New stratigraphic and palaeogeographic data from the Mesozoic strata of the Tripolitza platform in Central Crete. Evidence of subaerial exposures during Albian-Early Cenomanian*

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ABSTRACT: The Gavrovo – Tripolitza platform is the most important external platform of the Hellenids and one of the most important platforms of the Tethyan realm. Two palaeogeographic areas (subzones) are distinguished within the platform. The external one, the Gavrovo subzone, crops out in western Greece and the internal one, the Tripolitza subzone, crops out in central Peloponnesus, Cythere and Crete

This paper describes an Aptian – Cenomanian carbonate succession from the Tripolitza subzone and particularly a continuous sequence of about 230m with sedimentological features proving repeated subaerial exposures, dated by microfossils that escaped dolomitization. Although analogous phenomena have been described from this period in the Gavrovo subzone, the palaeoenvironments in the Tripolitza subzone was as yet considered subtidal. The described sequence is characterized by an alternation of limestones, dolomites and dolomitic breccias. Its base is dated as Late Aptian in age, based on the presence of *Salpingoporella dinarica* and *Praechrysalidina infracretacea*. Early to middle Albian is documented by the presence of *Pseudonummoloculina aurigerica* and *Vercorsella* cf. *scarsellai*, Late Albian by *"Coskinolina" bronnimanni*, and Late Cenomanian by *Pseudonummoloculina regularis, Pseudorhapydionina dubia, Chrysalidina gradata*. The overall sequence is characterized by a well expressed cyclicity and consists of alternations of peritidal facies, going from shallow subtidal (foram-algal limestones, miliolid-mollusc / miliolid-ostracod / ostracod / ostracod-rudist limestones) to intertidal / supratidal (microbial stromatolitic dolomites, peloidal-bioclastic peloidal fenestral limestones), cycles being following the shallowing – upward type of evolution. The environment of deposition corresponds to a very shallow – water ramp and coastal lagoons. The sequence was repeatedly exposed to subaerial conditions, so that sediments of the intertidal / supratidal intervals have been penecontemporaneously dolomitized. Emergence surfaces are delineated by concretions of oxides and are characterized by indices of intensive desiccation, microkarstification, *in situ* brecciation and calcretization. Within some beds the environment became evaporitic, as indicated by the presence of authigenic quartz and pseudomorphs after evaporitic crystals and textures.
Key-words: *Stratigraphy, Sedimentology, Aptian, Albian, Cenomanian, Tripolitza platform, Greece*.

ΠΕΡΙΛΗΨΗ: Η πλατφόρμα Τριπόλεως, αποτελεί το εσωτερικό τμήμα της πλατφόρμας Γαβρόβου – Τριπόλεως. Η στρωματογραφική ακολουθία της σειράς Τριπόλεως, παρότι πιο πλήρης από αυτή της Γαβρόβου, υπολείπεται σε λεπτομερή γνώση των στρωματογραφικών οριζόντων, λόγω της εντονότερης δολομιτίωσης των ιζημάτων της και της σπανιότητας των μικροαπολιθωμάτων που βρίσκονται σε αυτά. Άμεση συνέπεια του γεγονότος αυτού είναι, σημαντικά γεγονότα κατά την παλαιογεωγραφική εξέλιξη της πλατφόρμας Τριπόλεως να μη μπορούν να χρονολογηθούν και να παραμένουν άγνωστα.

Στην παρούσα εργασία, μελετάται μια ανθρακική ακολουθία Απτίου – Κενομανίου της σειράς Τριπόλεως στην κεντρική Κρήτη. Σε μια συνεχή ανθρακική ακολουθία 230μ, η οποία χαρακτηρίζεται από εναλλαγές ασβεστολίθων, δολομιτών και δολομιτικών λατυποπαγών, προσδιορίστηκαν βάσει μικροαπολιθωμάτων που διέφυγαν τη δολομιτίωση, οι ακόλουθοι ορίζοντες:

-Ανώτερο Άπτιο με *Salpingoporella dinarica* και *Praechrysalidina infracretacea*.
-Κατώτερο – Μέσο Άλβιο με *Pseudonummoloculina aurigerica* και *Vercorsella* cf. *scarsellai*
-Ανώτερο Άλβιο με *"Coskinolina" bronnimanni*
-Ανώτερο Κενομάνιο με *Pseudonummoloculina regularis, Pseudorhapydionina dubia, Chrysalidina gradata*.

Η ακολουθία χαρακτηρίζεται από σαφή κυκλικότητα, με εναλλαγές περιπαλιρροιακών φάσεων, αβαθούς υποπαλιρροιακής (foram-algal limestones, miliolid-mollusc / miliolid-ostracod / ostracod / ostracod-rudist limestones) έως μεσοπαλιρροιακής - επιπαλιρροιακής (microbial stromatolitic dolomites, peloidal-bioclastic peloidal fenestral limestones), με ρήχευση προς το ανώτερο μέρος των κύκλων. Το περιβάλλον απόθεσης αντιστοιχεί σε πολύ ρηχή πλατφόρμα ήπιας κλίσης (ramp) και παραλιακές λιμνοθάλασσες. Η ακολουθία υπέστη κατ'επανάληψη έκθεση σε υποαεριώδεις συνθήκες, με αποτέλεσμα τα μεσοπαλιρροιακά και επιπαλιρροιακά ιζήματα, να υποστούν ταυτόχρονη – πρωιμοδιαγενετική δολομιτίωση. Οι επιφάνειες ανάδυσης συνοδεύονται από συγκρίμματα οξειδίων και παρουσιάζουν ενδείξεις έντονης ξήρανσης, μικροκαρστικοποίηση, λατυποποίηση *in situ* και πεδογενετική εξαλλοίωση. Παρουσία αυθιγενούς χαλαζία και ψευδομορφώσεων εβαποριτικών κρυστάλλων και δομών, μαρτυρούν ότι ορισμένα στρώματα αποτέθηκαν σε εβαποριτικό περιβάλλον.

* Νέα στρωματογραφικά και παλαιογεωγραφικά δεδομένα στη μεσοζωική ακολουθία της πλατφόρμας Τριπόλεως στην κεντρική Κρήτη. Επαναλαμβανόμενες αναδύσεις κατά το Άλβιο – Κατώτερο Κενομάνιο.

Τα ανωτέρω δεδομένα τεκμηριώνουν μια σχετική αστάθεια της πλατφόρμας Τρίπολης κατά το Άλβιο – Κατώτερο Κενομάνιο, διάστημα κατά το οποίο η πλατφόρμα ευρέθη επανειλημμένα εκτεθειμένη σε υποαεριώδεις συνθήκες. Ενώ ανάλογα γεγονότα είναι ήδη γνωστά για το εξωτερικό τμήμα της πλατφόρμας, την υποζώνη Γαβρόβου, η ιζηματογένεση στην υποζώνη Τριπόλεως εθεωρείτο ότι γινόταν σε υποπαλιρροιακές συνθήκες. Το περιβάλλον απόθεσης και διαγένεσης κατά το ανώτερο Άπτιο και ανώτερο Κενομάνιο χαρακτηρίζεται υποπαλιρροιακό.
Λέξεις-Κλειδιά: *Στρωματογραφία, Ιζηματολογία, Άπτιο, Άλβιο, Κενομάνιο, πλατφόρμα Τρίπολης, Ελλάδα.*

