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1.2. The Lower Cretaceous Mésogée: A state of the art

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Abstract

The Mésogée as defined by DOUVILLÉ (1900a) is both a paleobiogeographic and a paleogeographic concept. The configuration is revised here for the Lower Cretaceous by applying advances in knowledge over the last 80 years to the original concept. The global distribution of rudist-orbitolinid assemblages support the broad configuration of Mésogée proposed by DOUVILLÉ. Their distribution is more extended than in the former definition, especially concerning the latitudinal range; the circumterrestrial extension is confirmed.

The Tethys sensu SUESS (1893) is more limited longitudinally but is wider latitudinally: Mésogée and Tethys have two distinct meanings and are not to be confused.

1. Introduction

Mésogée was originally defined by DOUVILLÉ (1900a) as:
– the Cretaceous phase of the "Tethys" sensu SUESS (1893, 1900)
or the "Central Mediterranean" sensu NEUMAYR (1885)
– the sea inhabited by rudists and associated faunas.

Therefore Mésogée involves both, paleogeographic and paleobiogeographic aspects.

In fact the boundaries of the Mésogée as mentioned by DOUVILLÉ are not indentical to those of the Tethys of SUESS. First, the Mésogée corresponds only to the "equatorial zone" of the Tethys, i. e., its southern part. Secondly, Tethys is limited in longitude by Central America to the West and the Bengali delta to the East (the "Sino-Australien continent" acts as a barrier between the Te-

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thys and the Pacific Ocean), whereas Mésogée is inferred to have been circumterrestrial.

The contradiction between the geographic configuration proposed for Mésogée and the simple assimilation of its configuration to a particular phase of Tethys was misleading. This is probably the explanation for the extensive usage of "Tethys" in the sense of "Mésogée", i. e., as a paleobiogeographic entity (see for example DOUGLASS, 1960; COATES, 1973; KAUFFMAN, 1973; RAMSON, 1973; MIDDLEMISS, 1973; STEVENS, 1980; ENAY, 1980; SOHL, 1987) in spite of the original, essentially paleogeographic meaning.

Furthermore, as remarked by PHILIP (1982), Mésogée was used mistakenly for example as an oceanic domain limited to the Eastern Mediterranean (BIJU-DUVAL et al., 1977, DERCOURT et al., 1986) or in a too restricted sense for example as the perimediterranean area only (PELISSIE et al., 1982).

As a consequence of the author's experience and knowledge, the present paper is limited to the Lower Cretaceous phase of Mésogée, its objectives are:

– to recall the conceptual framework of DOUVILLÉ based on the paleobiogeographic reference taxa, their broad paleoclimatic significance and the inferred paleogeographic boundaries of their corresponding area of distribution.

– to test DOUVILLÉ's model against our present knowledge concerning the geographic distribution of rudist-orbitolinid assemblages, and to discuss their paleogeographic distribution using global plate-tectonic reconstructions,

– to present briefly the main guidelines for improvement of the model by a better definition of biotic assemblages using paleogeographic entities linked to specific paleoenvironments and their general paleoclimatic framework.

2. The Mesogée sensu Douvillé

The Lower Cretaceous Mésogée of DOUVILLÉ (1900a) was essentially the sea inhabited by rudists and large foraminifera, especially orbitolinids. The boundaries of this sea were derived from the gross geometry of the plotted localities in which both reference taxa have been recognized. In fact, the Mésogée area defined by DOUVILLÉ deals either with both reference taxa or only with one, i. e., many localities are characterized only by orbitolinids. Furthermore, ammonites and even some echinoids are also used as mesogean indicators.

In spite of Valanginian to Hauterivian (?) rudist developments in Western Europe (although Orbitolinids are lacking) the history of Mésogée is mainly recorded since the Barremian. Its extension at that time was from Colombia to Iran (or Pakistan?); but the central part was situated in the Mediterranean area to which rudists seemed to be limited. Orbitolinids appeared during the Late Barremian and were limited to the SE of France. Thus during this stage, outside Western Europe, Mésogée was essentially defined by ammonites.

Rudists and orbitolinids of Aptian age are known from North America (Texas), North-Africa (Algeria), the southern edge of the Black Sea, the Cauca-

sus and several localities in Iran; they also existed in Western Europe, up to Southern England. The contemporaneous presence of mesogean ammonites from Venezuela to Iran and North India has been noted. The spreading of Mesogée to North Pakistan was proved in 1926 after the study of a collection of rudists and orbitolinids from the Indus upper valley (Kohistan).

