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STRATIGRAPHY OF THE TRIASSIC FORMATIONS OF THE ISLAND OF HYDRA

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ABSTRACT

The Triassic formation of the island of Hydra are described geologically and a detailed micropaleontological, stratigraphical and microfacies study is presented. The results are refering to three different sections; the first one is located in the area of Episkopi-Agia Marina having a direction N to E, the second in Agia Triada at the same direction and the third one in the area of the cup Zurba of NE to SW direction.

The sections include «HAN-BULOG. type limestones of the «HALLSTATT» facies, limestones with chert and chert limestones of the «Eros» facies. Predominant facies are micrites to biomicrites (wackestones to packstones) with filaments and radiolaria and oosparites (Grainstones). The identified formanifera microfauna in connection with the ammonites fauna permit the division of the triassic limestones overlying the permo-triassic formations into the following stratigraphic units: Skythian, Anisian (Aegean, Bithynian, Pelsonian, Illyrian), lower Ladinian and Upper Ladinian-Carnian.

ΠΕΡΙΛΗΨΗ

Οι τριαδικοί σχηματισμοί της νήσου Ύδρας περιγράφονται γεωλογικά και αναλύονται λεπτομερώς μικροφασικά, μικροπαλαιοντολογικά και στρωματογραφικά.

Τα αποτελέσματα αναφέρονται σε τρεις τομές από τις οποίες οι δύο έγιναν κατά τη διεύθυνση Β-Ν στις περιοχές Επισκοπή-Αγία Μαρίνα (τομή ΥΑ) και Αγία Τριάδα (τομή ΥΓ) και η τρίτη κατά τη διεύθυνση ΒΑ-ΝΔ στην περιοχή του ακρωτηρίου Ζούρβας (τομή ΥΒ).

Η τομή ΥΑ περιλαμβάνει τους τριαδικούς σχηματισμούς που εμφανίζονται στις δυτικές περιοχές της νήσου.

Ο κατώτερος σχηματισμός που δειγματίστηκε είναι ωολιθικοί ασβεστόλιθοι, από τη μικροφασική ανάλυση των οποίων προέκυψε ότι απετέθησαν σε περιβάλλον περιθωρίου ανθρακικής πλατφόρμας. Μικροαπολιθώματα δεν βρέθηκαν, από τη στρωματογραφική τους θέση όμως και τα βιβλιογραφικά στοιχεία συνάγεται ηλικία ανωτέρου Σκυθίου κατώτατου Ανισίου.

Στη συνέχεια αναπτύσσονται οι ασβεστόλιθοι «Έρως». Πρόκειται για βιομικρουδίτες, βιοσπαρίτες και βιοσπαρουδίτες, που έχουν υποστεί έντονα διαγενετικά φαινόμενα. Χαρακτηρίζονται από την έντονη παρουσία βιοκλαστών, κυρίως φυκών, και περιέχουν άφθονη μικροπανίδα τρηματοφόρων που υποδηλοί την παρουσία

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της ζώνης *Pilammina densa* στα ανώτερα στρώματα. Με βάση την κατανομή των διαφόρων ειδών στα δείγματα και το στρωματογραφικό τους εύρος, διακρίθηκαν, εκ των κάτω προς τα άνω οι εξής ορίζοντες:

Ανώτερο Αιγαίϊο-Βιθύνιο (δείγματαΥΑ1 και ΥΑ3).

Πελσόνιο (δείγματα ΥΑ4 έως ΥΑ6) με *Meandrospira dinarica* και *Pilammina densa.*

Ιλλύριο (δείγματα ΥΑ7 έως ΥΑ11) με *Endothyra badouxi, Nodosaria ordinata* και *Pilammina densa.*

Το περιβάλλον αποθέσεως εξακολουθεί να αντιστοιχεί σε περιθώρια της ανθρακικής πλατφόρμας.

Οι ανώτεροι ορίζοντες των ασβεστολίθων «Έρως» έχουν υποστεί έντονο τεκτονισμό και λατυποποίηση. Στα δημιουργηθέντα κενά (δείγμα ΥΑ11) έχει διεισδύσει υλικό από την υπερκείμενη ασβεστολιθική φάση τύπου «Hallstatt». Εξ αυτού συμπεραίνεται ότι η απόθεση των ασβεστολίθων τύπου «Hallstatt», στην περιοχή της Επισκοπής, άρχισε κατά το τέλος του ανωτέρου Ιλλυρίου, άποψη που ενισχύεται από την περιεχόμενη σε αυτούς μικροπανίδα. Η φάση είναι πελαγική και αποτελείται από απολιθωματοφόρους μικρίτες και βιομικρίτες με ακτινόζωα και Filaments.