INTRODUCTION

The Gavrovo – Tripolitza platform is the most important external platform of the Hellenids and one of the critical platforms of the Tethyan realm. It forms the continuation of the Dalmate zone of the Dinarids and passes into the Menderes platform in the Taurides. Two palaeogeographic areas or subzones are distinguished in the platform; the external one, the Gavrovo subzone cropping out in western Greece and the internal one, the Tripolitza subzone, that crops out in the central Peloponnesus, Cythere and Crete (Fig. 1). Sedimentation in the Gavrovo subzone is characterized by a thick carbonate succession of about 3000m, deposited from Late Jurassic up to Late Eocene, followed by flysch sedimentation. The Tripolitza stratigraphic column is more complete and comprises a volcanosedimentary succession, the Tyros beds, at the base, of Late Permian to Late Triassic age. This is followed by a 2500 m of neritic carbonate series deposited during the Late Triassic up to the Late Eocene and a flysch formation whose deposition begins during Late Eocene. Besides the difference in the thickness of the carbonate sequence, the sedimentation in the two distinct areas of the platform presents certain differentiations. In particular, the Tripolitza deposits are characterized by more intense dolomitization and a paucity of microfossils. On account of this fact, as well as the intense tectonism that affects the series, the stratigraphy of Tripolitza subzone is less detailed than that of the Gavrovo subzone.

Research in the Gavrovo area, has demonstrated much variation in the sedimentation of the platform during its alpine history, as a result of instability in this region (Fleury, 1980; Grötsch, 1991; Mavrikas, 1992; Landrein, 2001).

The difficulties in reconstructing a detailed stratigraphic column and dating of the Tripolitza series result in

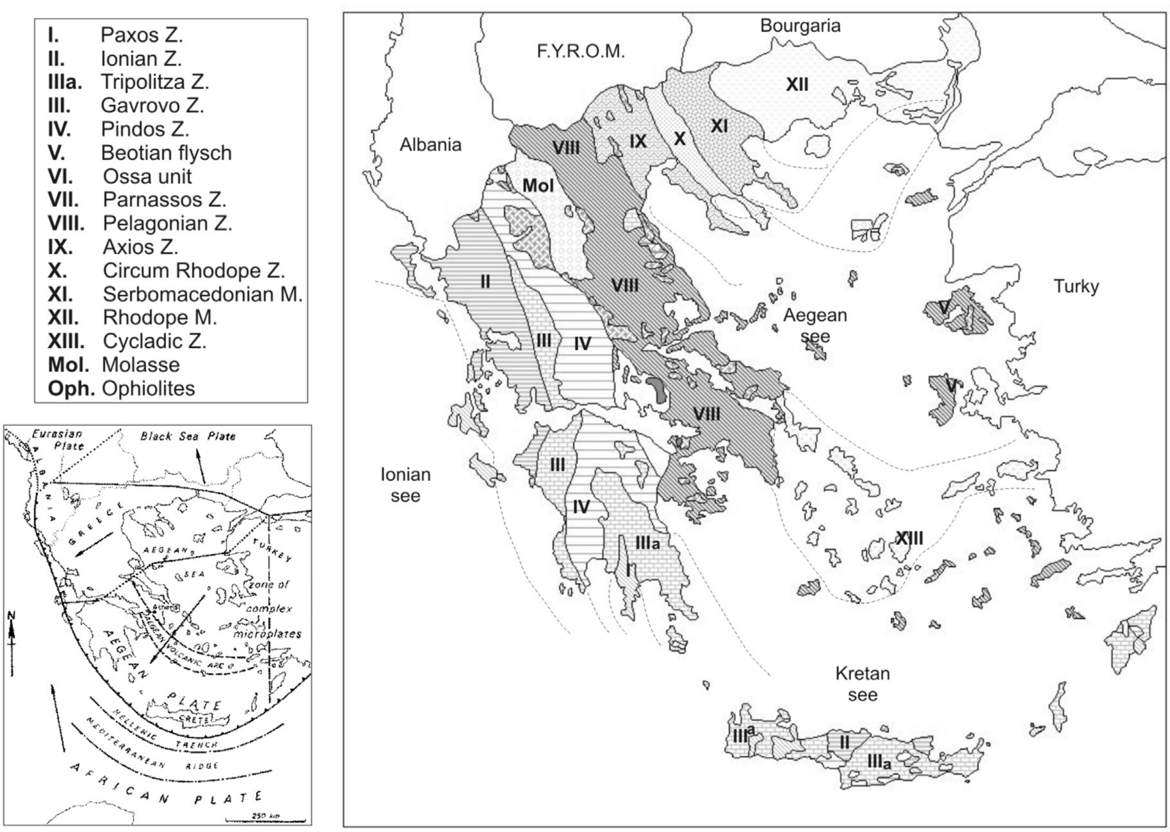

Fig. 1. Structural scheme of Hellenids.

uncertainties concerning the palaeogeographic evolution of this part of the Gavrovo – Tripolitza platform. This area is suggested to be a more stable environment, dominated by subtidal conditions of sedimentation (FLEURY, 1980; BERNIER & FLEURY, 1980). However, detailed research during the last twenty years in the eastern part of the platform (Tripolitza subzone) has allowed its stratigraphic definition on the basis of dating by microfossils that escaped dolomitization. Consequently a number of emergence events have been recognized at the top of shallowing - upwards sequences in different stratigraphic levels of the Tripolitza subzone.

The section presented in this paper, despite the intense dolomitization, contains an interesting microfauna from which the sedimentological features can be dated to prove repeated subaerial exposure of the Tripolitza platform during the Late Aptian – Late Cenomanian.

DESCRIPTION OF THE STUDIED SECTION. MICROPALAEONTOLOGICAL ANALYSIS.

The studied section is situated in central eastern Crete, southwest of Psychro village and the Dicteo cave (Fig. 2).

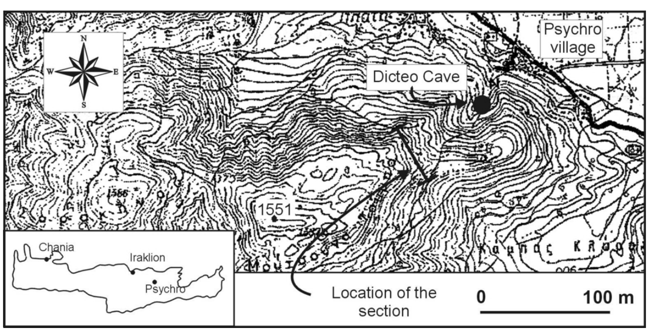

Fig.2. Location of the section.

The sequence is composed of 231 m of dolomites, dolomitic limestones, limestones, stromatolites and laminites, with intercalations of dolomitic breccia (Fig. 3). The following units are distinguished in the section.

Unit A: The base of the sequence is composed of 23m of medium-bedded stromatolitic grey-whitish dolomites and laminated limestones. It is characterized by the frequent presence of *Salpingoporella dinarica* (Fig. 4). Additionally *Praechrysalidina infracretacea* (Fig. 5), *Sabaudia minuta* (Fig. 6), *Vercorsella immaturata*, cf. *Debarina hahounerensis* and sparse fragments of echinoderms are present.