The Albian stage was characterized by important paleogeographic changes in Europe, but rudist-orbitolinid assemblages still existed. The mesogean ammonites and some echinoids are found from Chile through Peru and Venezuela to Texas, while they are also reported from North America to Syria. At the same time this mesogean fauna extended to the South Atlantic (Brazilian and Angolan coastal basins), some ammonites are recorded from Roumania to the Cameroons and even to India. In his paper on American rudists DOUVILLÉ (1900b) was not convinced about the precise age of the Middle Cretaceous fauna from Mexico; thus the record of the reference mesogean taxa in this region was doubtful for the Albian stage.

This brief summary of DOUVILLE's knowledge shows that the Mésogée was poorly defined during the Berriasian to Hauterivian interval.

During the Barremian-Albian interval the Mésogée is better defined by ammonites rather than by the rudist-orbitolinid assemblage, which is mainly known in the perimediterranean area with some extensions into North America (Texas) and the Middle East (Iran and Pakistan). Consequently, there is no evidence that Mésogée was a circumterrestrial entity during the Lower Cretaceous because no mesogean fauna was recorded in Eastern Asia as it was in Upper Cretaceous times.

No map was provided by DOUVILLÉ but his text is precise enough to draw the broad configuration of his Mésogée considered as a circumterrestrial entity during the whole Cretaceous. It corresponds to a latitudinal band about 20° wide in latitude; its median line coincides with the present situation of the equator in SE Asia (Borneo), while it shifts in the Euro-African area to about 20° N and in America to about 10° N (Fig. 1). The southern boundaries of Mésogée are related to shorelines and are considered as the northern border of the Brazilian and Saharian shields. The northern boundaries are not related to shorelines but to the distribution of the rudist-orbitolinid assemblage followed northwards by the "boreal communities" in the sense of NEUMAYR (1895). In spite of the reported coincidence between the paleogeographic and paleobiogeographic boundaries on its southern side "southern faunal extensions" (see above) show that at least during the Albian, the Mésogee probably spread south of the present equatorial line, especially on South Atlantic margins.

3. The present knowledge of Mésogée

Improved knowledge concerning the distribution of rudist-orbitolinid assemblages since DOUVILLE's work requires some modifications of his results concerning the geographic extension of Mésogée. Moreover, plate-tectonic con-

cepts also require that the paleogeographic framework of the paleobiogeographic reconstructions be modified.

Furthermore, the development of orbitolinid paleontologic studies require that DOUVILLE's orbitolinid conceptions be rediscussed. Actually this group is now divided into two "subfamilies" (see MOULLADE, 1965): The Orbitolinidae correspond with the forms to which DOUVILLÉ referred as "orbitolinids" (large, flat; frequently discoidal). They are only known from Barremian to Albian times (ARNAUD-VANNEAU, 1982; ARNAUD-VANNEAU & al., 1985). The Dictyoconinae (relatively smaller, essentially conical) occurred during the entire Lower Cretaceous (ARNAUD-VANNEAU, 1982; ARNAUD-VANNEAU & al., 1985).

Regarding the paleo-environmental significance of the rudist-orbitolinid assemblage on the one hand and the ammonite assemblage on the other, and based on the present stage of the investigation, the rudist-orbitolinid assemblage is considered here as the main reference because of its unequivocal shallow water evidence.

A – New Data (Fig. 2)

1 – Within the geographic area originally indicated as mesogean, many localities with rudists and/or orbitolinids have been added to those mentioned by DOUVILLÉ. This confirms the proposed broad configuration. These localities are as follows:

America

– Texas-Arizona. New information has put rudist-orbitolinid assemblages mainly into the Albian stage (COOGAN, 1977; PERKINS, 1974; SCOTT, 1979; 1981) while DOUVILLÉ (1900b) believed them to be of Aptian age. Numerous rudist taxa have been described from here since 1900 (see ADKINS, 1930; PERKINS, 1960; COOGAN, 1973), all of Albian age. Nevertheless, Lower Aptian rudists were recently found in the Sligo formation from the subsurface of Texas (SKELTON, 1982).

– Caribbean area. Lower Aptian (to Barremian?) rudists were recorded in Trinidad and Venezuela (HARRIS & HODSON, 1922; IMLAY in COOGAN, 1977; MASSE & ROSSI, 1987) as well as in Jamaica (CHUBB, 1971; COATES, 1977). Albian Caprinids were reported from Cuba, the Dominican Republic, Puerto Rico and their presence in the Virgin Islands is also possible (SOHL, 1976).

The Mexican Lower Cretaceous rudists, first recognized by FELIX (1891), then by PALMER (1928) and MUELLERRIED (1933), have been described recently in more detail (ALENCASTER & PANTOJA ALOR, 1986). Orbitolinid occurrences from Arizona, New Mexico, Texas, and from the subsurface of Mississippi and Florida are well documented by DOUGLASS (1960a). Later Lower Cretaceous orbitolinid-bearing limestones are also mentioned from the Dominican Republic, Puerto Rico, Barbados and Trinidad (DOUGLASS, 1961) as well as from Guatemala and Venezuela (DOUGLASS, 1960b).