Οι ίδιοι μικροφασικοί χαρακτήρες επαναλαμβάνονται και στους υπερκείμενους των ασβεστολίθων τύπου «Hallstatt» ασβεστολίθους με κερατολίθους, με μόνο ιδιαίτερο χαρακτηριστικό την έντονη συσσώρευση Filaments η οποία τοπικά δημιουργεί Lumachelle. Τα τρηματοφόρα εδώ είναι σπάνια. Εν τούτοις στους ανώτερους ορίζοντες εντοπίστηκαν βιοικοινωνίες ανωτέρου Λαδινίου-Καρνίου, οπότε και στα ενδιάμεσα στρώματα αποδίδεται ηλικία κατωτέρου Λαδινίου.

Η απόθεση, τόσο των ασβεστολίθων τύπου «Hallstatt» όσο και των ασβεστολίθων με κερατολίθους, έλαβε χώρα σε περιβάλλον ηπειρωτικής κλιτύος προς την πλευρά της ανοικτής θάλασσας.

Η τομή ΥΓ έγινε στην κεντρική περιοχή της Ύδρας και αναφέρεται καθ' ολοκληρία σε ασβεστολίθους τύπου «Han-Bulog» της φάσης «Hallstatt», οι οποίοι σχηματίζουν στενή λωρίδα, από τα ΒΔ μέχρι τα ΝΑ παράλια της νήσου, καταλαμβάνοντας τα υψηλότερα τοπογραφικά σημεία.

Η μικροφασική τους ανάλυση έδειξε ότι παρουσιάζουν σαφείς διαφοροποιήσεις από τους ασβεστολίθους τύπου «Hallstatt» της τομής ΥΑ, τόσο ως προς τους ιζηματολογικούς όσο και ως προς τους μικροπαλαιοντολογικούς τους χαρακτήρες. Πρόκειται για απολιθωματοφόρους μικρίτες και βιομικρίτες με ακτινόζωα και Filaments, οι οποίοι, κυρίως στους κατώτερους ορίζοντες, εναλλάσσονται με βιο-πελ-μικρίτες και βιο-πελ-μικρορουδίτες.

Έντονη είναι η παρουσία ηφαιστειακού υλικού και βιοκλαστών, κυρίως εχινοδέρμων και φυκών. Έντονα είναι επίσης τα διαγενετικά φαινόμενα.

Με βάση τα προσδιορισθέντα τρηματοφόρα αναγνωρίσθηκαν οι παρακάτω στρωματογραφικοί ορίζοντες:

Ανώτερο Σκύθιο (δείγματα ΥΓ3 και ΥΓ6)

Αιγαίϊο-Βιθύνιο (δείγματα ΥΓ7 έως ΥΓ15) με *Meandrospira pusila* και *Trochammina almtalensis.*

Πελσόνιο (δείγματα ΥΓ16 έως ΥΓ30) με άφθονο Duostominidae και *Paleomiliolina judicariensis.*

Κατώτερο Ιλλύριο (δείγματα ΥΓ31 έως ΥΓ37).

Το περιβάλλον απόθεσης είναι και εδώ αυτό της ηπειρωτικής κλιτύος προς την πλευρά της ανοικτής θάλασσας, θα πρέπει όμως να διαφοροποιείται από αυτό στο οποίο απετέθησαν οι αντίστοιχοι σχηματισμοί της τομής ΥΑ.

Η τομή ΥΒ περιλαμβάνει ασβεστολίθους του ανατολικού άκρου της νήσου, οι οποίοι στη βιβλιογραφία αναφέρονται ως ασβεστόλιθοι «Έρως». Η μικροφασική τους ανάλυση όμως έδειξε ότι δεν περιλαμβάνουν φάσεις παρόμοιες με αυτές που απαντώνται σε αντίστοιχους σχηματισμούς των άλλων περιοχών της Ύδρας. Πρόκειται για μικρίτες, απολιθωματοφόρους μικρίτες και ανακρυσταλλωμένους μικρίτες με θραύσματα κρινοειδών, ακτινόζωα και σπάνια Filaments.

