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New ammonite data about the earliest syn-rift deposits (Lower Jurassic) in the Ionian Zone of N-W Greece (Epirus)

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With 10 figures

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Abstract: New finds of Mediterranean ammonites in the uppermost Siniais and Louros limestones lead to improved dating of the earliest pelagic deposits in the Ionian Zone. Although the beginning of deposition still cannot be dated, these finds indicate that (a) the first episode of pelagic sedimentation ended in mid-to-late Domerian times, (b) rifting began either in – or more probably before – the mid-Carixian as shown by the occurrence of *Protogrammoceras dilectum* (FUCINI) in one of the study sections.

Zusammenfassung: Funde von mediterranen Ammonitenfaunen im oberen Teil der Kalke von Siniais und von Louros erlauben präzise Aussagen zur Chronologie der ersten pelagischen Sedimente in der Ionischen Zone. Obwohl das Alter des Beginns dieser Formationen noch unbekannt ist, zeigen die neuen Daten, daß a) die erste pelagische Episode im mittleren/oberen Domerium zu Ende geht und b) der Beginn des Riftings entweder in das mittlere Carixium oder, wahrscheinlich sogar früher, datiert. Dies wird durch ein *Protogrammoceras dilectum* (FUCINI) aus einem der untersuchten Profile belegt.

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Introduction

The Ionian Zone of NW mainland Greece (Epirus) is one of the outlying zones of the Hellenids (Paxos Zone, Ionian Zone, Gavrovo-Tripolitza Zone; Fig. 1). The evaporites, dated Scythian-Anisian by POMONI-PAPAIOANNOU & TSAILA-MONOPOLIS (1983), DRAGASTAN et al. (1985), forming the base of the Ionian series (Fig. 2) are capped by the Foustapidima limestones, dated Ladinian-Rhaetian by KARAKITSIOS & TSAILA-MONOPOLIS (1990). These are overlain by the Pantokrator limestones, classically dated as Lower Jurassic (AUBOUIN 1959, IGRS-IFP 1966, KARAKITSIOS & TSAILA-MONOPOLIS 1988). These neritic platform deposits give way to mainly carbonate, locally silicified, pelagic deposits of Jurassic age. This series begins with either the Siniais limestones (with rare flint beds) or the Louros limestones (no flints). The facies and thickness variations of these deposits are indicative of active tectonic spreading compounded by halokinesis involving the evaporites of the base of the series (KARAKITSIOS 1988, 1992, 1995).

The period when the Siniais and Louros limestones studied in this paper were being deposited was an important one in the history of the Ionian Zone in Greece and in Albania as it saw the onset of rifting. What until then had been extensive, monotonous carbonate platforms (e.g. Pantokrator limestones in Epirus, neritic *Paleodasycladus mediterraneus* limestones in Albania) broke up as a pelagic sedimentary basin formed (e.g. Siniais or Louros limestones in Greece and Kakodhiki limestones in Albania). The break-up of the carbonate platforms was followed by intense differentiation in the inner part of the Ionian Basin engendering lateral variations in thickness and facies as well as synsedimentary features (e.g. faults, sedimentary dykes) which persisted until Tithonian times (KARAKITSIOS 1992, 1995). However, the beginning of basin formation cannot be dated directly as the lowermost pelagic formations (Siniais or Louros limestones in Greece, Kakodhiki limestones in Albania) contain no fossils. The upper part of these

Fig. 1. A: Extent of the four outermost zones (Paxos, Ionian, Gavrovo, Pindos) of Western Greece and location of the study sites (α, β, γ) in the Epirus region.
B: Location of sections 1 to 5 (ringed) (1: Vathy, 2: Klissoura South-East, 3: Klissoura East, 4: Neokori, 5: Mavron Oros) and geological sketches. **a**: Pantokrator, Siniais or Louros limestones. **b**: Late Liassic-Malm formations (ammonitico rosso or lower schists, limestones with filaments and upper schists). **c**: Vigla limestones. **d**: Alpine formations after Vigla limestones. **e**: Undifferentiated post-Alpine formations. **f**: Section.