Europe

Extensive data have been provided on rudist communities from Switzerland, France (PAQUIER, 1903–1905; DOUVILLÉ, 1918; MASSE, 1976) Italy (TORRE, 1965; MAINELLI, 1975–1983; CAMOIN, 1982; MASSE & al., 1984; LUPERTO-SINNI & MASSE, 1982; MASSE, 1985), Spain (BATALLER,1974; PASCAL, 1984) and Portugal (REY, 1972; BERTHOU & al., 1983 and unpublished observations from MASSE, REY & SKELTON). Orbitolinids have also been described from these localities especially in the Barremian-Albian interval, as characteristic components of "Urgonian limestone" formations. Dictyoconids are present from Valangian to Albian in the European Province, whereas they are mainly known from Hauterivian to Albian in the African one (PELISSIE & al., 1982; MOULLADE & al., 1984), while rudists occur subcontinuously. Large amounts of data about rudists have been provided from Bulgaria (PAQUIER & ZLATARSKI, 1901; TZANKOV, 1960; ATANASSOVA-DELTCHEVA, 1978), where these bivalves are mainly of Barremian? to Lower Aptian age. Rudists have been mentioned from different parts of Roumania: Carpathic zone (DRAGASTAN, 1975) as well as Dobrogea (NEAGU & al., 1977). Lower Aptian caprotinids and caprinids were reported from the West Carpathians in Czechoslovakia (KÜHN & ANDRUSOV, 1942) and also from the Pienine Klippen Belt (MESIK, 1966). Barremian to Aptian Urgonian limestones with rudists have been described from the High Tatric Massif in South Poland (PASSENDORFER, 1930; LEFELD, 1968) as well as from Hungary (BENKÖ-CZABALY, 1970). In nearly all these localities orbitolinids are associated with rudists. Monopleurid and requienid limestones are well documented from Eastern Serbia (JANKICEVIC, 1978, 1984); some caprotinids and caprinids have been recoreded from Croatia (POLSAK, 1970), Slovenia (PLENICAR & BUSER, 1967) and Bosnia (MASSE & al., 1984), where some Aptian radiolitids have been recently described (SLISKOVIC, 1982, 1984). Barremian to Albian rudists were also reported from the Parnassus zone of Central Greece (COMBES & al., 1981) as well as from Albania (PEZA & al., 1981).

Urgonian formations are well known in the Southern USSR: in Crimea (PCHELINTSEV, 1959; YANIN, 1975a–b, 1985) and in the Caucasus (RENGARTEN, 1950; YANIN, 1985) with a well developed rudist-orbitolinid association within the Barremian-Aptian, whereas rudists have also been found in the Berriasian to Hauterivian interval, especially in Crimea. Similar Urgonian rudists were also described from the Ukrainian Carpathians (YANIN & TCHERNOV, 1979).

North Africa

Rudists associated with Urgonian limestones are known from the Aptian of Algeria (eastern part) (BLAYAC, 1908; EMBERGER, 1954; VAN DE FLIERT, 1952; CHIKHI-AOUIMEUR, 1980, 1983; MASSE & CHIKHI-AOUIMEUR, 1982) and Tunesia (PERVINQUIÉRE, 1903; MASSE, 1984). At the same time, caprotinids and requienids are present in Hauterivian limestones both in Algeria and Tunisia (MASSE, unpublished). Requienids have also been mentioned from Aptian lime-

stones of Morocco (CANEROT & al., 1981). In all these localities orbitolinids (both Orbitolininae and Dictyoconinae) are associated with rudists.

Near and Middle East

From Sinai, Lebanon and Syria orbitolinids were reported by HENSON (1948), SAID & BARAKAT (1957) and SAINT-MARC (1970).

A typical mesogean fauna is documented from shallow shelf carbonates extending from Yemen to Iran through Saudi Arabia and Oman. Thus, rudists are known from Hauterivian to Aptian, orbitolinids are recorded mainly during the latter stage (MASSE & al., 1984; ALSHARHAN & NAIRN, 1986; SIMMONS & HART, 1987; MOSHIER & al., 1988). Urgonian limestones with unidentified rudists but with a clear Lower Cretaceous age were also reported from Central Turkey (GUTNIC & MOULLADE, 1967).

Around the Persian Gulf, orbitolinid occurrences have been mainly reported by HENSON (1948).

Central and Southern Asia

Following the first observations of DOUVILLÉ (1926), detailed studies in Pakistan (ROSSI-RONCHETTI, 1965; PUDLEY & al., 1985) and Afghanistan (MONTENAT & al., 1982) have shown the importance of orbitolinid-rudist asemblages of Aptian-Albian age in this region. Orbitolinids were also reported from Burma (SAHNI, 1937), but the corresponding paleontologic and sedimentologic framework is not well known.