Χαρακτηριστικά τρηματοφόρα δεν αναγνωρίστηκαν, έτσι η ηλικία δεν μπορεί να προσδιορισθεί με ακρίβεια. Όσον αφορά το περιβάλλον αποθέσεως ο χώρος της ηπειρωτικής κλιτύος φαίνεται ως ο πλέον πιθανός.

Εκ των αποτελεσμάτων και παρατηρήσεων αυτών προκύπτουν τα παρακάτω συμπεράσματα.

Στις δυτικές περιοχές της Ύδρας (Επισκοπή-Αγία Μαρίνα), κατά τη διάρκεια του ανωτέρου Σκυθίου-Ανισίου επικρατούσαν συνθήκες περιθωρίων ανθρακικής πλατφόρμας όπου απετέθησαν ωολιθικοί ασβεστόλιθοι και νηριτικοί ασβεστόλιθοι φάσης «Έρως». Κατά το ανώτερο Ιλλύριο και μετά από μία φάση εντόνου τεκτονισμού, επικρατούν συνθήκες ηπειρωτικής κλιτύος και αρχίζει η απόθεση πελαγικών ασβεστολίθων τύπου

«Hallstatt». Οι συνθήκες αυτές εξακολουθούν καθ' όλη τη διάρκεια του Λαδινίου και μέχρι του κατωτέρου Καρνίου, δίνοντας γένεση σε ασβεστολίθους με κερατολίθους.

Στις κεντρικές περιοχές της νήσου, αντιθέτως, οι συνθήκες ηπειρωτικής κλιτύος επικρατούν ήδη από του ανωτέρου Σκυθίου οπότε και αρχίζει η απόθεση των ασβεστολίθων τύπου «Han-Bulog» της φάσης «Hallstatt», ο σχηματισμός των οποίων διήρκεσε σε αυτή την περιοχή (Αγία Τριάδα), μέχρι και το κατώτερο Ιλλύριο.

Για τις ανατολικές περιοχές (Ακρωτήριο Ζούρβας), από τα υπάρχοντα μέχρι τώρα στοιχεία, προκύπτει ότι δεν είναι δυνατός ο συσχετισμός τους με κάποια από τις φάσεις που εντοπίσθηκαν στις άλλες περιοχές.

INTRODUCTION

The island of Hydra, extending south of the Argolis peninsula (Fig. 1), is of a great importance for the interpretation of the geological structure and the understanding of the tectonic evolution of the region.

Many publications have been dedicated to the geology of Hydra. The pioneers P. BOBLAY & TH. VIRLET (1833) in their classic work «Expedition scientifique de Moree» refer to the limestones of the piedmonts of the island ad consider them similar to the Tripolitza limestones, without mentioning any stratigraphic evidence. Following their ideas A. PHILIPPSON (1882) attribute a Cretaceous age to these limestones.

Systematic study to the island starts with C. RENZ and his numerous geological expeditions (1909, 1910, 1912, 1925, 1931, 1945, 1955). He mainly describes the geological structure of the island (1945, 1955) and distinguishes several stratigraphic units, from Carboniferous to Triassic. Oeconomides (1940), practically repeats the conceptions of RENZ, while H. BENDER & al. (1960) and N. BANNERT & H. BENDER (1968) have doubted his «nappe model».

H. RÖMMERMANN (1963) has mapped Hydra on a scale 1:50.000 and has presented several publications (1965, 1968, 1969) with detailed stratigraphic studies, refering also, for the first time, to the jurassic and cretaceous formations of the island.

Recently many authors, as, J. WENDT (1973), D.A.V. STOW (1975), D.K. RICHTER & H. FÜCHTBAUER (1981), P. SCHLÄFER & B. SENOWBARI-DARYAN (1983), G. SCHILL (1983) and H. DÜRKOOP *et al.* (1986) have worked in Hydra, dealing mainly with the stratigraphy and the paleontology of the island.

Finally CH. SIDERIS (1986) refers to the palleogeographic evolution of the wider area, during the Permo-triassic, using among others stratigraphic data from Hydra.

