatus (Quenstedt), with the type species Orthospinctes laufenensis (Siemiradzki). Oloriz (in Oloriz et al., 1990) assumes that the densely ornamented Perispinctidae with polygyre ribs, known from the marginal areas of the North American plate, and from the Caribbean, belong to the subgenus Praeataxioceras.

Cuban ammonites included within the genus "Discospinctes" have such ornamentation. It is also similar to that of the ammonites belonging to subgenera Perispincthes (Cubaspinchtes) and P. (Antilloceras). The Cuban Perispinctidae could therefore be classified within the European genus Orthospinctes. Such interpretation is, however, seriously weakened by the fact, that in Europe, the oldest representatives of the subgenus Orthospincthes (Praeataxioceras) appear in the Late Oxfordian Bimammatum Zone (Atrops, 1982), or even in the topmost part of this zone, together with the ammonites assigned by Meléndez (1989) to the genus Cubaspidoceras Myczyński, 1976.

According to Wierzbowski (1976), the genus Orthospinctes is not known from Cuba. The faunal horizon containing Perispinctidae is of Middle Oxfordian age in the Pinar del Río Province (Wierzbowski, 1976; Myczyński, 1976a). Representatives of the subgenus Perispincthes (Cubaspinchtes) and the genus "Discospinctes" occur below the horizon with Mirospinchtes and Euaspidoceras, and therefore below the younger horizon with Mirospincthes and Cubaspidoceras. One cannot exclude the possibility that ammonites belonging to the subgenus Praeataxioceras appeared earlier in the Proto-Caribbean basin than in Europe. Another possibility implies a much wider stratigraphic range (Oxfordian - Early Tithonian) of the ammonites with similar type of ornamentation (Oloriz, 1978; Oloriz et al., 1990).
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3 List of the ammonite genera recorded in the Upper Jurassic and the Lower Cretaceous deposits of Cuba, compiled from the present author's own data and published results of other authors (Judoley & Furrazola-Bermúdez, 1968; Kanchev et al., 1978; Garde-Vinent et al., 1981)

1 Tithonian ammonites; 2 Early Cretaceous ammonites
The Late Oxfordian ammonite assemblage is known from the Pimienta Member of the Jagua Formation (Sierra de los Organos - Myczyński, 1976a), from the upper part of the Francisco Formation and from the basal strata of the Artemisa Formation in the Sierra del Rosario (Kutek et al., 1976). This assemblage, including the genus *Mirosphinctes*, Euaspidoceratinae (mainly *Cubaspidoceras*) and Oppeliidae, occupies the highest stratigraphic position in the Oxfordian deposits of Western Cuba. The ammonite *Taramelliceras* (*Metahaploceras*) sp. (Pl. I: 4 - 6) also occurs in this assemblage; this is the first *Taramelliceras* found in the Oxfordian of Cuba. The scarcity of the Late Oxfordian ammonites is a phenomenon characteristic for the whole area of Western Cuba, and was related to the marine regression in the Caribbean region (Imlay, 1942).

During Middle Oxfordian, the northwestern part of the narrow Proto-Caribbean basin was probably connected with the eastern part of Mexico, as indicated by similarity of fauna, mainly ammonites (Burckhardt, 1906, 1912, 1919-21; Imlay, 1939, 1942, 1980; Wierzbowski, 1976; Rangin, 1977; Alencaster, 1984). The Oxfordian carbonate deposits of Western Cuba are the equivalent of the Zuloaga Formation in Mexico (Olóriz et al., 1990). The genera "*Discosphinctes*, *Cubaochetoceras*, and *Perisphinctes* (*Antilloceras*) are common for Western Cuba and Mexico (Wierzbowski, 1976). Rangin (1977) recorded "*Discosphinctes* caribbeanus" (Jaworski), characteristic for the Oxfordian of Cuba, from the Sonora Province in Mexico. This species has also been found in the Oxfordian Smackover Formation of Louisiana and Texas, as well as in California and southwestern Oregon (Imlay, 1961, 1980).