Many new sites have been recorded, of which locations were predictable from the DOUVILLÉ model whereby previous data were definitely lacking. The corresponding locations are mainly the result of offshore and/or deep-sea drilling investigations.

North Atlantic Sites

On the Grand Banks of Newfoundland, shelf petroleum wells discovered orbitolinids (GUPTA & GRANT, 1971). D.S.D.P. recorded a rudist-orbitolinid assemblage of Barremian?-Lower Aptian age (PERKINS, 1979; SCHROEDER & CHERCHI, 1979) at the southern toe of the Bank. At Meriadzek Bank, caprinids were identified in association with a typical Urgonian assemblage of microfossils (PASTOURET & al., 1974).

Western Pacific Sites

An Aptian orbitolinid-rudist assemblage (with caprinids) was dredged off Japan (Geisha guyots) and between the Marshall and Hawaiian Islands (Pacific Mountains) (HEEZEN & al., 1973).

From many localities where DOUVILLÉ only mentioned ammonites, orbi-

tolinids have been described in the meantime. This is the case for Colombia and Venezuela (GERHARDT, 1897, and KARSSEN, 1858–1886), both references in DOUGLASS (1960a). At least the occurrence of orbitolinids in Borneo reported by FRITSCH (1878) (in DOUGLASS, 1960a), which is not included in DOUVILLÉ's localities, falls within his Mésogeé.

Many new sites have been recorded outside the proposed Mesogean realm of DOUVILLÉ.

On the Pacific side of South America, Lower Cretaceous requienids and/or monopleurids have been mentioned in Chile at 30° S present latitude and Peru. These rudists are associated with calcareous sponges and corals (FRITZSCHE, 1924). Coral biostromes were recently described in the Hauterivian-Barremian of Peru (SCOTT & ALEMAN, 1984) and have been interpreted as typical Tethyan (= Mesogean) assemblages, as well as similar faunas from the Middle Jurassic of Chile (PRINZ, 1986).

In Eastern Africa, rudist-orbitolinid assemblages have been described from Somalia (TAVANI, 1947; SILVESTRI, 1932 in PEYBERNES, 1982) and from Tanzania (HENNIG, 1916; DIETRICH, 1925 in PEYBERNES, 1982). The Somalian fauna is dated as Albian (a possible Aptian age is also possible for part of the Mid-Cretaceous formations). The Tanzanian fauna recently revised by PEYBERNES & FORSTER (1987) belongs to the Aptian. Orbitolinids have also been figured from Kenya and Ethiopia (PEYBERNES, 1982).

In the Japanese archipelago several orbitolinid-rudist-bearing beds have been found since 1920 (YABE & NAGAO, 1926; YABE & HANZAWA, 1926; OKUBO & MATSUSHIMA, 1959). All these beds are apparantly of Aptian age.

B – Mésogée Extension: A Discussion

New data since the publication of DOUVILLÉ's work show that the Lower Cretaceous Mésogée auct. needs to be extended:

– southward on the Pacific side of South America and on the eastern side of Africa.

– northward on the Pacific side of Eastern Asia.

A problem arises concerning the significance of the northern part of the West African, central and southern Atlantic margins considered by DOUVILLÉ as "Mesogean extensions" of Mid-Cretaceous age. Similarly, Brazilian marginal basins pose the same question.

No rudist-orbitolinid assemblages have yet been found in any of these regions. However, shallow water carbonates with calcareous green algae and Foraminifera with Mesogean significance are known from the following localities:

– offshore of Senegal, dasyclads are associated with orbitolinids in limestones of Aptian-Albian age (PEYBERNES, 1982; MICHAUD, 1984),

– Southeast of Nigeria, dasyclads are associated with Trocholina in limestones of Albian age (DESSAUVAGIE, 1968; FORSTER, 1978; POIGNANT & LOBITZER, 1982).

– offshore of the Brazilian coast (Sergipe basin), Albian carbonate platforms have been recognized (unpublished results of Petrobras) along with shallow water foraminifera (BENGTSON & BERTHOU, 1982).

Platform carbonates have also been recognized offshore of Marocco and Mauritania, where their age is thought to be Aptian (JANSA & WIEDMANN, 1982; VON RAD & WISSMANN, 1982; RANKE & al., 1982), although no precise information has been given on their paleontologic content. In all these localities, rudists, and/or orbitolinids are to be expected and further investigations are needed. "Mesogean", but pelagic, foraminifera have been reported by CHEVALIER and FISCHER (1982) from Gabon. Here, Gargasian forms similar to the perimediterranean ones support the idea of a pre-Albian communication between the Southern and Central Atlantic and the extension of Mésogée to the meridional part of Western Africa. This point of view is not shared by ANGLADA & RANDRIANASOLO (1985), for whom the Central Atlantic pelagic foraminifera were mainly controlled by migrations coming from the South Atlantic. Consequently, the question of a Mesogean extension southward of Nigeria is still open.