Unit B: In the overlying series of 71 m three parts can be distinguished from bottom to top:

a: 24 m of dolomites and saccharoidal dolomites with intercalations of dolomitic breccia

b: 11 m of black limestones with intraclasts, lamination increasing upwards, containing Ophthalmidiids, Miliolids, *Vercorsella immaturata* (Fig. 7), *Glomospira* sp., *Glomospirella* sp. (Fig. 8), and cf *Debarina hahounerensis*

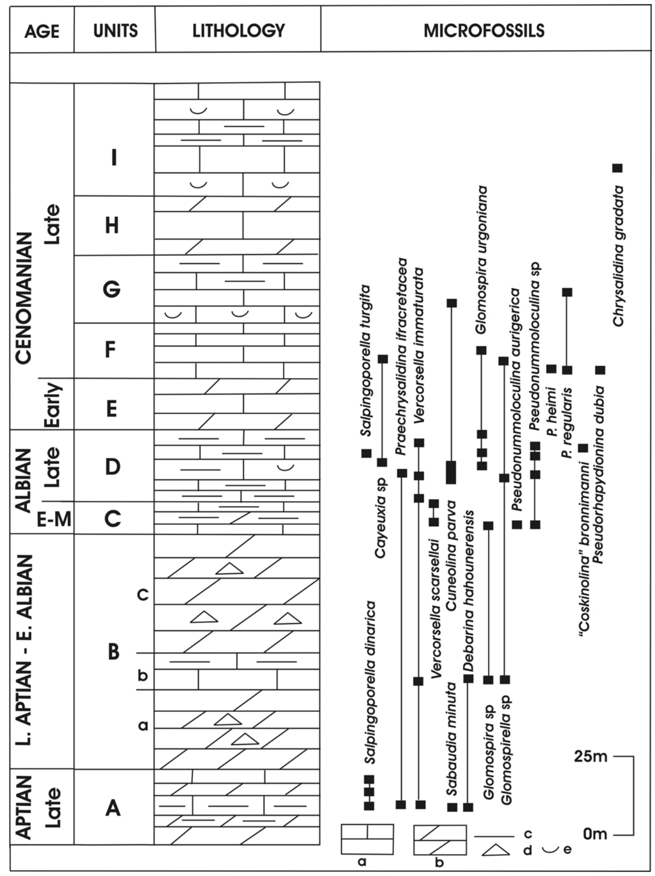

Fig. 3. Stratigraphic column of the studied section. a: limestones, b: dolomites, c: laminites, d: breccia, e: ostracods.

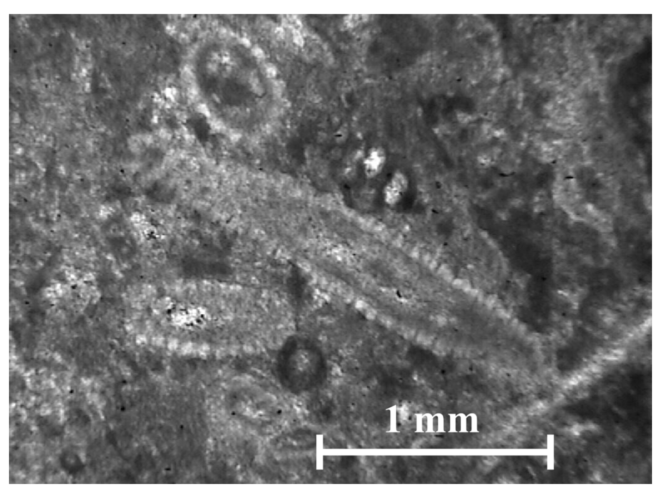

Fig. 4. *Salpingoporella dinarica*.

c: 36 m of whitish dolomites, crystalline dolomites and dolomitic breccia. The breccia elements are found to be up to 1 cm in size. Ophthalmidiids and intraclasts containing filaments of ostracods are present.

Unit C: The overlying section of 10m consists of grey to dark laminated or micritic limestone alternating with

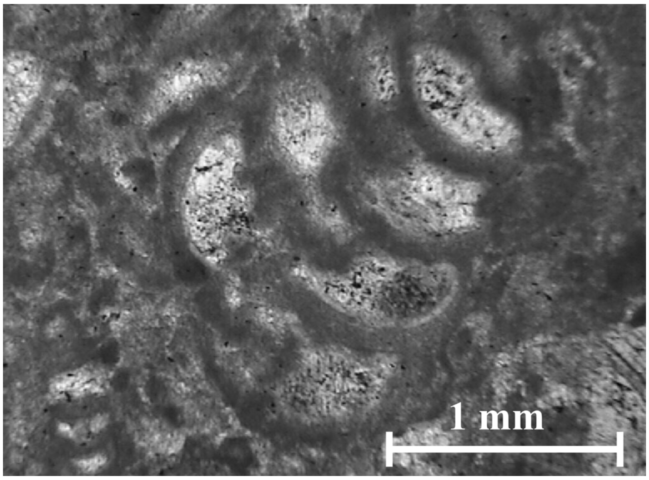

Fig. 5. *Praechrysalidina infracretacea*.

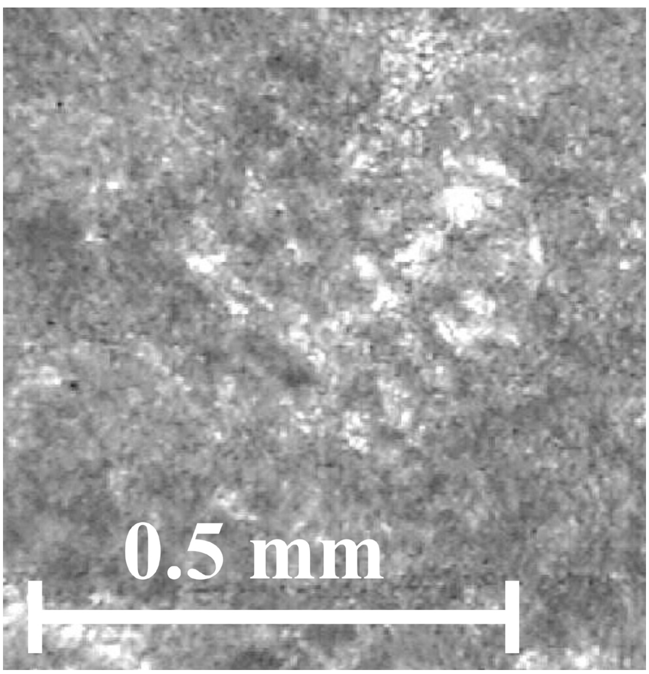

Fig. 6. *Sabaudia minuta*.

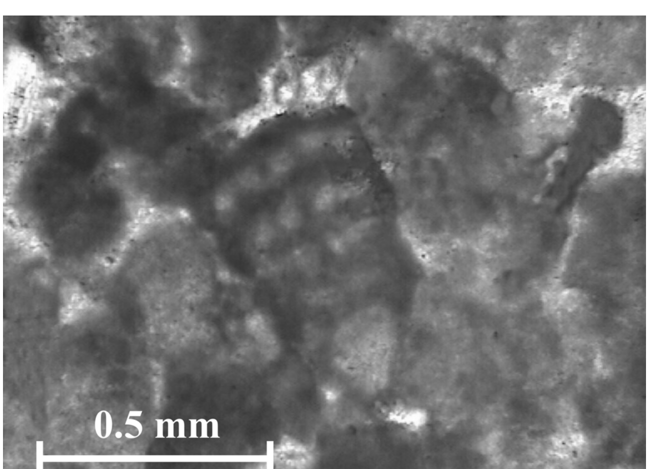

Fig. 7. *Vercorsella immaturata*.