A connection between the Proto-Caribbean basin and the Andean Province during the Oxfordian was possible. The following ammonite genera characteristic for the Oxfordian of Western Cuba, do also occur in Chile: *Perisphinctes* (*Vinalesphinctes*), *P. (Subvinalesphinctes)*, *Cubaochetoceras* (Wierzbowski, 1976), "*Discosphinctes*, *Cubaspidoceras* and *Mirosphinctes* (Förster & Hillebrandt, 1984; Myczyński & Brochowicz-Lewiński, 1981; Chong et al., 1984; Meléndez & Myczyński, 1987; Gygi & Hillebrandt, 1991).

Some ammonite taxa, well-known from Cuba, have also been reported from Ellsworth Land, Antarctica (Quilty, 1970). Ammonites belonging to the Cuban genus *Cubaspidoceras* were recorded from Western Tethys (Chong et al., 1984; Meléndez, 1989). The northwestern part of the Oxfordian Proto-Caribbean basin belonged to the zoogeographical Caribbean Province (the Mesozoic biota of the Gulf of Mexico-Caribbean region *sensu* Scott, 1984).

**Kimmeridgian**

Facies change due to shallowing is marked in the Late Oxfordian deposits of the Cordillera de Guaniguanico (Pszczółkowski, 1978). Massive carbonates of the Kimmeridgian San Vicente Member accumulated on a shallow bank, while limestones of the lower part of the
Artemisa Formation were deposited in less agitated (and deeper?) water. Infrequent fish debris occurs in the southern sequence of Sierra del Rosario, but ammonites are so far missing from the Kimmeridgian carbonate rocks of Western Cuba. During the Kimmeridgian, shallow seaway connected the Proto-Caribbean basin with Gulf of Mexico (Pszczółkowski, 1987, fig. 3).

In northeastern and central Mexico, the Kimmeridgian grey to black, bedded limestones and marly shales belonging to the La Caja and La Casita formations yielded ammonites of the following genera: Idoceras, Ataxioceras, Nebrodites and Procraspedites (Olóriz et al., 1990). These deposits accumulated in deeper and/or less restricted basin than the coeval carbonates of Western Cuba.

**Tithonian**

In the stratigraphic sequences of the Cordillera de Guaniguanico, a facies change from shallow-water to deeper-water deposits occurred during Early Tithonian. In the Sierra de los Organos, the earliest Tithonian ammonites belong to the genera: Mazapilites, Haploceras, Neochetoceras, Pseudolissoceras, Protanycloceras, Aulacosphinctoides, and others (Judoley & Furrazola-Bermúdez, 1968; Houša, 1974; Myczyński, 1989). In the Sierra del Rosario, the oldest Early Tithonian ammonite assemblage contains a few taxa only (Parakeratinites sp. and Schaireria sp.).

Ammonites of worldwide distribution have been recorded in late Early Tithonian limestones: Protanycloceras sp. (aff. P. gracile), Glochiceras (Lingulaticeras), Simoceras and Simocosmoceras (Imlay, 1942; Myczyński, 1989, 1990; Myczyński & Pszczółkowski, 1994). Endemic ammonites, not known outside the Caribbean region, do also occur in the Lower Tithonian deposits of Western Cuba: Phylloceras pinarensis Imlay, "Subplanites" cubensis Chudoley et Furrazola-Bermúdez, Lytoholites carribeanus Imlay, "Parodontoceras" butti Imlay, "Parodontoceras" antilleanum Imlay and Vinalesites rosariensis Imlay (Imlay, 1942; Judoley & Furrazola-Bermúdez, 1968; Myczyński, 1989). Bivalves of the genus Buchia, characteristic for the Boreal Realm, occur together with these ammonites (Myczynski & Pszczółkowski, 1994). Relatively high proportion of the Tethyan taxa in the Early Tithonian fauna of Western Cuba, leads to the conclusion that migration of ammonites from Western Tethys to the Proto-Caribbean basin took place at this time (Myczynski, 1989).