On the Pacific side of North America, no Lower Cretaceous rudist-orbitolinid assemblages have been found, but JONES (1972) refers to a "Tethyan faunal assemblage" near 45° N, whose "warm shallow water" significance is not clearly demonstrated. Furthermore, this area belongs to a terrane complex whose geographic origin is probably more meridional (BLAKE & JAYKO, 1986; AUBOUIN & al., 1986). Therefore the precise significance of this Tethyan assemblage is not quite clear, neither from palaeoecologic nor from palinspastic points of view.

The configuration of proposed Mésogée is different from PHILIP's (1982), which was based mainly on Upper Cretaceous data. Regarding the "Tethys" as a paleobiogeographic concept closely similar to Mésogée, some differences are also noticeable to the "Tethyan realm" of KAUFFMAN (1973), KAUFFMAN & JOHNSON (1988). In this model the North-West Pacific area (the Japanese and Hawaiian seamounts), the Atlantic coastal zone of North America (including the Grand Banks area) and the Atlantic margin of France and Great Britain are all placed in the North temperate realm. This reconstitution also ignores the occurrence of Central-European (Poland, Czechoslovakia) sites. COATE's (1973) reconstitution using rudists and/or hermatypic corals as well as SOHL's (1987) using gastropods are very similar to those of KAUFFMAN.

The configuration proposed here is similar to this by GUPTA & GRANT (1971) using the distribution of the orbitolina group and the LLOYD model (1982) based on "warm water fauna including bivalves, hermatypic corals and orbitolinas". But all of these reconstitutions fail to take into account the Pacific side of South America, the West Pacific seamounts and the West Africa-Brazilian localities.

Consequently, the southward extension of Mésogée is far greater than it was previouly thought. The present day shift of this realm between the South American and East African latitudes is about 20°. The northward shift between

East Asia and West Europe is only about 10°. The total latitude extension appears now to be of about 55° both on the Pacific side of America and between Central Europe and Eastern Africa.

C – Mésogée Configuration in Palinspastic Reconstructions

The following is evident for the Lower Cretaceous prior to the communication of the southern and the northern part of the Atlantic by the opening of the central part of this ocean by regarding palaeotectonic reconstructions, especially those of BARRON & al. (1981) with some complements of DERCOURT & al. (1986) for the Mediterranian and the Middle East:

On palinspastic paleogeographic maps (Fig. 3) DOUVILLÉ's Mésogée configuration shows a strong discrepancy between the location of Mésogée and the position of the paleo-equator. This is also indicated by earlier attempts of KAUFFMAN (1973), PHILIP (1982) as well as PARRISH & BARRON's (1986) reconstructions of warm seas/carbonate platform relationships. According to this, Mésogée is mainly developed in the northern paleohemisphere. In the configuration proposed here (Fig. 4), the paleolatitudes of the Mésogée boundaries near the oceanic margins are very similar in the southern hemisphere, i. e. about 35° S. In the northern hemisphere they are about 35° N in Western Europe and on the Atlantic side of North America; on its Pacific side the paleolatitude is close to 40° N, although this value needs further confirmation. On the East Asiatic margins it ranges close to 60° N.

It appears from this reconstruction that the latitudinal extension of Mésogée is wider than proposed by previous models: probably near 100°, i. e., far more like the present intertropical situation of warm seas. Mésogée is nearly symmetrical on both sides of the paleo-equator, especially in the Neo-Tethysian area and in the Eastern Pacific. This situation fits well with the paleo-equator position proposed by the palinspastic plate-tectonic reconstructions (see above), whereas this fit was anomalous in previous models. An important asymmetric pattern is nevertheless observed on the East Asiatic margin. Similarily, as the result of possible paleogeographic barriers in the Central Atlantic region, Mésogée has here a limited extension southward, at least in pre-Albian times. In this region the limited extension southward in the Albian poses some questions which need further investigations.

Conclusions

The Lower Cretaceous Mésogée as proposed by DOUVILLÉ (1900a–1926) is supported by many data obtained since his work. Nevertheless, the following findings, tentative conclusions, and remarks are to be stressed.

1. In spite of the lack of many oceanic settings DOUVILLÉ's Mésogée was essentially circumterrestrial, a hypothesis supported by modern data concerning oceanic areas which fit with plate tectonic reconstructions.