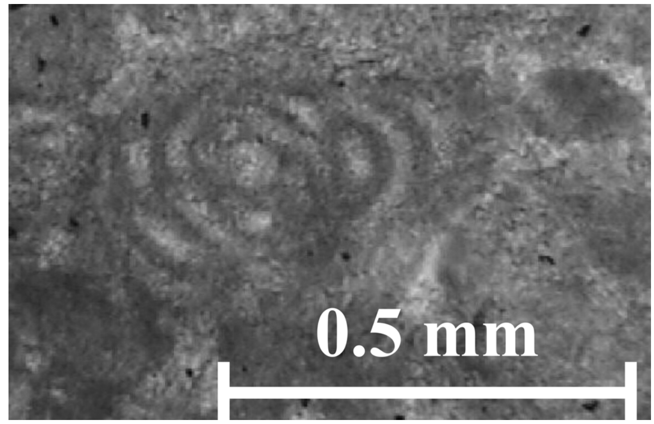

Fig. 8. *Glomospirella* sp.

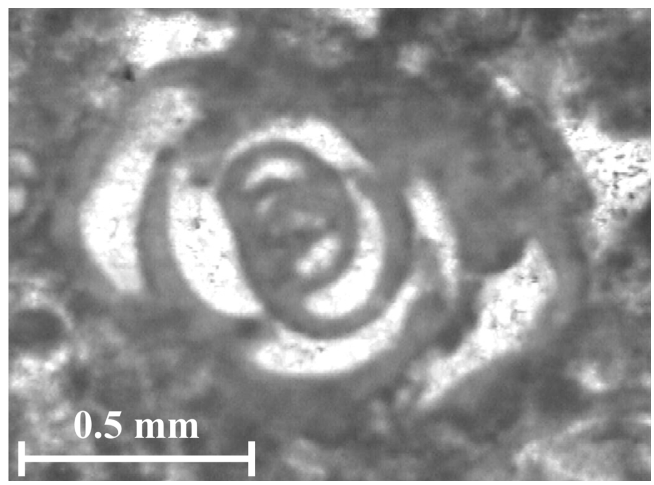

Fig. 9. *Pseudonummoloculina aurigerica*.

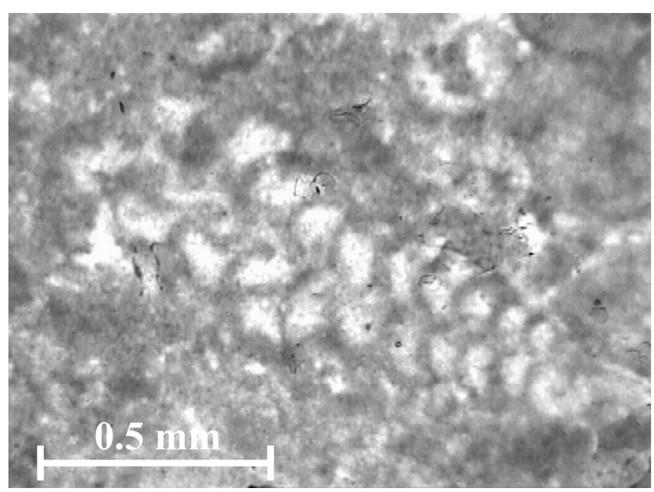

Fig. 10. *Vercorsella* cf. *scarsellai*.

grey to whitish crystalline laminated dolomite. Beds of reworked intraclastic pebbles are observed at some levels. *Pseudonummoloculina aurigerica* (Fig. 9), *Pseudonummoloculina* sp., *Vercorsella* cf. *scarsellai* (Fig. 10), *Glomospira*

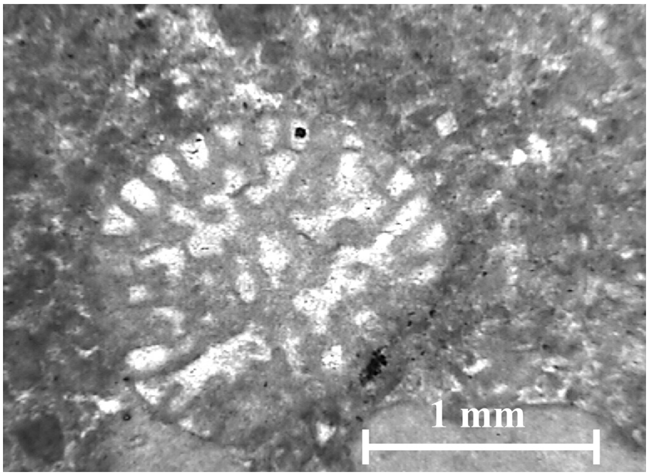

Fig. 11. *"Coskinolina" bronnimanni*.

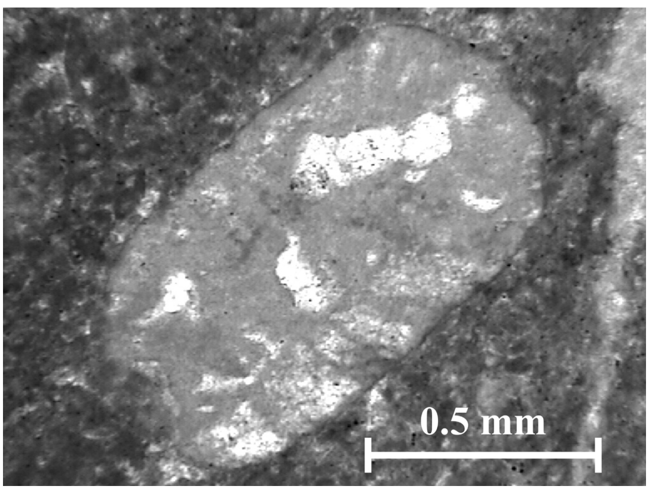

Fig. 12. *Salpingoporella turgita*.

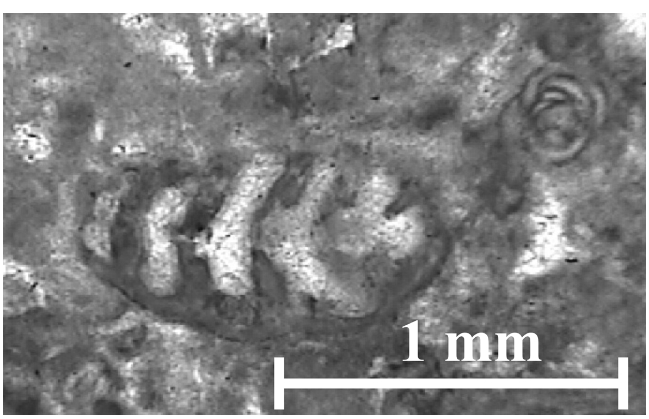

Fig. 13. *Pseudophapydionina dubia*.

sp., Miliolids, Ophthalmidiids, ostracods and Dasycladaceans have been identified among the microfauna.

Unit D: A series of 21 m of grey – black laminated limestone containing peloids and intraclasts (Fig. 16) is superposed in conformity. It is characterized by the presence of Orbitolinids that are probably attributable to

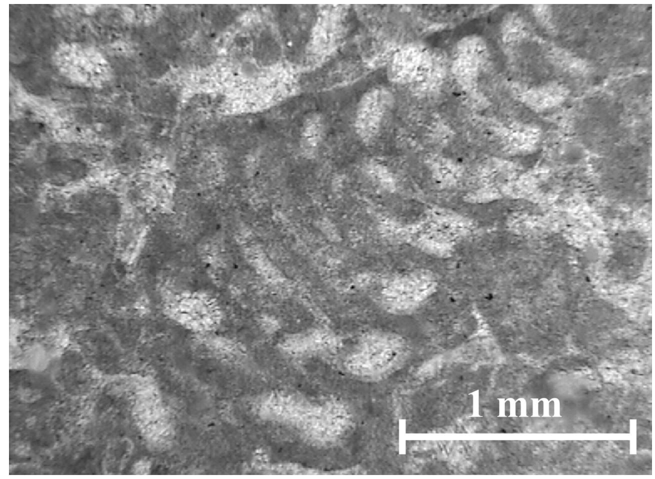

Fig 14. *Chrysalidina gradata*.