An important change of faunal assemblage occurred in the Caribbean Province during the early Late Tithonian. In the Upper Tithonian deposits of Western Cuba prevail ammonites of endemic character for Cuba or of Pacific origin: Hildoglochiceras (Salinities), "Haploceras", Dickersonia, "Parodontoceras", Vinalesites, Corongoceras, Kossmatia, and Micracanthoceras. Six of these genera are com-
mon for Cuba, Mexico and the southern United States (Cantú Chapa, 1968, 1976; Imlay, 1980; Alencaster, 1984; Myczyński, 1989; Myczyński & Pszczółkowski, 1990). The bivalves *Buchia* also occur in the Upper Tithonian deposits of these areas. The migration of fauna from the Western Tethys to the Caribbean region via the Proto-Atlantic seaway was probably restricted during the Late Tithonian (Fig. 2).

At the end of the Tithonian, wide distribution of radiolarian microfacies in the Cordillera de Guaniguanico sequences indicates deepening of sedimentary basin in Western Cuba (Myczynski & Pszczółkowski, 1994). Ammonites become infrequent in limestones of the latest Tithonian age; they belong mainly to the genera *Protancyloceras* and *Vinalesites* (Myczynski, 1977; Myczyński & Triff, 1986). The genera *Suarites*, *Acevedites* and *Wichmanniceras*, occurring in the latest Tithonian deposits of Mexico (Cantú Chapa, 1976), have not been recorded from Cuba.

**Early Cretaceous**

Early Cretaceous ammonites are known in Cuba from the Sierra del Rosario, Camajuaní, Placetas and Zaza sequences (Fig. 1). The Camajuaní and Placetas sequences crop out in the Matanzas Province of Western Cuba (Myczynski & Triff, 1986), and in the Villa Clara, Sancti Spiritus and Camagüey Provinces of Central Cuba (Imlay, 1942; Furrazola-Bermúdez et al., 1964; Shopov in Kantchev et al., 1978). Early Cretaceous ammonites are frequent in the Sierra del Rosario (northern sequence), but are rather poorly preserved (Myczynski, 1977). Ammonites are rare in the Lower Cretaceous pelagic limestones of the Sierra de los Organos sequence.

Berriasian ammonites are infrequent in the Sierra del Rosario, and, starting from the latest Tithonian, heteromorph forms are dominant in the poor assemblage of this age. These ammonites belong to the genera *Protancyloceras* and *Leptoceras* (Myczynski, 1977), the latter genus being frequent in the Lower Cretaceous deposits of the Mediterranean Province (Wiedmann, 1980, 1988).

Ammonites are infrequent in the Valanginian and Hauterivian deposits. In the Sierra del Rosario, the Valanginian ammonites are represented by the genera *Bochianites*, *Kilianella*, *Thurmanniceras* and *Olcostephanus*. The bivalves of the genus *Buchia* are present in the deposits of Valanginian age. The following ammonite genera occur in the Hauterivian pelagic limestones: *Moutoniceras*?, *Pseudothurmannia* and *Mexicanoceras*.

The Barremian assemblage contains abundant ammonite genera, mainly *Phyllopachyoceras*, *Lytoceras*, *Protetragonites*, *Macroscaphites*, *Hamulinites*, *Hamulina*, *Anahamulina*, *Crioceratites*, *Paracrioceras*,
Acrioceras, Colchidites, Hemihoplites, Spitidiscus, Pulchellia and Nicklesia (Myczynski, 1977; Myczyński & Triff, 1986).