2. The latitudinal extension of Mésogée is wider than postulated by DOUVILLÉ; the main regions which need to be added to DOUVILLÉ's Mésogée are: Eastern Asia, the Central Pacific side of South America and North America counterparts (north of California), and the North Atlantic. Moreover, the southward shifting of Mésogée boundaries around the South America-Africa blocks fits with the paleo-equator position proposed by paleotectonic reconstructions. That is to say, Mésogée has a nearly symmetrical extension on both sides of the paleo-equator.

3. As mentioned by DOUVILLÉ, the Mésogée boundaries in the South American-African block (i. e., the Brazilian-Ethiopian continent of NEUMAYR) are formed by shorelines, whereas its northern boundaries are climatically and/or paleobiologically controlled. This configuration was modified during the Albian as a result of the opening of the central Atlantic. Orbitolinid-rudist assemblages have not yet been recorded here.

4. Consequently, Tethys differs at least from Mésogée by its limited longitudinal extension and wider latitudinal spreading, especially in northwestern Europe. The two words have significantly different meanings, both from the conceptual point of view (PHILIP, 1982; MONOD, 1985) and from the objects they tend to describe. As proposed by MONOD (1985), Tethys must be used essentially in a paleogeographic and paleostructural sense, while Mésogée should be used essentially in a paleobiogeographic sense even if, as a paleobiologic entity, it also has a paleogeographic meaning.

5. Palinspastic reconstructions of the Mésogée need to be discussed and tested with paleoclimatic and ocean circulation/atmosphere relationship models. A reappraisal of Mesogean biota in order to obtain a better definition of bioprovinces and communities and to establish accurate models of biotic community/environment relationships should be undertaken.

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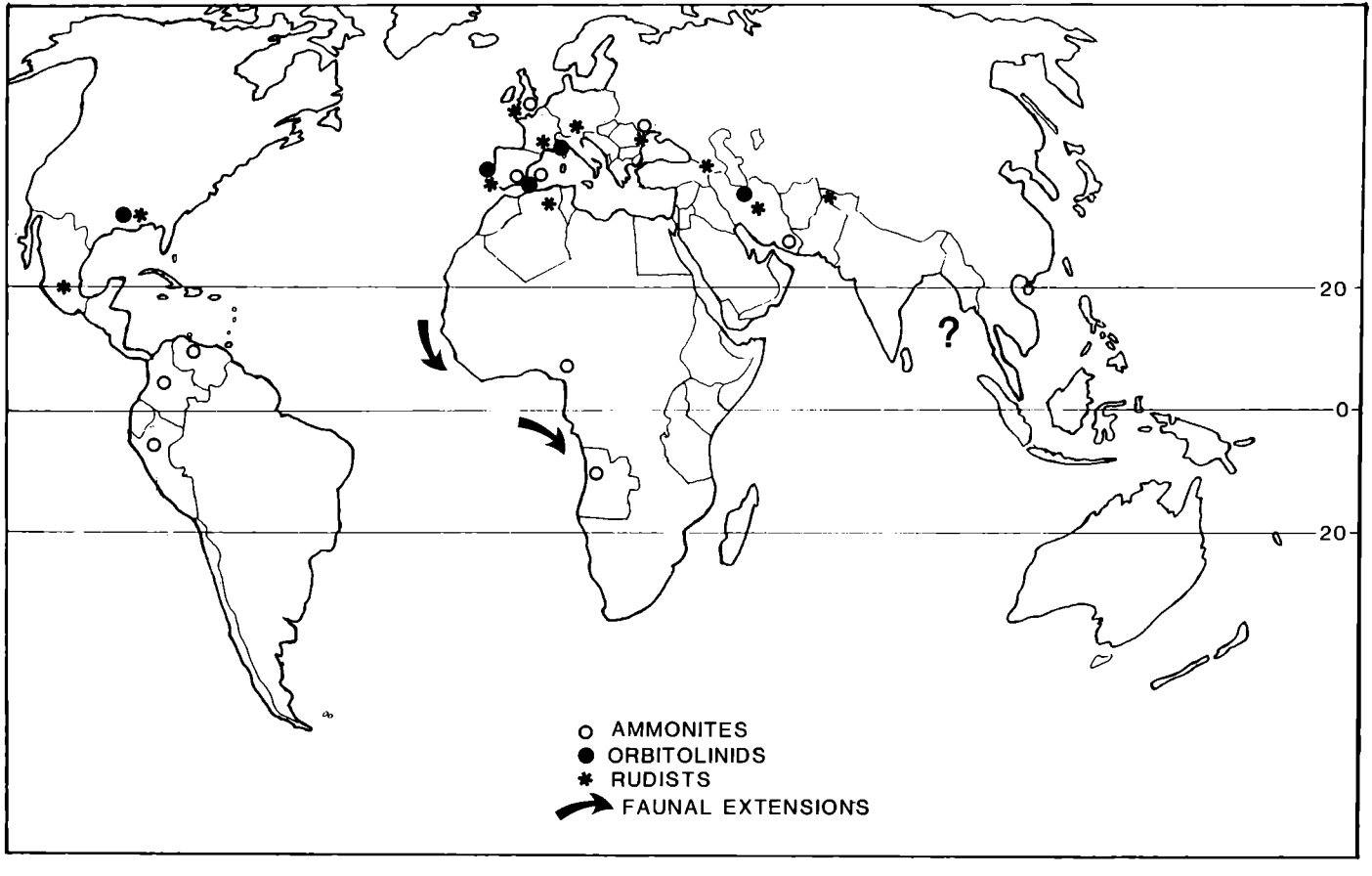