"Coskinolina" bronnimanni (Fig. 11). Fragments of bivalves (Fig. 17) are also observed. Additionally ostracod filaments, Ophthalmidiids, Miliolids, *Glomospira urgoniana, Glomospirella* sp., *Pseudonummoloculina* sp., *Vercorsella immaturata, Cuneolina parva, Praechrysalidina infracretacea, Cayeuxia* sp., *Salpingoporella turgita* (Fig. 12) are also determined in the sequence.

Unit E: Alternations of grey dolomite, locally crystalline dolomite, with black micritic non-fossiliferous limestone characterize the overlying 16m of the sequence.

Unit F: A series of 17 m of grey and dark limestone is overlying conformably. *Pseudonummoloculina regularis*, *Pseudonummoloculina heimi*, *Pseudophapydionina dubia* (Fig. 13), are determined at the base of the series, which is characterized by the frequent presence of peloids. The rest of the faunal content consists of Ophthalmidiids, Miliolids, *Glomospira urgoniana*, *Glomospirella* sp., *Cayeuxia* sp. and dissolved tests of gastropods (Fig. 22).

Unit G: A series of 21 m of light and dark limestone and laminated limestone contains filaments of ostracods, rare Ophthalmidiids, Miliolids, *Pseudonummoloculina regularis*, *Cuneolina parva* and indeterminable algae.

Unit H: The following 17.5 m are characterized as alternations of dolomite and dark thick-bedded limestone with intraclasts, algae and ostracods.

Unit I: The top of the succession represented by 35 m of thick-bedded light and dark - coloured limestone and laminated limestone, is marked by the presence of *Chrysalidina gradata* (Fig. 14), associated with Ophthalmidiids, Miliolids, algae and abundant ostracods (Fig. 18).

BIOSTRATIGRAPHICAL REMARKS

The base of the section (Unit **A**) is attributed to the Late(?) Aptian due to the frequent presence of *Salpingoporella dinarica*. Although the known stratigraphical distribution of this Dasycladacean species is Valanginian-Albian (Bassoullet *et al*., 1978), it is a characteristic form of Aptian peri-Mediterranean platforms. In the Hellenic platforms it has not recorded in post-Aptian deposits. In the studied section this species is restricted to Unit A and it is associated with *Praechrysalidina infracretacea, Sabaudia minuta* and *Vercorsella immaturata*. Additionally the absence of characteristic microfossils of Early Aptian age (e.g. *Palorbitolina lenticularis*), indicates a Late Aptian age for Unit A.

The overlying sequence (Unit **B**), deposited in a restricted palaeoenvironment contains only a few Ophthalmidiids, Miliolids, Glomospires and *Vercorsella immaturata*. It is considered to represent the Aptian – Albian transitional beds.

Pseudonummoloculina aurigerica dates the overlying Unit **C**, as Early to Middle Albian. Determined by CALVEZ (1988) in Pyrenees in the base of Simplorbitolina conulus biozone, this foraminiferal species dates the top of Early Albian to Middle Albian. According to this author, it is common in neritic deposits of the internal infralittoral environment (lagoon or proximal ramp), of moderate to low energy where bioclastic wackestone-packstone with small sized rudists and isolated Polypiers are deposited. *P. aurigerica* has also been recorded by ARNAUD-VANNEAU & PREMOLI SILVA (1995) in Middle to Late (?) Albian in strata from the Pacific Ocean. In the described section it has been found in a thin layer of dark micritic limestone alternating with laminated limestone and grey to whitish crystalline laminated dolomite, associated with *Vercorsella* cf. *scarsellai*, Glomospires, Miliolids and Ophthalmidiids.

The absence of *Pseudonummoloculina aurigerica* and the presence of Orbitolinids of the group *"Coskinolina" bronnimanni* (pers. commun. D. Decrouez) and *Salpingoporella turgita* argue for the attribution of the overlying sequence, Unit **D**, to the Late Albian. The Orbitolinid species does not offer very characteristic sections for its certain determination. It has been found with certainty in Late Albian carbonates in the central Peloponnesus and central Crete (Tripolitza subzone) as well as in the Kanala section (Gavrovo subzone), where it is found in association with *Paracoskinolina fleuryi, Naupliella insolita, Orbitolina* sp., *Simplorbitolina* sp. (FLEURY, 1980). *Salpingoporella turgita* is found in Albian – Lower Turonian carbonates (BASSOULLET *et al*., 1978) of Italy (PRATURLON, 1966; LUPERTO SINNI, 1966), Croatia, Herzegovina, Montenegro (RADOICIC, 1965), Romania (DRAGASTAN, 1975) and Liban (SAINT-MARC, 1974).

The very restricted depositional environment results in the absence of microfossils in the following sequence of dolomites and limestones (Unit **E**), which are attributed to the Early Cenomanian due to its position under dated upper Cenomanian limestones.

The Late Cenomanian occurs in the upper part of the succession (Units **F, G, H, I**), dated by *Chrysalidina gradata, Pseudophapydionina dubia, Pseudonummoloculina regularis* and *Pseudonummoloculina heimi*.

SEDIMENTOLOGICAL ANALYSIS

Lithofacies Associations

Sedimentological analysis revealed the following lithofacies associations, which indicate specific palaeoenvironments. These lithofacies are repeatedly observed overall the section.

a. *Foram-algal limestones*

Bioclastic wackestones-packstones with calcareous algae, benthic foraminifera (miliolids, textulariids) and molluscs (gastropods). Intraclasts are absent and the sediments are intensively bioturbated (Fig. 15) This lithofacies dominate in the Unit A (Late Aptian) and suggest deposition in a well-oxygenated lagoonal environment with normal salinity.

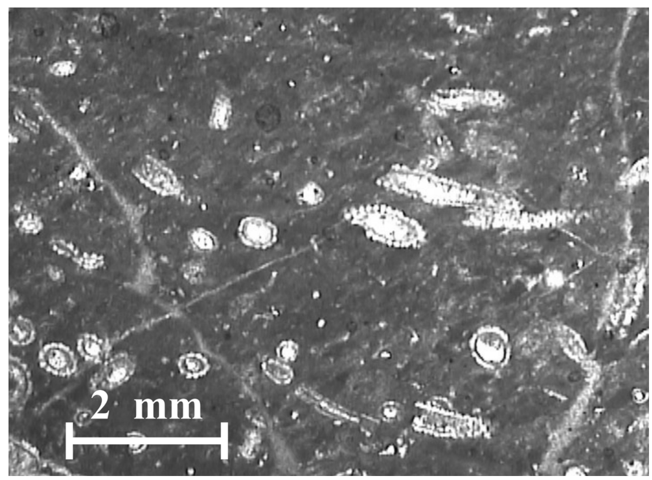

Fig. 15. Wackestone with calcareous algae (Lithofacies a).

b. *Miliolid-mollusc / miliolid-ostracod / ostracod / ostracod-rudist limestones*

Bioclastic wackestones and wackestones-packstones with small benthic foraminifera (miliolids) (Fig 16) and small gastropod shells. In the middle part of the succession in the Unit D (Late Albian), bioclastic floatstones and packstones with rudist fragments occur, in places associated with ostracods (Fig. 17). Ostracod packstones are common in the upper part of the succession in the Unit I (Late Cenomanian) (Fig. 18).