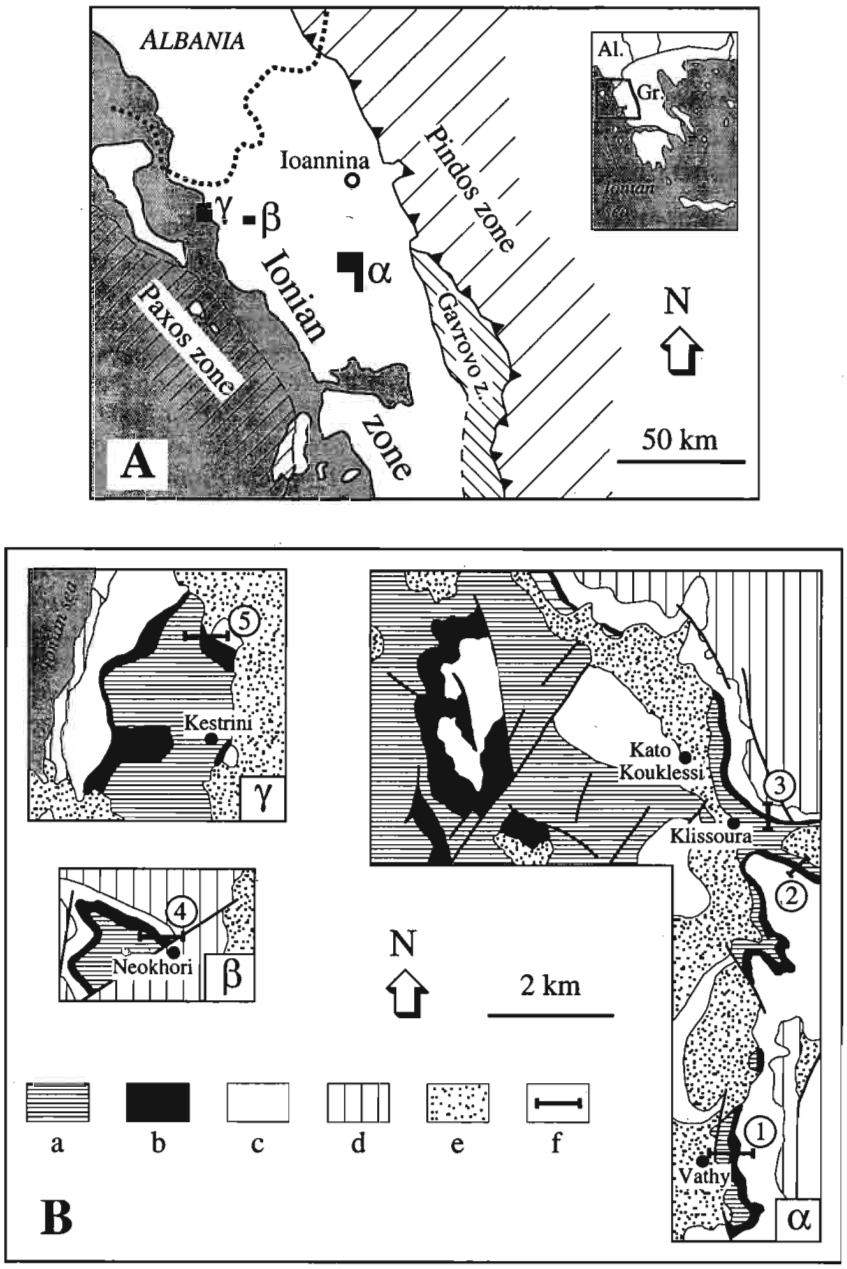

Fig. 1 (Legend see p. 300)

formations can, though, be dated precisely from the locally abundant macrofauna (brachiopods, ammonites) both in Greece and Albania (DOMMERGUES et al. 2000). This paper specifies the age of these fossil-bearing strata in northern Greece (Epirus, Middle-Eastern and Western Ionian Zone).

Sections and faunas

1. Vathy Section (Fig. 1, 3)

This section, in the eastern part of the Louros Valley, east of the village of Vathy, begins in the Pantokrator limestones: these are massive, grey-white, crystalline or microcrystalline limestones and gravelly limestones with sparite cement. These bindstone to grainstone, neritic limestones contain calcareous algae, benthic foraminifera, ostracods, crustacean coprolites, gastropods and lamellibranchs. This fauna suggests early-to-mid Liassic age, without greater precision. The facies are indicative of inner platform sedimentation (intertidal environment) at the limit of exposure (KARAKITSIOS & TSAILA-MONOPOLIS 1988).

The Vathy Section continues with some 60 m of Louros limestones. These are peloid-rich grainstones to packstones, characterized by intense secondary micritization. They contain oncoids, intraclasts and varied fauna: many foraminifera, ostracods, spicules and sponge debris, echinoderm fragments, gastropods, pelecypods, brachiopods and ammonites. These last two groups are found mainly in the upper part of the formation, with the ammonites in the final few metres. The Louros limestones are indicative of a much deeper depositional environment than that of the underlying Pantokrator limestones and are characteristic of an outer platform environment (KARAKITSIOS & TSAILA-MONOPOLIS 1988).

The final metres of the Louros limestones at Vathy, immediately below the ammonitico rosso, have yielded the following ammonite fauna: Phyllocera-

Fig. 2. Stratigraphic column of the Ionian Zone (after KARAKITSIOS 1995): **1**: Pelites and sandstones. **2**: Limestones with flints and lithoclasts. **3**: Pelagic limestones with lithoclasts. **4**: Pelagic cherty limestones. **5**: Cherty beds with intercalated clays. **6**: Siliceous argilites, marls and pelagic limestones. **7**: Pelagic limestones with pelagic pelicypods. **8**: Nodular pelagic limestones with ammonites. **9**: Micritic limestones with brachiopods and small ammonites. **10**: Pelagic limestones with flints. **11**: Platform limestones. **12**: Platy black limestones. **13**: Gypsum and salt. **14**: Dolomites. **15**: Breccia. **16**: Pelagic pelecypod section (filament). **17**: Ammonite. **18**: Brachiopod.