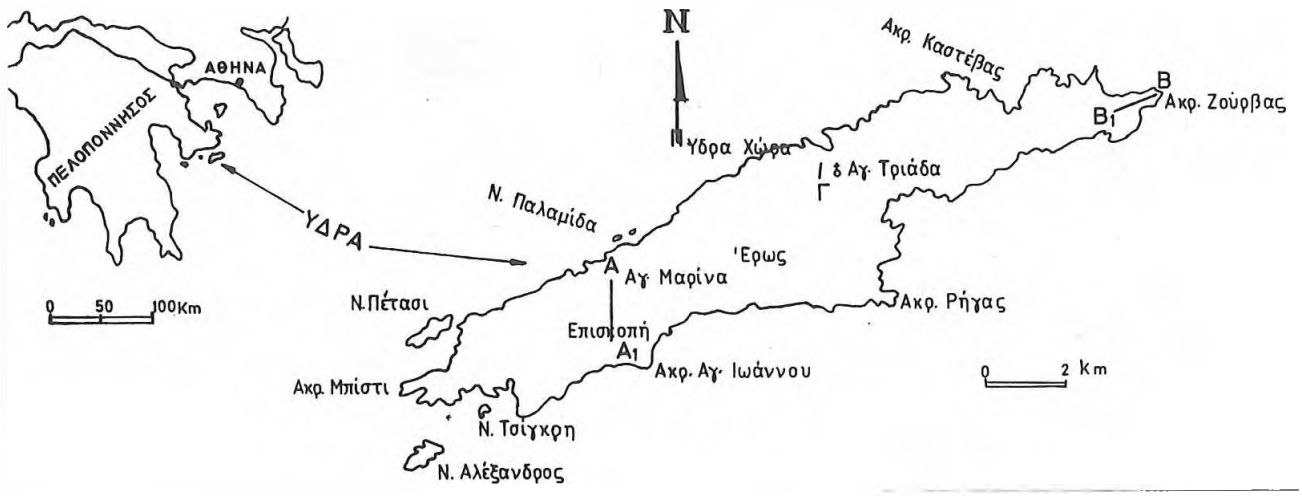

Fig. 1: Locality and sketch map of the Hydra island showing location of sections.

THE TRIASSIC OF HYDRA

Deposited over the grey limestones with a very rich and diversified brachiopod fauna of the upper Permian, known as Lyttonia limestones, the triassic sequences, including the permo-triassic transitional beds, present considerable variations from the east to the west of the island.

The contact between the upper Permian and the permo-triassic formations is usually normal and only, locally, a slight unconformity is detected.

Three geological sections have been sampled, along the triassic formations of the island, two of them with direction N-S, in the regions Episkopi-Agia Marina and Agia Triada and a third with direction NE-SW in the region of cape Zourva (Fig. 1).

They include «Han-Bulog» limestones of «Hallstatt» type facies, cherty limestones and oolithic massive limestones of «Eros» facies. A detailed description is given below.

SECTION YA

The section YA (Fig. 2) includes all the triassic formations of the western part of the island and has been effectuated almost perpendicularly to the general direction of the rocks which is NW-SE, with a dip 45°N, measurements taken in the «Hallstatt. type limestones and the cherty limestones, the «Eros» limestones being massive and without any stratification.

The sampling was very detailed in the surroundings of the Agia Marina monastery, which is built on «Hallstatt» type limestones (samples YA1-YA10) annd the overlying thin-bedded cherty limestones and cherts (samples YA19-YA28). In the underlying «Eros» limestones, the samples have been taken randomly along the way from Agia Marina to Episkopi (samples YA30-YA38). In Episkopi, below the «Eros» limestones, an oolithic limestone occurs (samples YA39-YA45), lying over the permo-triassic transitional beds composed of aternations of shales and sandstones (SCHILL 1983).

According to RÖMERMANN (1968) between the oolithic limestones and the transitional beds, tuffitic deposits are intercalated, overlaid by lenses of «Hallstatt» type limestones, which revealed a conodont microfauna of lower Anisian age. Finally, below the transitional beds, occur the limestones with silex of the upper Permian (TSELEPIDIS & CORONEOU, 1987).