This lithofacies association reflects a protected inner platform-lagoon setting, where the restricted environment did not allow the development of a varied fauna. The ostracod limestones correspond to lacustrine deposits.

c. *Microbial stromatolitic dolomites*

They occur as microscopic encrusting structures produced by the activities of microbial organisms, such as cyanobacteria and other bacteria, fungi and algae, possessing a characteristic peloidal packstone-grainstone texture (Fig. 19). The stromatolitic texture is enhanced by

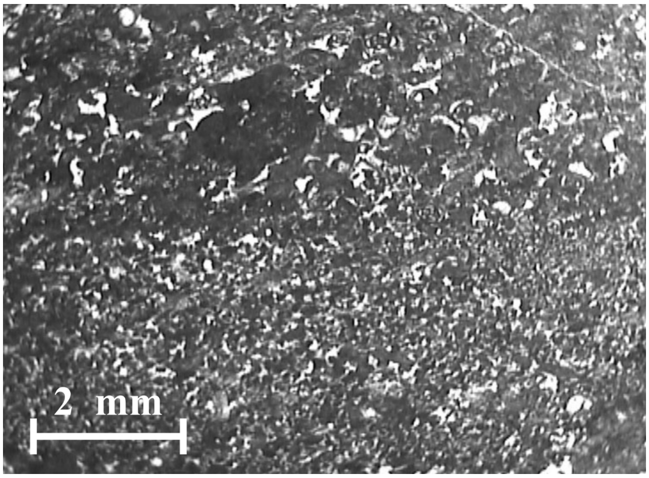

Fig. 16. Wackestone with peloids and miliolids (Lithofacies b).

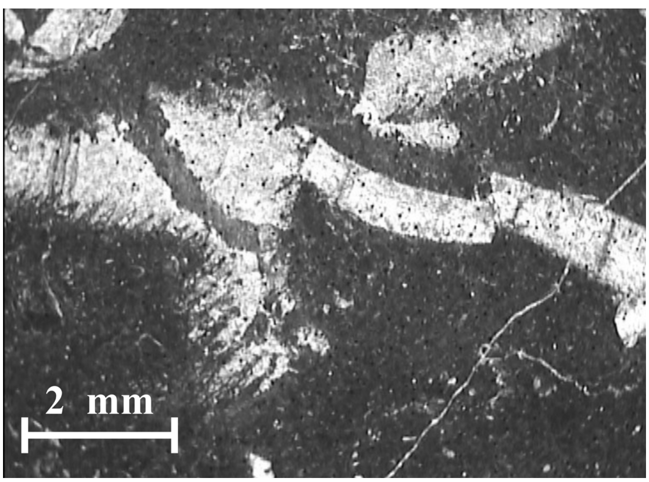

Fig. 17. Rudist floatstones (Lithofacies b).

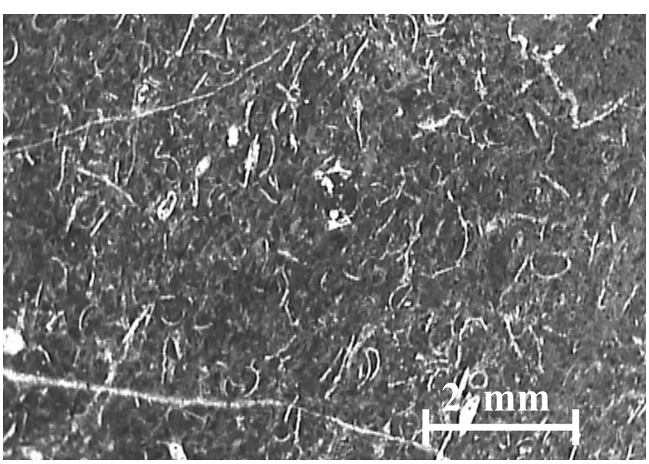

Fig. 18. Ostracod packstones (Lithofacies b).

iron-oxides. Bioclasts of echinoderms occur frequently between the laminae. This lithofacies predominates at the lower part of the succession (Unit A) and characterizes the intertidal zone.

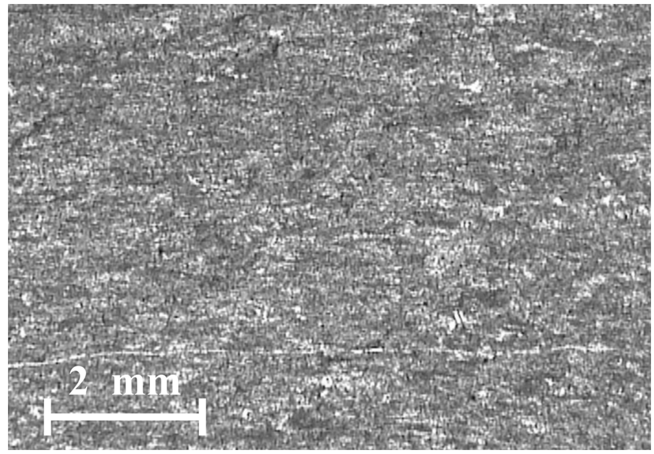

Fig. 19. Microbial stromatolitic dolomites (Lithofacies c).

d. ***Peloidal – bioclastic peloidal fenestral limestones***

This is a pseudograinstone containing large irregular subrounded peloids, small, well-sorted peloids and peloidal aggregates (Fig. 20). Small peloids occur either as fillings between the larger peloids or they may coat the large peloids and form bridges between them. Peloids may also make up the whole of the fabric to give a finer, better sorted grainstone. The cavities between the grains are filled by blocky calcite, or by prismatic crystals remniscent of pseudomorphs after evaporites. In places, layers of compacted masses of peloids occur, commonly including authigenic quartz euhedra.

This lithofacies corresponds to the upper part of an elementary cycle and subliniates the subaerial exposure of the platform. Thus, it is widespread throughout the sequence and it shows indices of pedogenesis developed in a vadose diagenetic environment (supratidal zone). Relic bioclasts, from a pre-existing subtidal facies, occur in places. Large peloids represent calcrete peloids, whereas concentrations of smaller peloids are caused by illuviation, e.g. washing down of material in suspension. Even though the peloids are composed of micrite, they are interpreted as calcified faecal pellets (excreta of soil

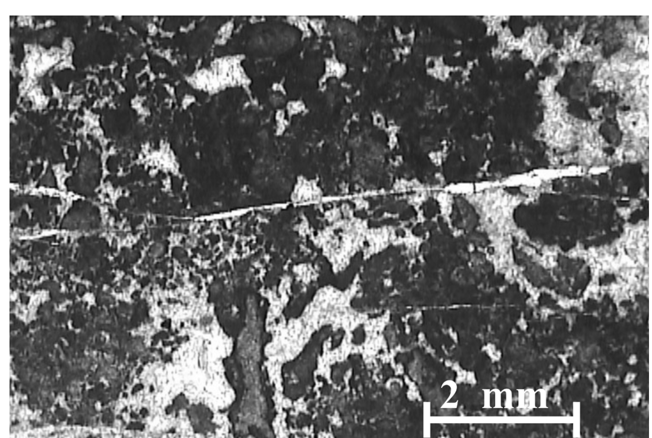

Fig. 20. Peloidal fenestral limestone of pedogenic origin (Lithofacies d).

fauna). Microbial organisms are responsible for the generation of small bridges between the larger peloids.

Pseudomorphs after evaporites and quartz euhedra favour a high-salinity environment.