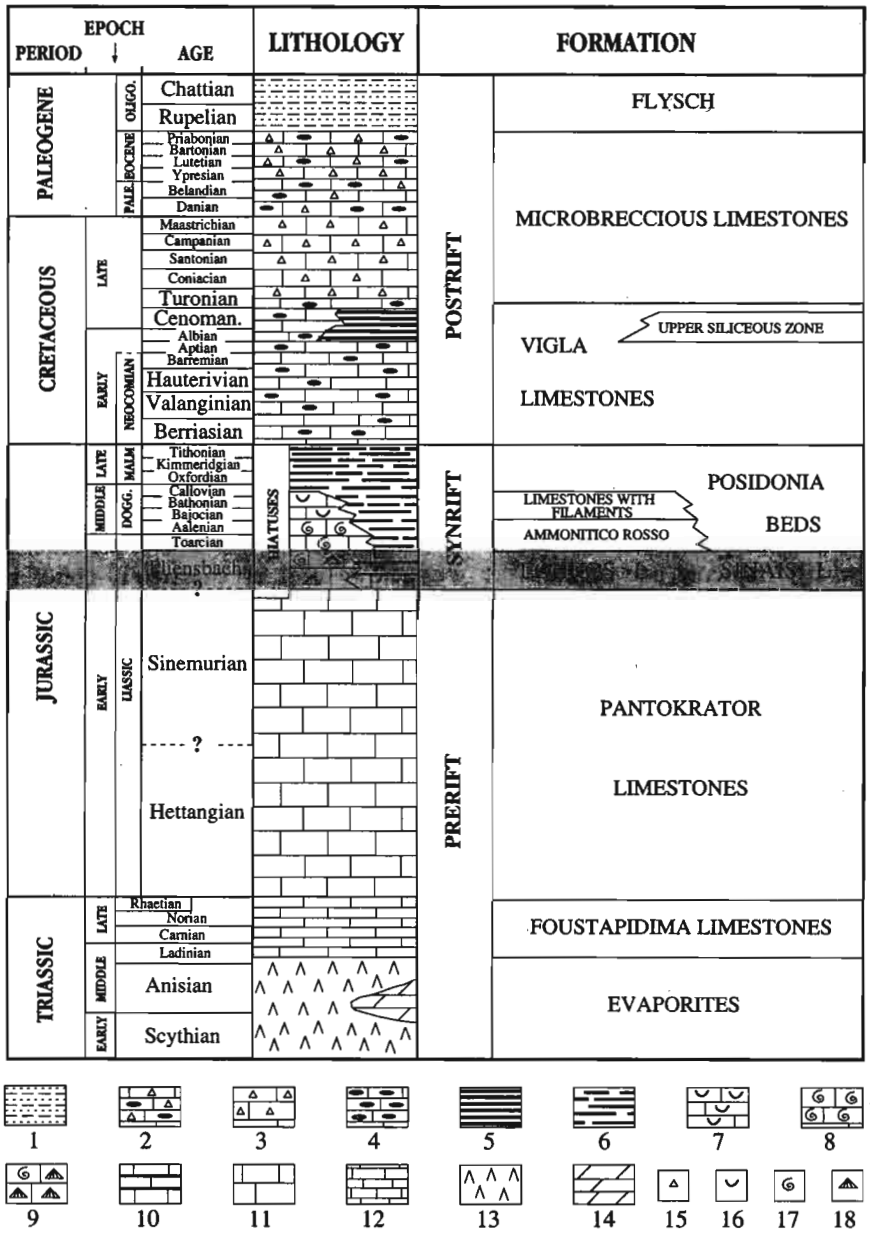

Fig. 2 (Legend see p. 302)

taceae sp. (1 specimen), *Lytoceras* sp. (1 specimen), Dactylioceratidae sp. (1 specimen), Harpoceratinae sp. (1 specimen), *Neolioceratoides schopeni* (GEMMELLARO) (1 specimen, Fig. 4. 8).
This fauna indicates a late Domerian age for these strata (Hawskerense Subzone; Fig. 5).

The Vathy Section continues with some ten metres of Toarcian ammonitico rosso (KARAKITSIOS & TSAILA-MONOPOLIS 1988, KARAKITSIOS et al. 1988 and KARAKITSIOS 1992).

2. Klissoura South-East Section (Fig. 1, 6)

The Louros limestones can also be observed on the southern side of Klissoura Gorge (the section in fig. 6 is located some 1300 m ESE of the village of Klissoura). Outcrops some 10 metres thick are visible on the plateau edge and run more or less unbroken NW for some 800 m. However, the base of the formation is not exposed. The microfauna is very similar to that in the Vathy section. The Louros limestones SE of Klissoura are crossed by palaeofaults with throws of several metres marked by spectacular sedimentary dykes filled with yellow-brown breccia with a micritic limestone matrix containing small filaments and spicules of sponges as well as calcareous material (KARAKITSIOS 1992). The top of the Louros limestones (immediately below the ammonitico rosso) is rich in brachiopods [*Zeilleria mutabilis* (OPPEL), *Spiriferina gryphoides* (UHLIG), *Phymatothyris rheumatica* (CANAVARI), *Propygope* (*nucleata*) *aspasia* (MENEGHINI), *Pisirhynchia retroplicata* (ZITTEL), *Phymatothyris* cf. *cerasulum* (ZITTEL), identified by J. H. DELANCE). Most of these brachiopods are characteristic of the limestone facies of the Tethyan middle Liassic: e.g. Trentino- Alto Adige, the Apennines, Sicily and the Bakony Mountains. Many not readily extractable ammonites are observed:

a) Several collection points in the final metre below the top of the formation yielded: Phylloceratacеae sp. (2 specimens), *Phylloceras* sp. (1 specimen; Fig. 4.1), *Lytoceras* sp. (1 specimen), *Calliphylloceras* gr. *bicoclae* (MENEGHINI) (2 specimens; Fig. 4.2), *Protogrammoceras* (*Paltarpites?*) sp. (1 specimen), *Lioceratoides* sp. (1 specimen), *Arieticeras* gr. *bertrandi* (KILLIAN) (2 specimens; Fig. 4.9, 12), *Arieticeras* gr. *algovianum* (OPPEL) (2 specimens; Fig. 4.11), *Arieticeras* sp. (4 specimens), *Leptaleoceras ugdulenai* (GEMMELLARO) (2 specimens; Fig. 4.6, 7), *Leptaleoceras* sp. (1 specimen).

b) The northernmost collection point (some 500 m SSE of Klissoura), some two to four metres below the top of the formation, yielded: *Protogrammoceras dilectum* (FUCINI) (1 specimen; Fig. 4.5).

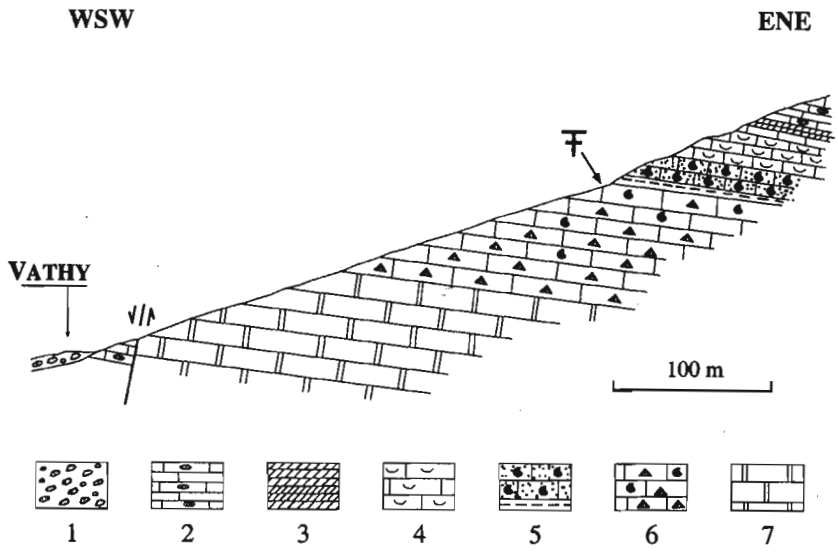

Fig. 3. Vathy section: **1**: Quaternary surface formations. **2**: Vigla limestones. **3**: Upper Posidonia Beds. **4**: Filament limestones. **5**: Ammonitico rosso. **6**: Louros limestones. **7**: Pantokrator limestones.