Fig. 1: Geographic distribution of the Lower Cretaceous Mesogean fauna after DOUVILLÉ (1900–1926).

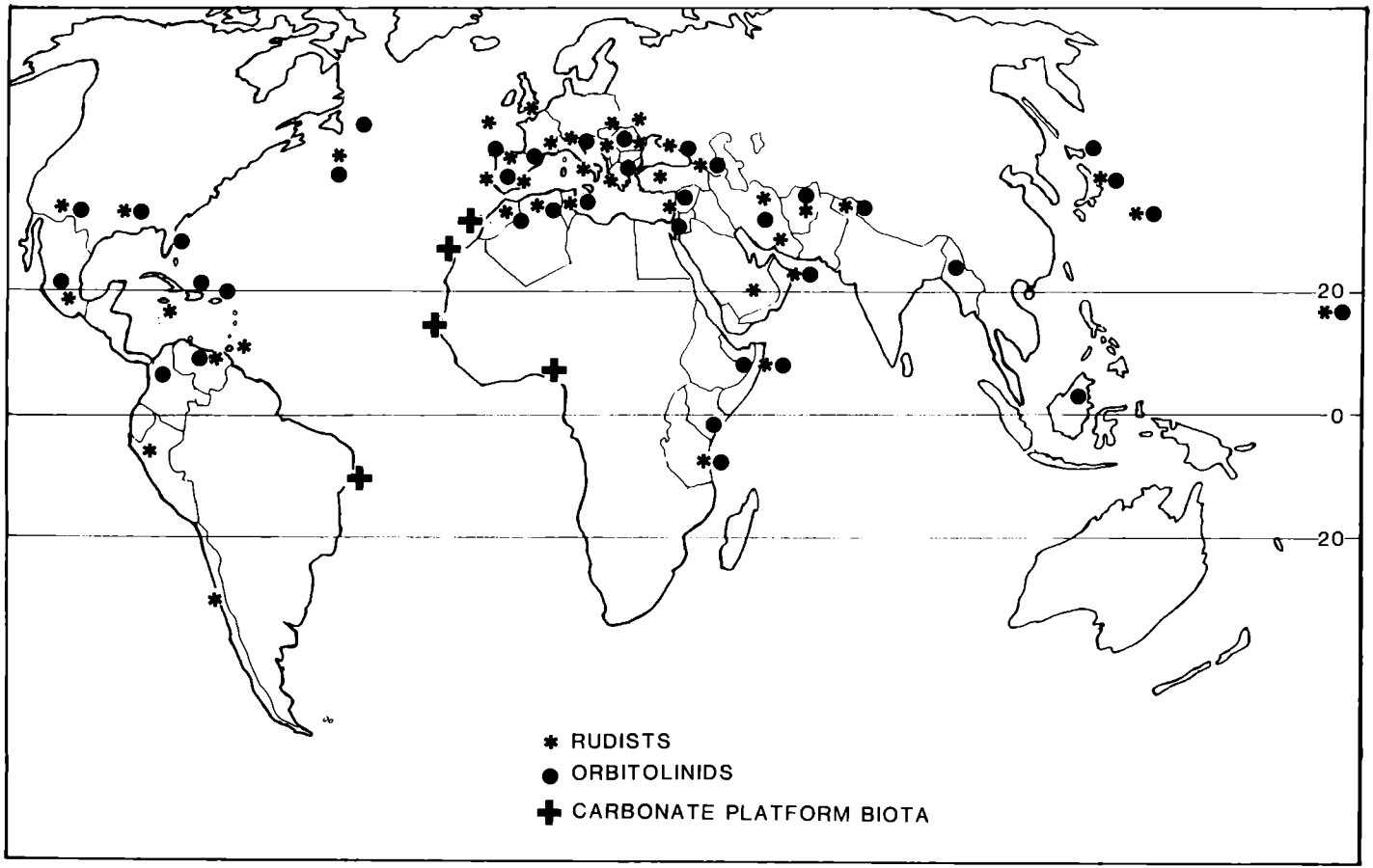

Fig. 2: Geographic distribution of the Lower Cretaceous Rudists, Orbitolinids (Orbitolininae and Dictyoconinae) and carbonate platform biota (Large Foraminifera – dasyclads aceans) according to present knowledge on Lower Cretaceous.