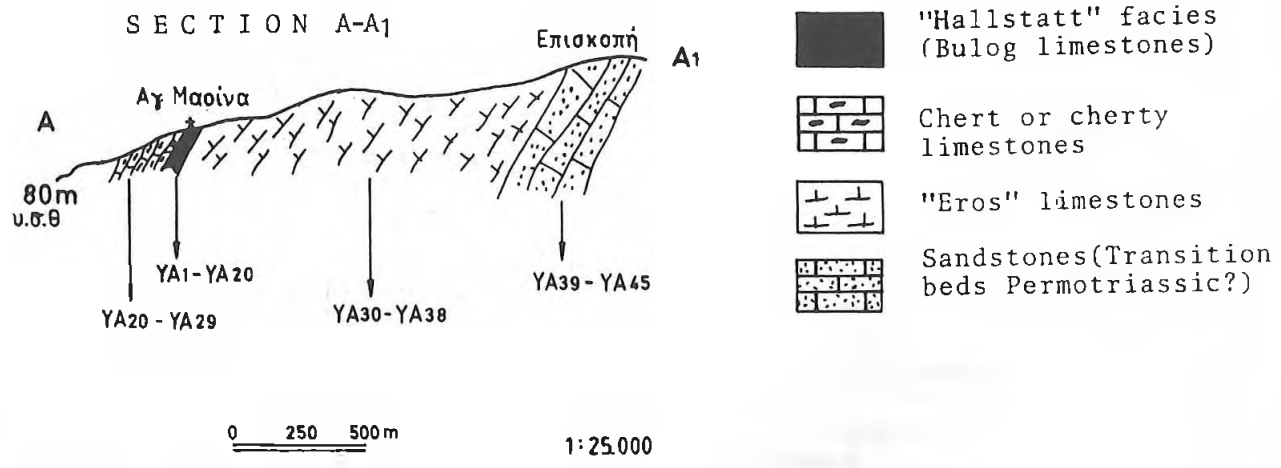

Fig. 2: Geological section YA.

From the microscopic study of the samples three different microfacies have been identified, corresponding to two different environments of deposition. From the base of the section to the top, the description of each facies has as follows:

Facies 1

Oolithic facies (probably the lower parts of «Eros» limestones). It includes oolithic limestones or oosparites (FOLK, 1962), that is the SMF type-15 of FLUGEL (1982).

The rocks are composed of coated grains, in this case oolithes (ooids), surrounded by coarsely cristalline calcite. In thin sections both normal ooids with several laminae (sample 44) and superficial ooids with one or very few laminae of various thickness are present (sample 39). The frequency of ooids is quite high reaching in some samples (YA44, YA38, YA36) the 60% of the total mass of the sample. The values of grain size vary from 0,135mm to 0,80mm with a mean value of 0,050 mm. The samples exhibit generally a degree of sorting ranging from «moderate» to «well sorted». Most of the observed ooids are «single» ooids with a spherical - like shape, but «compoud» ooids developed as multiple ooids are also present (samples YA36, YA32). Refering to their completeness, whole ooids, without any change in the shape of the structure of the laminae (in all samples) and «half-moon ooids» occur (sample YA39). Half-moon ooids are formed by leaching and collapse of the inner laminae, which then accumulate as a geopetal fabric on the bottom of the ooid (CARROZZI, 1963); the residual internal cavity in the above ooids is filled by sparite.

In the laminae of the ooids two main microstructures can be recognized: micritic rings laminae in most of the samples and tangential structure in sample YA44. A «suspicious» radial structure is restricted to only few ooids (sample YA44). Besides, an «oomoildic» and «in-situ calcitized. structure (PERYT, 1983), in severaol samples, is under discussion. The latter are mentionned by RICHTER occuring in the Triassic of Hydra, locality Episkopi. The micritic rings appear to be formed by a regular way and no signs of any algal borings have been observed. Each laminae of the ooid is very thin, usually of a size of 0,010 mm.

The nucleus of the ooids, where can be seen, is relatively small compared with the size of the ooids. It is noteworthy that the size of the nuclei is independent of the final size of the ooids, as well as that the ooids of similar sizes have different nuclei sizes. Although most nuclei are calcitic there are nuclei either of dolomitic or siliceous composition. It is obvious that the nuclei composition corresponds to the available sedimentary material.

Broken ooids do occur, some of them used as nuclei for the formation of new ooids (sample YA36). «Deformed» ooids also occur (sampel YA38), apparently as a result of compaction forces. Generally, the shape of the ooids is not symmetrical, a good indication of quiet water ooids.

A final remark concerns the occurrence of ooids in relation to the presence of other particles. Apart from angular quartz crystals of various sizes, ranging from 0,05 mm up to 0,50 mm (sample YA36) as well as abundant dolomitic rhombohedra (samples YA42, YA43), no other constituents can be observed. Skeletal particles are extremely rare, whereas pellets or any algal material are lacking. Dolomitic and quartz material are filling either the inner parts of the ooids or appear scatterly within the matrix of the samples. Fragments of igneous rocks are characteristic in the sample YA36, and stylolites with iron oxides seam material are present in the sample YA44.