These ammonites as a whole allow the final metres of the Louros limestones to be dated to the mid-Carixian – end of Domerian (Fig. 5). However, most of the fauna, found in the final metre, are of mid-to-late Domerian age (Fig. 5).

3. Klissoura East Section (Fig. 1, 7)

The Louros limestones crop out on the edge of the plateau on the northern side of Klissoura Gorge (some 500 m East of Klissoura village). Some 12 m are exposed. The top two metres of the formation (immediately below the Toarcian ammonitico rosso) yielded: Phylloceratacеae sp. (1 specimen), *Calliphylloceras* gr. *bicicolae* (MENEGHINI) (1 specimen), *Arieticeras* gr. *bertrandi* (KILLIAN) (1 specimen), *Arieticeras* sp. (1 specimen).
This fauna is of a mid-Domerian age (Fig. 5).

4. Neokhori graveyard section (Fig. 1, 8)

On the eastern side of Golnitsa hill, behind the chapel of the Neokhori graveyard, the final metres of the Siniais limestones and the first metres of the Toarcian ammonitico rosso can be observed as an inverted series. In this locality, the sublithographic bedded Siniais limestones (wackestones) contain cherts. This formation varies in thickness in the different domains of the Ionian Zone, reaching as much as 200 metres (IGRS-IFP 1966). It is 60 m thick at Neokhori. Facies are indicative of a deeper water environment than for the Pantokrator limestones (IGRS-IFP 1966), or at least of increased oceanic influences (BERNOULLI & RENZ 1970). The Siniais limestones are a lateral equivalent of the Louros limestones (KARAKITSIOS & TSAILA-MONOPOLIS 1988, KARAKITSIOS 1992), but unlike the latter until now had not yielded macrofossils. The uppermost bed of Siniais limestones at Neokhori yielded: *Neolioceratoides hoffmanni* (GEMMELLARO) (1 specimen Fig. 4.15). This ammonite allows the top of the Siniais limestone to be dated directly for the first time. It is from the end of the Domerian (Hawskerense Subzone; Fig. 5).

5. Mavron Oros Section (Agios Nikolaos-Kestrini Chapel) (Fig. 1, 9)

This section is located NW of the eastern side of Mavron Oros hill (2 km north of Kestrini village, a hundred metres west of Agios Nikolaos chapel). Below the Toarcian-Aalenian ammonitico rosso (KARAKITSIOS 1992), lies a mainly limestone, predominantly micritic, formation some 50 metres thick, whose facies is intermediate between the Louros and Siniais limestones. The

Fig. 4. 1: *Lytoceras* sp., SE Klissoura, Gibbosus Subzone to Hawskerense Subzone. **2, 3**: *Calliphylloceras* gr. *bicicolae* (MENEGHINI), (2) SE Klissoura, Gibbosus Subzone to Hawskerense Subzone et (3) Mavron Oros, Gibbosus Subzone. **4**: *Protogrammoceras* (*Paltarpites* ?) sp., SE Klissoura, Gibbosus Subzone to Hawskerense Subzone. *5*: *Protogrammoceras dilectum* (FUCINI), SSE Klissoura, Ibex Zone. **6, 7**: *Leptaleoceras ugdulenai* (GEMMELLARO), SE Klissoura, Gibbosus Subzone. **8**: *Neolioceratoides schopeni* (GEMMELLARO), Vathy, Hawskerense Subzone. **9, 12**: *Arieticeras* gr. *bertrandi* (KILLIAN), SE Klissoura, Gibbosus Subzone. **10, 13, 14**: *Leptaleoceras* gr. *canavarii* (GEMMELLARO), Mavron Oros, (13a: 2x magnified), Gibbosus Subzone. **11**: *Arieticeras* gr. *algovianum* (OPPEL), SE Klissoura, Gibbosus Subzone. **15**: *Neolioceratoides hoffmanni* (GEMMELLARO), Neokhori. Hawskerense Subzone.