4.2 *Sedimentological Remarks*

A high-frequency cyclicity, resulting from the Earth's orbital fluctuations, is ubiquitous in the studied Cretaceous shallow-water carbonates of Tripolitza subzone. A more detailed sampling (cm-scale) is necessary for greater accuracy. The cycles seem to correspond to single beds (elementary cycles). In the topmost part of each cycle, a phase of relative lowering of the sea level is documented. Early meteoric diagenesis overprints subtidal deposits. Several lines of evidence indicate that discontinuity surfaces represent subaerial exposure horizons: soil horizons occur on the top of these surfaces and pseudospherulitic fibrous calcite in limestones beneath the discontinuities, is interpreted as pseudomorph after enterolithic anhydrite texture (Fig. 21). Transgressive surfaces are indicated by a lag of reworked intraclastic pebbles.

Other field and petrographic evidence includes surficial microkarsts, incipient caliche features and the presence of dolomite. Exposure surfaces were overprinted by marine hardgrounds during a lag phase after shallow flooding. Evidence for a marine hardground comes from borings that truncate burrows and bioclasts.

Each of the discontinuities documents a relative fall of sea level and subaerial exposure of the seafloor. The origin of the numerous minor discontinuities might result from high-frequency, low–amplitude fluctuations in eustatic sea level (allocyclic). Lagoonwards, storm waves washed the debris of rudists and other sessile shelly benthos.

Texturally the strata consist of bioclastic wackestone, wackestone-packstone and packstone/floatstone. Subtidal deposits include benthic foraminifera, green algae and molluscs and peritidal deposits consist of microbial stromatolites. Throughout the section, the early meteoric overprint at the top of the cycles is characterized by varying depths of penetration of the emergence-related diagenetic features. Cavities resulted after dissolution of shells remained open or filled by blocky calcite (Fig. 22).

Emergence surfaces are characterized by mm-size cavities (microkarst). Dolomitization has affected some parts of the succession, clearly revealing pre-existing evaporites (enterolithic anhydrite, anhydrite rosettes, authigenic quartz euhedra), whereas calcretization processes seem to be ubiquitous (Figs. 23, 24) Pedogenic horizons exhibit fine-grained peloidal fenestral fabrics, locally laminated and are interpreted as rendzina-type calcrete profiles (WRIGHT, 1983). Some emersive surfaces are characterized by deeply penetrating, pervasive pedogenesis, expressed by Microcodium structures or "alveolar-like" features, locally associated with rhizoconcretions (Fig. 25).

Numerous layers of fragmented and displaced skeletal material occur in the section. The layers consist of well-sorted bivalves, peloids and lithoclasts with erosional lower boundaries (bioclastic – peloidal packstones). The shell layers might document events of exceptionally high hydrodynamic energy, most probably storms (tempestites).

CORRELATIONS

In the studied section, Aptian – Cenomanian carbonates of the Tripolitza subzone are for the first time dated in a continuous succession. ZAMBETAKIS – LEKKAS *et al.* (1995) described in Central Crete three sections representing carbonates of the Lower Cretaceous – Cenomanian interval. In the Karouzanos section, as a result of the absence of characteristic microfauna, a

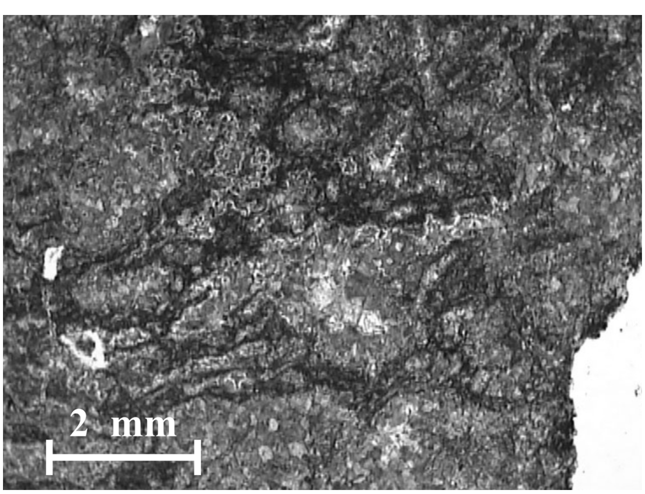

Fig. 21. Pseudospherulitic fibrous calcite interpreted as a pseudomorph after enterolithic anhydrite texture.

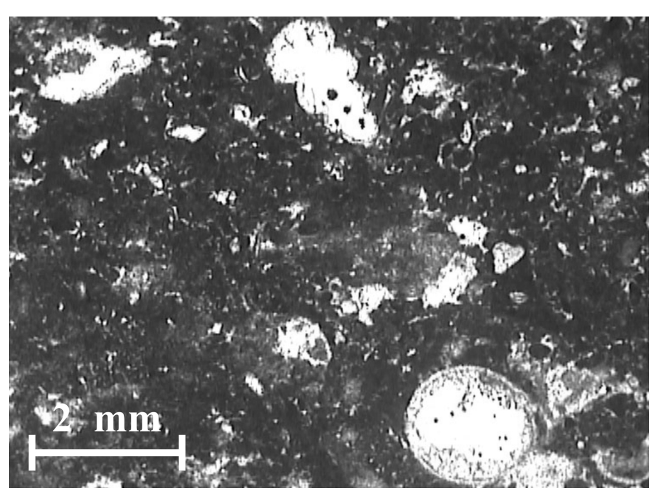

Fig. 22. Early meteoric dissolution of shells, cavities remaining open or filled by blocky calcite.

sequence of 233 m is attributed to the Albian – Early Cenomanian by dat adjacent sediments. It consists of laminated limestones and stromatolitic dolomites with

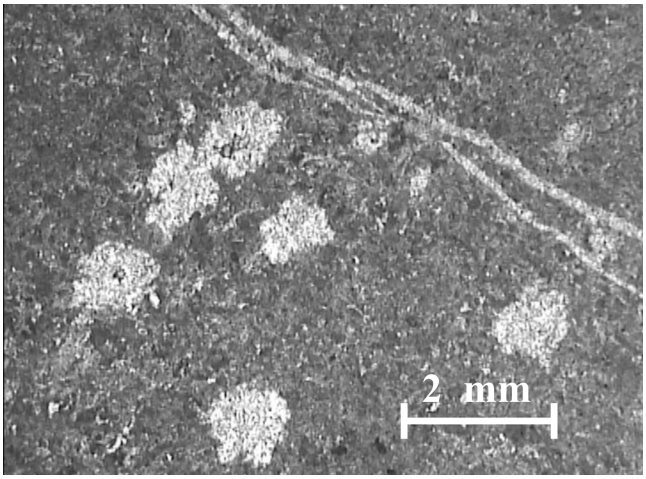

Fig. 23. Dolomite with pseudomorphs of calcite after anhydrite rosettes.

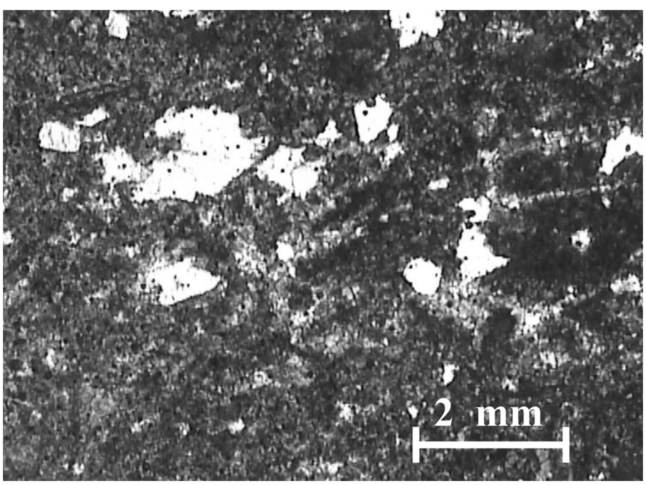

Fig. 24. Dolomite with authigenic quartz euhedra.