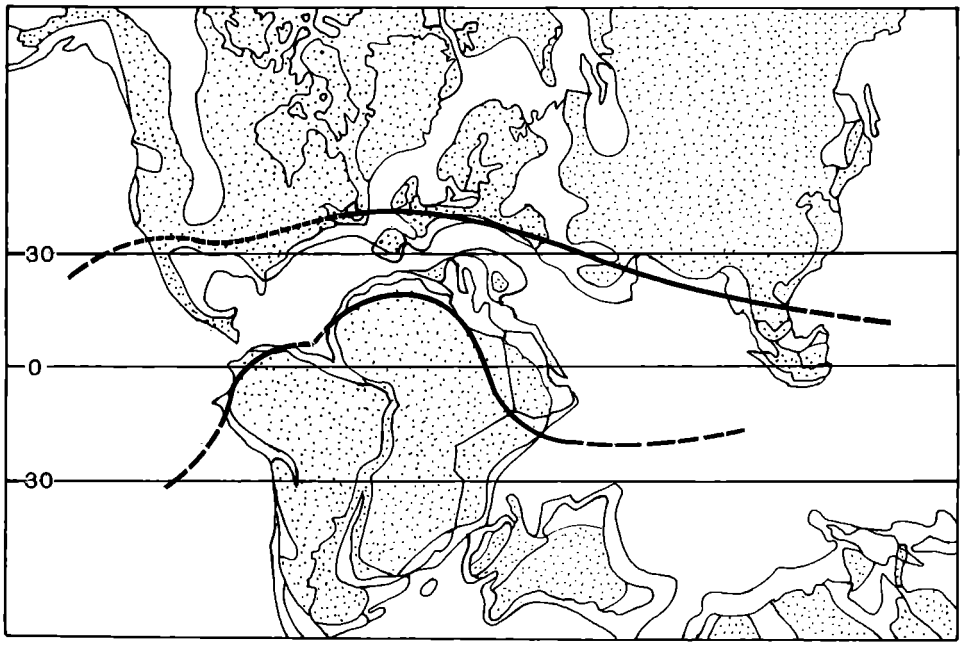

Fig. 3: Palinspastic configuration of the Lower Cretaceous Mésogée using DOUVILLÉ's data (paleogeographic reconstruction of continents after BARRON & al. [1981] and DERCOURT & al. [1986]).

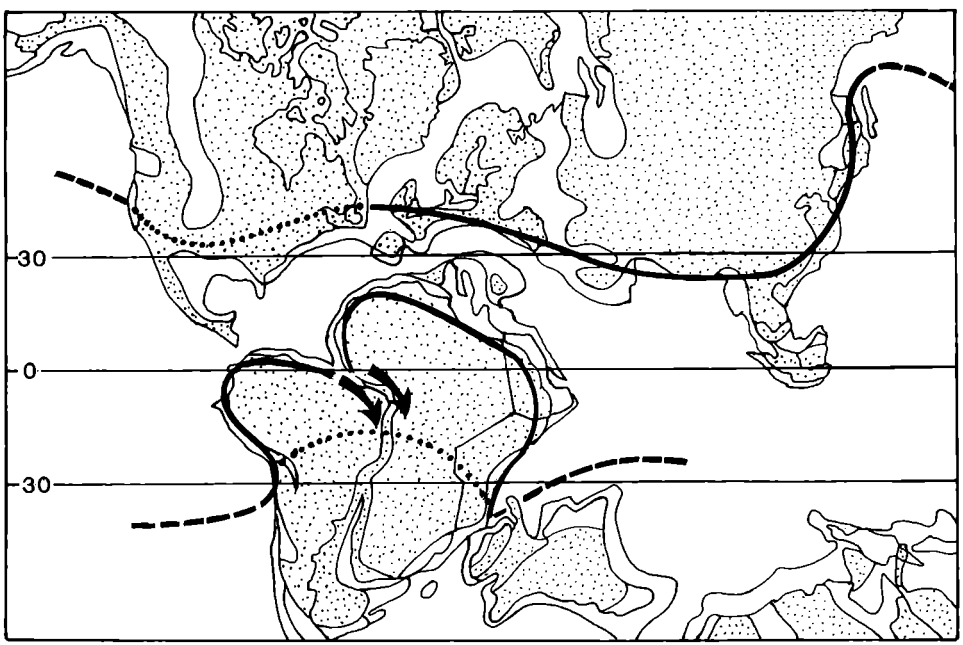

Fig. 4: Palinspastic configuration of the proposed Lower Cretaceous Mésogée. Arrows correspond to Albian Mesogean extensions on Central Atlantic.