The Early Cretaceous ammonites, collected in the Sierra del Rosario, are generally similar to the ammonite assemblages known from the Camajuaní and Placetas sequences in the Matanzas Province and Central Cuba. The genera Eulytoceras, Leptotetragonites, Neolissoceras, Parancyloceras, Uhligia, Heteroceras, Spiticeras, Subsaynella, Oosterella, Melchiorites and Astieridiscus have been recorded in Central Cuba and in the Matanzas Province (Shopov in Kantchev et al., 1978; Myczyński & Díaz in Piotrowska et al., 1981; Myczyński & Triff, 1986), but are not known from the Sierra del Rosario. Generally poorer preservation of fauna from Sierra del Rosario may partly explain this difference in composition of the compared Early Cretaceous ammonite assemblages. The rich Barremian ammonite assemblage of Cuba is similar to the coeval European fauna.

The following ammonites were found in the Berriasian deposits of the Mazatepec, Puebla (Mexico): Subthurmannia dominguense Cantú Chapa, S. mazatapense Cantú Chapa, Spiticeras sp., Berriasella aff. zacatecana Imlay and Groebliceras poblense Cantú Chapa (see Cantú Chapa, 1976). The last taxon is known only from Argentina, Mexico and Kurdistan.

From the Valanginian and Hauterivian deposits of the Taraises and Las Vegas formations in Mexico, the following ammonite taxa were recorded (see Imlay, 1937, 1938, 1980; Cantú Chapa, 1976; Cooper, 1981; Young, 1988; González-Arreola et al., 1992): Bochianites thieulioides Cantú Chapa, Thurmanniceras novihispanicus Imlay, Mexicanoceras neohispanicus (Böse), M. rarituberculatum Imlay, Neolissoceras bejucense Cantú Chapa, N. semisulcata Cantú Chapa, Distaloceras nodosum Imlay, Acanthodiscus magnificus Imlay, Olocostephanus atherstoni (Sharpe), O. baini baini (Sharpe), O. coahuilensis Imlay, O. quadriradiatus Imlay, O. durangensis Cantú Chapa, Karakaschiceras biassaleense (Karakasch), Maderia, Kiliandia, Bejucoceras, Saynoceras, and Subastiera. Three genera - Bejucoceras, Maderia and Mexicanoceras - are endemic. The other genera have a worldwide distribution, but in Mexico some of them are represented by endemic species and subspecies.

The presence of Mexicanoceras and Thurmanniceras novihispanicus Imlay in the pre-Barremian deposits of Cuba is significant, because these taxa have been recorded for the first time in the Taraises Formation of Mexico (Imlay, 1937; Gonzalez-Arreola et al., 1992). The ammonites assigned to the genera Macroscaphites, Protancycloceras, Bochianites, Hamites, Olocostephanus, Mexicanoceras, Thurmanniceras, Spiticeras, Oosterella and Pulchellia are common for both Cuba and Mexico. The genus Pulchellia is poorly represented in Mexico (Cantú Chapa, 1968), while the ammonites belonging to this genus are abundant in the Barremian of Colombia (Bürgl, 1956). Cuba and Colombia share the following ammonite genera: Crioceratites, Shasticrioceras, Parancyloceras, Leptoceras, Hamulina, Olocostephanus
(Rogersites), Colchidites, Thurmanniceras, Berriasella, Kilianella, Oosterella, Spitidiscus, Holocdiscus, Nicklesia and Pulchellia.

In Cuba and Argentina, the following ammonite genera are present: Crioceratites, Paracrioceras (?), Olocostephanus, Thurmanniceras, Spiticeras, Berriasella and Leopoldia. A few genera, such as Neolissoceras, Bochianites, Olocostephanus and Thurmanniceras, are known both in Cuba and Pakistan.