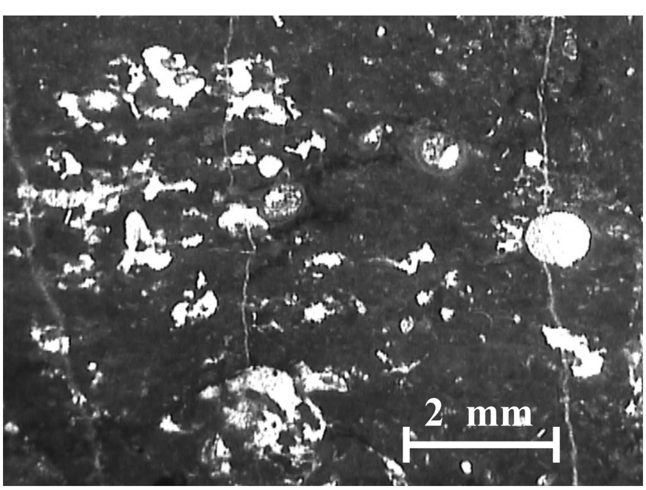

Fig. 25. Dolomite with "alveolar-like" texture.

intercalations of dolomitic breccia, thus suggesting regressive sedimentation. Tsaila-Monopolis (1977) described in western Peloponnesus a succession of 80m dolomitic breccia without microfossils, between dated Aptian and Upper Cenomanian limestones. Subtidal facies are ascribed to the Late Albian (determined by the presence of *"Coskinolina" bronimanni*) in a carbonate sequence in central Peloponnesus (Fleury, 1980; Bernier & Fleury, 1980). The same facies with a similar faunal content has also been found in a tectonized block of limestone in central Crete (Zambetakis-Lekkas & Alexopoulos, 2001). This evidence supports the view of variable palaeoenvironmental conditions on the Tripolitza platform during the Aptian – Cenomanian.

A more subtidal environment characterizes the upper part of the studied section (Units **F, G, H, I**), which is defined as Late Cenomanian. The diagenetic features of this part of the studied shallow – water carbonates indicate subaerial conditions. Zambetakis – Lekkas *et al*., (1988) have documented a clear exposure episode during the Late Cenomanian in the Tripolitza subzone in the Vitina region (central Peloponnesus). Additionally in central Crete, Zambetakis – Lekkas *et al*. (1998) reported a characteristic upper Cenomanian microfauna (*Pseudorhapydionina dubia* and *Pseudonummoloculina heimi*), occurring in two levels of Early and Late Maastrichtian age respectively, in a carbonate sequence of Late Cretaceous. This evidence suggests that Cenomanian blocks remained exposed during the Latest Cretaceous (Zambetakis – Lekkas *et al*., 1998).

Considering the western part of the Gavrovo –Tripolitza platform (Gavrovo subzone), lower Cretaceous carbonates deposited in a subtidal to supratidal paleoenvironment have been described in the Kanala section (Fleury, 1980). The Aptian age has been determined by the presence of *Salpingoporella dinarica, Debarina* sp. ("proche sinon identique à *D. hahounerensis*") and *Ovalveolina reicheli* whereas the Albian is dated by Orbitolinids, especially by *"Coskinolina" bronnimanni*. The peritidal (mostly subtidal with rare intercalations of intertidal) facies characterize the internal platform. Early to Middle Cenomanian carbonates are dated by *Ovalveolina* gr *maccagnoi, Sellialveolina* gr *viallii*. The Upper Cenomanian is dated by *Broeckina balcanica, Cisalveolina lehneri, Pseudorhapydionina dubia, P. laurinensis, Pseudonummoloculina regularis*. During the Cenomanian the carbonate succession shows a palaeoenvironment in the limit of exposure.

Detailed sedimentological investigations of the Barremian-Albian succession of the Kanala section by Grötsch (1991), established a cyclic development of about 220 cycles of different thickness. Repeated subaerial exposure and meteoric – vadose overprinting at the top of the cycles, indicates sea level changes with amplitude of one to several metres, probably due to variations of orbital parameters. Our investigations in the studied section, though not as detailed, are in accord with Grötsch's results. In other localities, as mentioned above, subtidal facies predominate during this period, proving differentiation in the sedimentation pattern over the platform.

Analogous sedimentation of peritidal environment with short periods of local exposure are also described in other Mediterranean platforms in Dinarids (VELIC, 1988) and Apennins (CHIOCCHINI *et al*., 1984)

CONCLUSIONS

A continuous carbonate succession of Aptian – Cenomanian age of the Tripolitza platform is described from central Crete. Despite intense dolomitization, the strata contain characteristic microfossils and interesting sedimentological features proving repeated subaerial exposure of the platform during this period.

The studied succession is composed of about 230m of limestone alternating with dolomite and dolomitic breccia. The Late (?) Aptian is dated by *Salpingoporella dinarica* and *Praechrysalidina infracretacea*. Additionally the absence of characteristic Early Aptian microfossils (e.g. *Palorbitolina lenticularis*) suggests that the studied sequence (Unit A) belongs to the Late Aptian. Early to middle Albian is dated by *Pseudonummoloculina aurigerica* and *Vercorsella* cf. *scarsellai*, Late Albian by *"Coskinolina" bronnimanni*, Late Cenomanian by *Pseudonummoloculina regularis*, *Pseudorhapydionina dubia, Chrysalidina gradata*. Overall the Cretaceous succession is characterized by a well - expressed cyclicity and consists of alternations of peritidal facies, shallow subtidal (foramalgal limestones, miliolid-mollusc / miliolid-ostracod / ostracod / ostracod-rudist limestones) to intertidal / supratidal (microbial stromatolitic dolomites, peloidal-bioclastic peloidal fenestral limestones). The cycles follow the shallowing – upward type of pattern. The environment of deposition corresponds to a very shallow – water ramp and coastal lagoons. The succession was repeatedly exposed under subaerial conditions. As a result of regular exposure the sediments of the intertidal / supratidal intervals have been penecontemporaneously dolomitized. Emergence surfaces are delineated by concretions of oxides and are characterized by features of intense desiccation, microkarstification, *in situ* brecciation and calcretization. Within some beds the environment became evaporitic, being proved by the presence of authigenic quartz and pseudomorphs after evaporitic crystals and textures.

The sedimentary conditions revealed in the studied succession are compared with other localities of the internal part of the platform (Tripolitza subzone) (FLEURY, 1980; ZAMBETAKIS – LEKKAS *et al.,* 1988; ZAMBETAKIS – LEKKAS *et al.,* 1995; ZAMBETAKIS – LEKKAS & ALEXOPOULOS, 2001), suggesting that emergent blocks persisted for a short or longer period, providing elements of breccia in younger deposits (ZAMBETAKIS – LEKKAS *et al*., 1998), while in other places subtidal conditions of sedimentation prevailed.

Analogous sedimentation conditions during this period are defined in the external part of the Gavrovo-Tripolitza platform (Gavrovo subzone) (FLEURY, 1980; BERNIER & FLEURY, 1980; GRÖTSCH, 1991), as well as in Dinarids (VELIC, 1988) and Apennins (CHIOCCHINI *et al*., 1984)

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