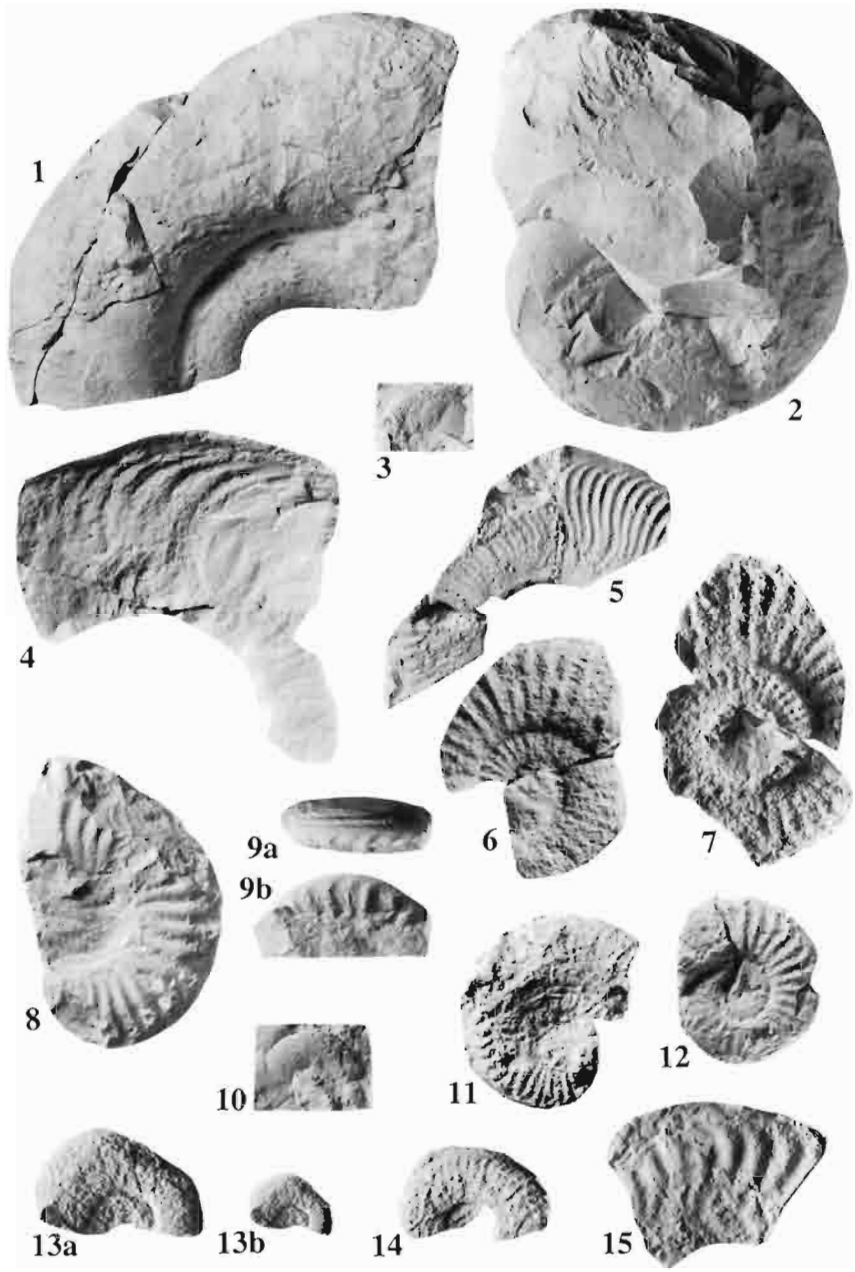

Fig. 4 (Legend see p. 306)

final bed before the ammonitico rosso is rich in brachiopods and ammonites but these fossils are particularly difficult to remove from the micritic matrix. We nonetheless collected: *Calliphylloceras* gr. *bicicolae* (MENEGHINI) (1 specimen; Fig. 4.3), *Leptaleoceras* gr. *canavarii* (GEMMELLARO) (4 specimens; Fig. 4.10, 13, 14). The latter species is indicative of mid-Domerian age (Bertrandi and Algovianum horizons; Fig. 5).

In the same region (NW Epirus), KOTTEK (1966) dated the bottom of his Pahania section to the Domerian on the strength of the presence of "*Protogrammoceras*" and "*Fuciniceras*". In fact, these proved to be Lower Toarcian ammonites, especially *Hildaites*, as GUEX (1973) indicated. The few *Leptaleoceras* gr. *canavarii* (GEMMELLARO) specimens collected for this study are therefore the first genuinely Domerian forms to be found in NW Epirus. They come from a bed that is clearly below the ammonitico rosso.

Biostratigraphy and palaeogeography

Except for a single specimen of *Protogrammoceras dilectum* (FUCINI) found in the Klissoura South-East locality and indicative of mid Carixian age (Fig. 5), all of the ammonites found in the Louros limestones are typical of the mid-to-late Domerian (Fig. 5). The "Klissoura South-East" deposits can therefore be distinguished from those of the neighbouring sections of Vathy and "Klissoura East" in that the fossil range extends further back. It is also probable that the Louros limestones are as little as ten metres thick, compared with some 60 metres in the neighbouring Vathy locality. Sedimentation and fossilization conditions at Klissoura South-East therefore seem to have been atypical (palaeotectonics?). The occurrence of *Protogrammoceras dilectum* (FUCINI) a few metres below the top of the formation means that the deposition of the Louros limestones began during – or more probably before – the mid-Carixian. The earliest stages of deposition cannot

Fig. 5. Biochronological signification of the taxa collected in the Ionian Zone in Epirus and stratigraphic extent of the fossil-bearing ranges for each of the study sites. **1**: Northern or southern spread in some NW European horizons. **2**: Most probable age of the taxon in Epirus. **3**: Possible extent of taxa throughout area of distribution. **4**: Age of all material collected at each site. **5**: Horizons valid for the Central Apennines after DOMMERGUES et al., (1983, 1997) and FERRETI & MEISTER (1994). **6**: Horizons valid for the Betic Ranges after BRAGA (1983), BRAGA & RIVAS (1985) and MEISTER (1987).