All samples are affected by a high degree of diagenesis, which in some cases reaches advanced stages of recrystallization. Packing index is particuularly high in certain cases (sample YA38).

Taking in to consideration the above description of the samples and compared with the relative bibliography (BATHRUST, 1975; FLUGEL, 1982; PERYT, 1983), we can conclude that these rocks were formed in a low energy environment by an interaction of inorganic and organic processes. Such an environment corresponds to a platform margin area.

No microfossil has been identified in any sample, therefore the age of this oolithic formation cannot be given with certitude. Nevertheless, from its stratigraphic position a late Scythian-early Anisian age is presumed.

Facies 2

«Eros» limestones. Platform margin facies, that is the SMF 5 type of FLUGEL. It includes biomicrudites, biosparites and biosparudites. It is characterized by the presence of algal clasts or algae with their original structure well preserved in a clar washed sparite cement.

Diagenetic features are very common. Processes of diagenesis include: dolomitization, micritization, crystalls overgrouths, formation of veins and stylolites. Among them, silica diagenesis is most impressive. Apparently, quartz material already present in the deposit is redistributed preferably within the algal clast. Two crystal forms have been observed, one of euhedral quartz crystal with a micritic nucleus and another of typical rhombohedra, remplacement after dolomite crystals.

The depositional environment is the margin of the carbonate platform.

The microfauna in the lower parts (samples YA1 to YA3) is poor and not well preserved. *Trochammina almtalensis* KOEHN-ZANINETTI, *Hemigordius?* cf. *chialingchiangensis* (HO), parts of *Calcitornella* sp. and *Endothyranella* sp. and not well developed attached forms, have been identified and the age of these strata is presumed to be Aegean-Bithynian.

Upwards, (samples YA4 to YA11) a more diversified microfauna contains *Pilammina densa* PANTIC, *Meandrospira dinarica* KOCHANSKY-DEVIDE & PANTIC, *Diplotremina astrofimbriata* KRISTAN-TOLLMANN, *Duostomina* cf. *alta* KRISTAN-TOLLMANN, *Hemigordius? chialingchianngensis* (HO), *Trochammina almtalensis* KOEHN-ZANINETTI, *Endothyra badouxi* ZANINETTI & BRONNIMANN, *Endothyra* cf. *salaj* GAZDZICKI, *Endothyranella bicamerata* SALAJ, *Endothyranella* cf. *wirzi* (KOEHN-ZANINETTI), *Endothyranella* cf. *alpina* ZANINETTI & BRONNIMANN, *Glomospira sinensis* HO, *Glomospirella* cf. *simplex* HARLTON, *Glomospira tenuifistula* HO, *Verneulinoides triserialis* ZIEGLER, *Earlandia tintiniformis* (MISIK), *Nodosaria* sp., *Geinitzinita* sp., *Ammobaculites* sp., whichh characterize the *Pilammina densa* range zone, and indicate a Pelsonian-Illyrian age.

In the sample YA11 a high degree of tectonization resulting in the formation of a tectonic breccia is observed. The so-formed interspaces are filled with material of the overlying «Hallstatt» type facies 3.

Facies 3

«Hallstatt» type limestones and cherty limestones. Pelagic facies including fossiliferous micrites and biomicrites, that is the SMF 3 type of FLUGEL (samples YA12 to YA28).

Recrystallization has affected to various degree most of the samples, hence the final appearance of each sample in thin section is different. The general picture is that of a micritic matrix containing several to abundant pelagic microfossils, mainly radiolarians and very fine filaments. Fragments of echinoderms and other macrofossils are also present. Filaments become abundant upwards and they even form lumachelle in the part corresponding to the cherty limestones.

Quartz grains are either completely absent or abundant in the form of «rhombic crystal» (after dolomite) of a mean size 0,080 mm (sample YA26). Chalcedony concentrations can also be observed (sample YA24). The presence of iron oxides in several samples pigmants them with characteristic pink colour (red micrite). The presence of fissure fillings and stylolites is very common.

The environment of deposition corresponds to a lower slope to basinal area. Rare badly preserved foraminifera have been found in the lower parts corresponding to the «Hallstatt» type limestones, as *Glomospira sinensis* HO, *Nodosaria* gr. *ordinata* TRIFONOVA, ? *Pilammina* sp., ? *Trochammina* sp. and some attached forms. The age is presumed to be late Illyrian.