The above presented data points out, that the Cuban Early Cretaceous ammonites are related to the fauna of the Mediterranean Province (Nikolov, 1987) and Colombia (Hass, 1960), as well as to the coeval ammonite assemblages of Mexico and the southern United States (Imlay, 1937, 1980; Muñoz, 1964). The Berriasian - Hauterivian ammonites of Cuba, Mexico and the southern United States belonged to the same zoogeographic province. This was the Caribbean Province, connected to the Mediterranean Province via the Proto-Atlantic seaway (Geyer, 1973; Westermann, 1984, 1992) and to the Pacific Ocean. Recognition of the Caribbean Province during the late Early Cretaceous is difficult due to the Tethyan faunal expansion during Barremian time. Nevertheless, Scott (1986) distinguished his Aptian Caribbean Province on the basis of distribution of the bivalves of the genus Protocardia.

CONCLUDING REMARKS

The Upper Jurassic-Lower Cretaceous sequences of Cordillera de Guaniguanico in Western Cuba were laid down in a sedimentary basin located at the eastern margin of the Yucatán block (Fig. 2), as suggested by some authors (Pszechłkowski, 1987; Iturralde-Vinent, 1994). During the Late Jurassic and Early Cretaceous, this part of the Proto-Caribbean basin was connected, through the southeastern Gulf of Mexico, with the southern United States and the northeastern and central parts of Mexico. The ammonites recorded from these areas belonged to the paleobiogeographical Caribbean Province. The faunal links between Western Cuba and the southern United States and Mexico were strong during the Oxfordian, Tithonian and at the beginning of the Early Cretaceous. Endemic taxa, characteristic for the Caribbean Province, developed during these times. In addition, some ammonites of the Andean provenance are known in the Oxfordian and Late Tithonian of the Caribbean Province. From the Barremian, the Early Cretaceous ammonites of Western Cuba were more closely related to the Colombian fauna than to that of Mexico. Strong paleobiogeographical links between Cuba, Colombia and the Mediterranean Province were established during Barremian time.
REFERENCES


Ryszard Myczyński

KARAIJSKIE ZESPOŁY AMONITOWE W SUKCESJACH JURY GÓRNEJ I KREDY DOLNEJ KUBY

Streszczenie

Górnokarbonskie i dolnokredowe zespoły amonitowe zachodniej i środkowej Kuby należały do paleobiogeograficznej prowincji karaisyjkiej, która istniała w późnej jurze (od środkowego okresu) do wczesnej kredy (do hoterywu włącznie). Zespoły amonitowe prowincji karaisyjkiej występują w górnokarbonskich i wczesno-dolnokredowych utworach Kuby, północnego i środkowego Meksyku oraz południowej części Stanów Zjednoczonych. W badaniach zaznaczyły się wyraźne związki biogeograficzne pomiędzy Kubą, Kolumbią a prowincją medyterranną.

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EXPLANATIONS OF PLATE

Plate I

1 — Perisphinctes (Antiloceras) sp., Jagua Formation (Jagua Vieja Member), Middle Oxfordian, Sierra de los Organos; x 1

2 — Cubospindoceras sp., Jagua Formation (Pimienta Member), Hoyo de la Sierra outcrop, Sierra de los Organos, Upper Oxfordian (? Hypselium Subzone); x 1.5

3 — Mirospinctes pinaresinus pinaresinus Myczyński, 1976, specimen nr 2225, Jagua Formation (Pimienta Member), Mogote La Mina outcrop, Sierra de los Organos, Upper Oxfordian (? Hypselium Subzone); x 2.5

4-6 — Tarzioellipsera (Metahaploceras) sp.; specimen No. LP-1; shell diameter D = 30 mm, whorl height H = 15 mm, whorl width E = 11 mm, umbilical diameter O = 3 mm, H/D = 0.50, E/D = 0.36, O/D = 0.10; Jagua Formation (Pimienta Member), Mogote Pancho Luis outcrop, Sierra de los Organos, Upper Oxfordian (? Hypselium Subzone); x 0.3
R. Myczyński – Caribbean ammonite assemblages ...