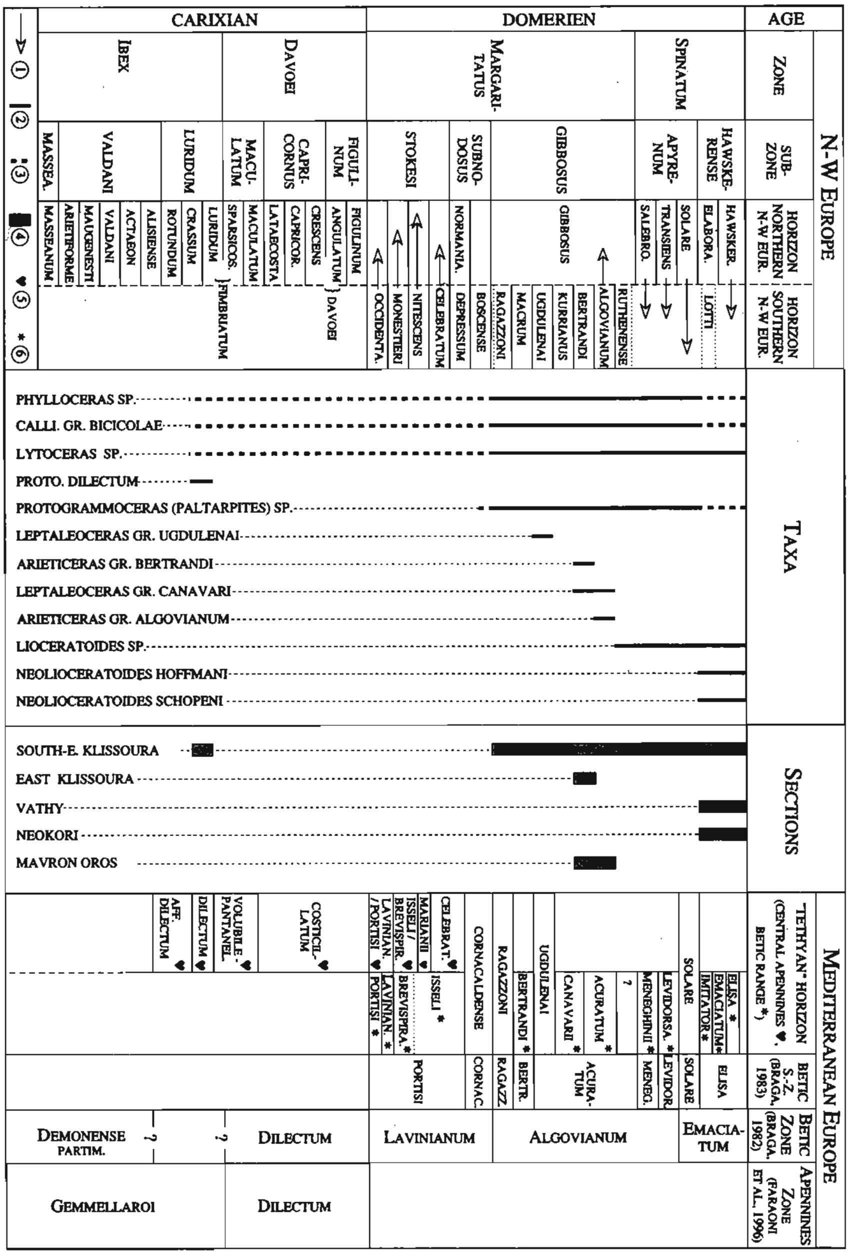

Fig. 5 (Legend see p. 308)

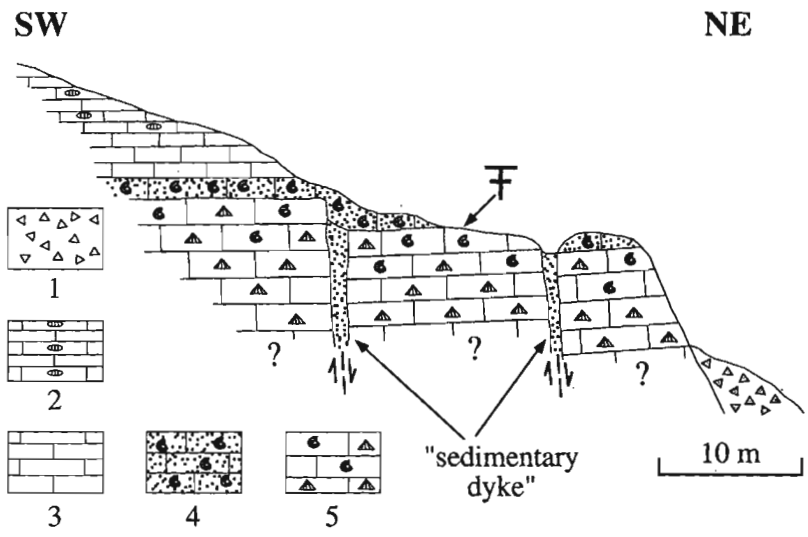

Fig. 6. Klissoura South-East Section (the outcrop is some 1300 m SE of the village): **1**: scree. **2**: Vigla limestones. **3**: Upper Posidonia Beds. **4**: Transitional limestones Ammonitico rosso. **5**: Louros limestones.

be dated as the lower and middle part of the formation has not yielded any characteristic fossils.

Unlike the Louros limestones whose upper reaches are comparatively rich in fossils, very little is known of the age of the Siniais limestones where macrofossils are particularly scarce. The only direct information available until now was the microfauna collected by IGRS-IFP (1966) at the top of this formation giving an age range of late Sinemurian, Pliensbachian and very early Toarcian (DANELIAN 1989, KARAKITSIOS 1992). The discovery of *Neolioceratoides schopeni* (GEMMELLARO) at Neokhori means the very top of the Siniais limestones can be precisely dated for the first time to the end of the Domerian. However, as with the Louros limestones, the age of the bottom of the formation is still uncertain.

Like the brachiopods, all of the ammonites studied here display clear Mediterranean palaeogeographic affinities. All the species cited are typical populations of the Western Tethys (e.g. Apennines, Sicily, Betic Ranges).

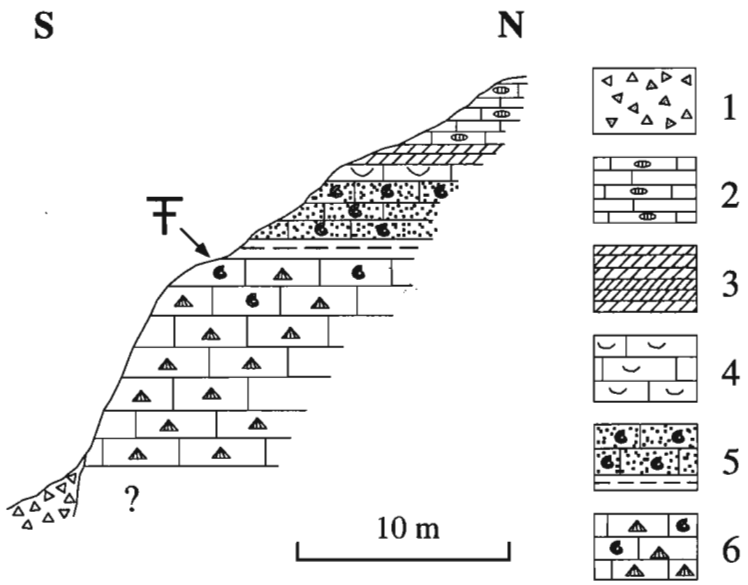

Fig. 7. Klissoura East Section: **1**: Scree. **2**: Vigla limestones. **3**: Upper Posidonia Beds. **4**: Filament limestones. **5**: Ammonitico rosso. **6**: Louros limestones.

Conclusion

At the time the Pantokrator limestones were deposited (early Liassic, in part?), the Ionian Zone formed part of a vast carbonate platform covering all of western Greece and extending at least as far as southern Albania (RENZ 1955, BERNOULLI & RENZ 1970, KARAKITSIOS 1992). Carbonate build-up during the early Liassic (in part?) that is locally more than a thousand metres thick shows that the platform underwent very intense subsidence capable of offsetting the intense carbonate production in an inner platform environment. These neritic platform limestones were then overlain by the Siniais and Louros limestones, which were deposited simultaneously but in different localities. Their facies are indicative of deeper water, outer platform environments. These are the earliest syn-rift deposits of the Ionian series: the beginning of formation of a basin between what remained two neritic

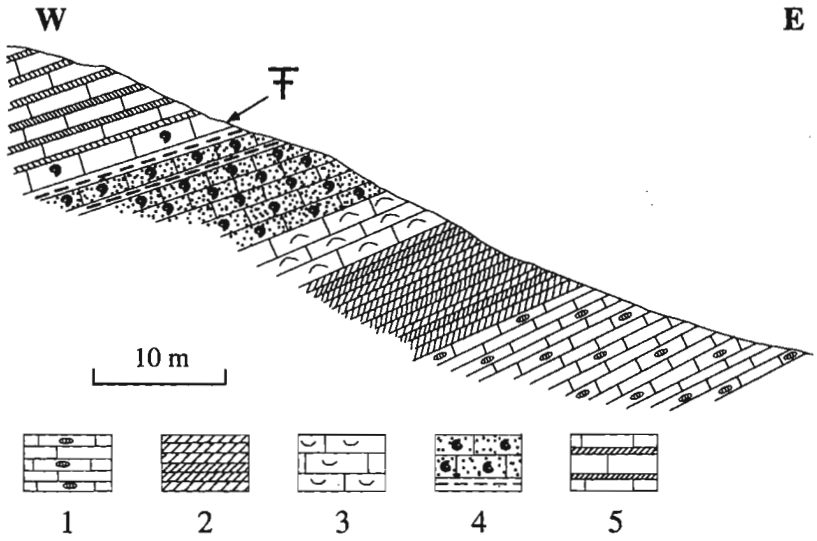

Fig. 8. Neokhori section: **1**: Vigla limestones. **2**: Upper Posidonia Beds. **3**: Filament limestones. **4**: ammonitico rosso. **5**: Siniais limestones.

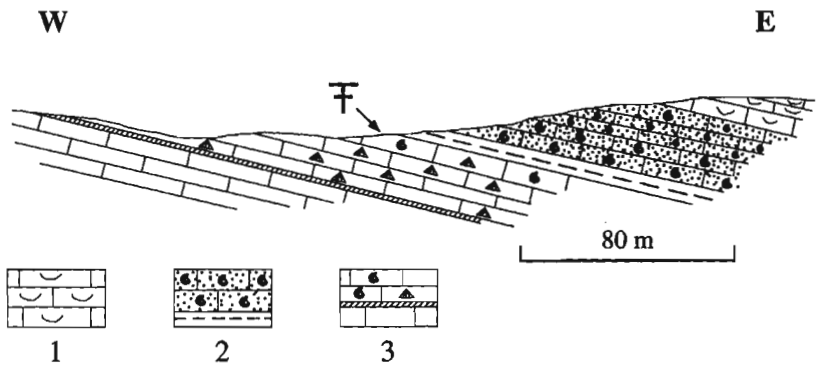

Fig. 9. Mavron Oros section (Agios Nikolaos-Kastrini): **1**: Filament limestones. **2**: Ammonitico rosso. **3**: Lateral transitional limestones between Louros and Siniais.

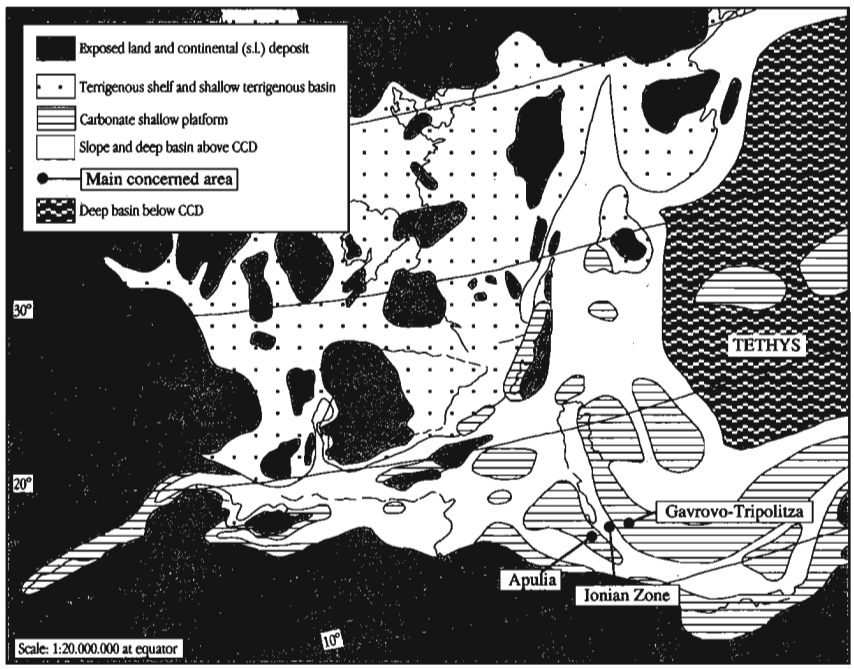

Fig. 10. The palaeogeographic context of the Mediterranean Tethys for the early Jurassic. Palinspastic reconstruction after ZIEGLER (1988) and BASSOULET et al. (1993). The position of the study region (Ionian Zone, Epirus) is shown.

domains: Apulia to the West and Gavrovo-Tripolitza to the East (Fig. 10). Comparison of these early syn-rift deposits in the inner domain (eastern part of the Louros valley in Epirus) and outer domain (Leukas, western Akarnania) of the Ionian Zone (KARAKITSIOS 1992) shows that the Siniais facies occupied the central part of the basin, while the Louros facies developed on its margins.

This work demonstrates that the earliest pelagic sedimentation of Jurassic times in Greece ended in the mid-late Domerian. However, it is still impossible to date its onset. The find of *Protogrammoceras dilectum* (FUCINI)

in one of the sections (Klissoura South-East) suggests a mid-Carixian or probably earlier age. It may even be Sinemurian, since the top of the Kakodhiki limestones in southern Albania, the local equivalent of the Louros and Siniais limestones, has yielded late Sinemurian – mid-Carixian ammonites (DOMMERGUES et al. 2000).

Acknowledgements

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References

AUBOUIN, J. (1959): Contribution à l'étude géologique de la Grèce septentrionale: les confins de l'Epire et de la Thessalie. – Ann. géol. Pays Hell., **9**: 1-483.

BASSOULET, J.-P., ELMI, S., POISSON, A., CECCA, F., BELLION, Y., GUIRAUD, R. & BAUDIN, F. (1993): Middle Toarcian (1984-1982 Ma). – In: DERCOURT, J., RICOU, L. E. & VRIELYNCK, B. (Eds.): Atlas Tethys palaeoenvironmental maps. Explanatory notes: 63-80; Paris (Gauthier-Villars).

BERNOULLI, D. & RENZ, O. (1970): Jurassic Carbonate Facies and New Ammonite Faunas from Western Greece. – Eclogae Geol. Helv., **63**: 573-607.

BRAGA, J. C. (1983): Ammonites del Domeriense de la Zona subbética (Cordilleras beticas, Sur de España). – Thesis Doctoral: 410 pp.; (Univ. Granada).

BRAGA, J. C. & RIVAS, P. (1985): The Mediterranean *Tropidoceras* (Ammonitina) in the Betic Cordilleras. – Eclogae Geol. Helv., **78**: 567-605.

DANELIANT, T. (1989): Radiolaires jurassiques de la zone ionienne (Epire, Grèce). Paléontologie, stratigraphie, implications paléogéographiques. – Thèse: 260 pp.; (Univ. Paris).

DOMMERGUES, J.-L., FERRETTI, A., GECZY, B. & MOUTERDE, R. (1983): Eléments de corrélation entre faunes d'ammonites mésogéennes (Hongrie, Italie) et subboréales (France, Portugal) au Carixien et au Domérien inférieur. – Géobios, **16**: 471-499.

DOMMERGUES, J.-L., MEISTER, C., BONNEAU, M., CADET, J.-P. & FILI, I. (2000): Les ammonites du Sinémurien supérieur et du Carixien inférieur à moyen du gisement de Lefterochori, près de Delvina, est de Saranda (Albanie méridionale). – Géobios, **33**: 329-358.

DOMMERGUES, J.-L., MEISTER, C. & MOUTERDE, R. (1997): Pliensbachien. – In: CARIOU, E. & HANTZPERGUE, P. (Eds.): Biostratigraphie du Jurassique ouest-européen et méditerranéen: zonations parallèles et distribution des invertébrés et microfossiles. – Bull. Centre Rech. Elf Explor. Prod., Mém **17**: 15-23.

DRAGASTAN, O., PAPANIKOS, D. & PAPANIKOS, P. (1985): Foraminifères, algues et microproblematica du Trias de Messopotamos, Epire (Grèce continentale). – Rev. Micropaleont., **27**: 244-248.

FERRETTI, A. & MEISTER, C. (1994): Composition des faunes d'ammonites dans l'Apennin des Marches et comparaison avec les principales régions téthysiennes et euroboréales. – In: PALLINI, G. (Ed.): Fossili, evoluzione, ambiente, 3rd Pergola int. Symp. 1990. – Paleopelagos, **1**: 143-153.

GUEX, J. (1973): Aperçu biostratigraphique sur le Toarcien inférieur du Moyen-Atlas marocain et discussion sur la zonation de ce sous-étage dans les séries méditerranéennes. – Eclogae geol. Helv., **66**: 493-523.

IGRS-IFP (INSTITUT DE GEOLOGIE ET RECHERCHES DU SOUS-SOL - INSTITUT FRANÇAIS DU PETROLE) (1966): Etude géologique de l'Epire (Grèce nord-occidentale): 306 pp.; Paris (Edition Technip).

KARAKITSIOS, V. (1988): Sur la différenciation de la zone ionienne en Epire (Grèce nordoccidentale). In: 3ème Congr. Soc. géol. Grèce (1986). – Bull. Soc. géol. Grèce, **20**: 181-196.

– (1992): Ouverture et inversion tectonique du bassin ionien (Epire, Grece). - Ann. Geol. Pays Hell., **35**: 85-318.

– (1995): The influence of preexisting structure and halokinesis on organic matter preservation and thrust system evolution in the Ionian basin, Northwestern Greece. – A.A.P.G. Bulletin, **79**: 960-980.

KARAKITSIOS, V., DANELIAN, T. & DE WEVER, P. (1988): Datation par les radiolaires des Calcaires à Filaments, Schistes à Posidonies supérieurs et Calcaires de Vigla (zone ionienne, Epire, Grèce) du Callovien au Tithonique terminal. – C. R. Acad. Sci., (2), **306**: 367-372.

KARAKITSIOS, V. & TSAILA-MONOPOLIS, S. (1988): Données nouvelles sur les niveaux supérieurs (Lias inférieur-moyen) des Calcaires de Pantokrator (zone ionienne moyenne, Epire, Grèce continentale). Description des Calcaires de Louros. – Rev. Micropaléont., **31**: 49-55.

– (1990): Données nouvelles sur les niveaux inférieurs (Trias supérieur) de la série calcaire ionienne en Epire (Grèce nord-occidentale). Conséquences stratigraphiques. – Rev. Paléobiol., **9**: 139-147.

KOTTEK, A. (1966): Die Ammonitenabfolge des griechischen Toarcium. – Ann. Géol. Pays Hell., **17**: 1-157.

MEISTER, C. (1987): Comparaison des faunes d'ammonites au Domérien (Jurassique inférieur) entre le Bassin des Causses et les Cordillières Bétiques; composition faunique et éléments de corrélation. – C.R. Acad. Sci. Paris, (2), **305**: 425-428.

POMONI-PAPAIOANNOU, F. & TSAILA-MONOPOLIS, S. (1983): Petrographical, Sedimentological and Micropaleontological studies of an evaporite outcrop, West of Ziros lake (Epirus-Greece). – Riv. Ital. Paleont. Strat., **88**: 387-400.

RENZ, C. (1955): Die vorneogene Stratigraphie der normal-sedimentären Formationen Griechenlands: 637 p.; Athènes (Institute of Geological Subsurface Research).

ZIEGLER, P. A. (1988): Evolution of the Artic- North Atlantic and western Tethys. – A.A.P.G. Memoir, **43**: 1-198.

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