Poor microfauna is also found in the upper parts of the cherty limestones (samples YA26, YA27, YA30), with *Agathammina* ch. *austroalpina* KRISTAN-TOLLMANN and *Nodosaria* sp. indicating a late Ladinian-Carnian age.

The intermediate parts are thus considered to have an early Ladinian age.

SECTION YB

The section YB includes rocks from the eastern part of the island from the cape Zourva to the small bay Zoodochos Pighi. The sampling was randomly carried out, starting from the higher point of the area along a general direction NE-SW. The rocks are white-grey massive limestones cut by numerous fissures and microfaults and no stratification or dip can be observed (samples YB1 to YB12). In direct contact wiht these limestones cherty limestones and cherts are observed (samples YB13 to YB20). The entire region is highly tectonized and it is very probable that the absence of the «Hallstatt» type limestones and the direct contact of massive and cherty limestones is due to the presence of faulting.

The microscopic study has shown that in thin section a particular and distinct facies, similar to those found in the sections YA and ΥΓ does not exist. The samples are micrites, fossiliferous micrites and recrystallized micrites. They contain crinoid fragments, radiolarians and some filaments.

Silt size limeclasts and quartz, as well as pelloids are common in all samples. In some samples, with a microbrecciated structure, the radiolarians are chertified, whereas in more coarse-grained samples diagenetic features are apparent. Dendrites and iron oxides are also present.

One common characteristic feature of this facies with the facies 2 of the section YA is the presence of sand size rhombohedra of quartz after dolomite, found in a sample located in the middle of the section (sample YB11).

Most appropriate place for the deposition of the above described rocks is the foreslope area of the basin (SMF 4).

No determinable foraminifera has been found and therefore the exact age is unknown.

SECTION ΥΓ

The section ΥΓ includes exclusively «Hallstatt» type limestones, which have been named «Han-bulog» Kalke by RENZ (1906), due to their macroscopic and faunistic ressemblance to the so-called limestones of Bosnia in Yugoslavia.

The section is located on the hills westwards of the Agia Triada monastery (Figs. 3 and 4).

The «Han-bulog» limestones extend as a narrow band crossing the island from the port of Hydra (Chora) to the north to the southern coasts, occupying the highest areas. They lie over grey-green volcanic rocks, keratophyric tuffs, which form a mophologically plan surface under the limestones (Fig. 3).

A layer of clastic volcanic material and ellipsoidal pebbles, with calcareous nuclei and red encrustations occur, in the lower part of the limestones, near the contact with the keratophyres.

The lower members of the formation are thin bedded, partly knuckled limestones. Upwards, they become compact, light-coloured grey-beige with thin red intercalations indicating the general stratification with direction N 70° W to E-W. The dip is about 45° N.

The sampling was detailed (almost every 50 cm).

The macrofauna is very rich, especially in the lower parts, where many Ammonoidea species of Anisian age have been identified (RENZ, 1908).

From the microscopic study of the samples, the following facies have been recognized.

Facies 1

Samples taken from the pebbles intercalated in the lower parts of the section, have shown features indicating subaerial exposure. Alveolar texture, glaebulus, clotted micrite, «plant roots like» structures are observed, together with some radiolarians, filled with drusy quartz, and other fossil fragments.

Cracking, fractures and stylolites are also common with seam material read micrite and clay minerals. Iron oxides pigment these samples, while bitumenous matter is often present.

It is almost clear that the samples have been deposited in a semiarid environment.

No characteristic microfauna has been identified.

Facies 2

Going up in the sequence, as the bedding is continuous, other facies can be recognized, including biomicrites, diagenetically alterated biomicrites and biomicrudites, alternated in the upper parts with filamentous biomicrites.

Radiolaria, filaments, algal clasts and echinoid fragments are present in all samples. Angular to subangular quartz, feldspars, fragments from volcanic rocks, pellets and pelloids are also common, while dolomite occurs only in the sample (ΥΓ 20) filling with typical rhombohedra a lithic component.

The filamentous samples are characterized by the absence of quartz and the presence of pelloids in a micritic cement, whereas the samples which contain algal clasts exhibit un abrupt wash of the micritic cement.

The above facies represent a foreslope environment of deposition.

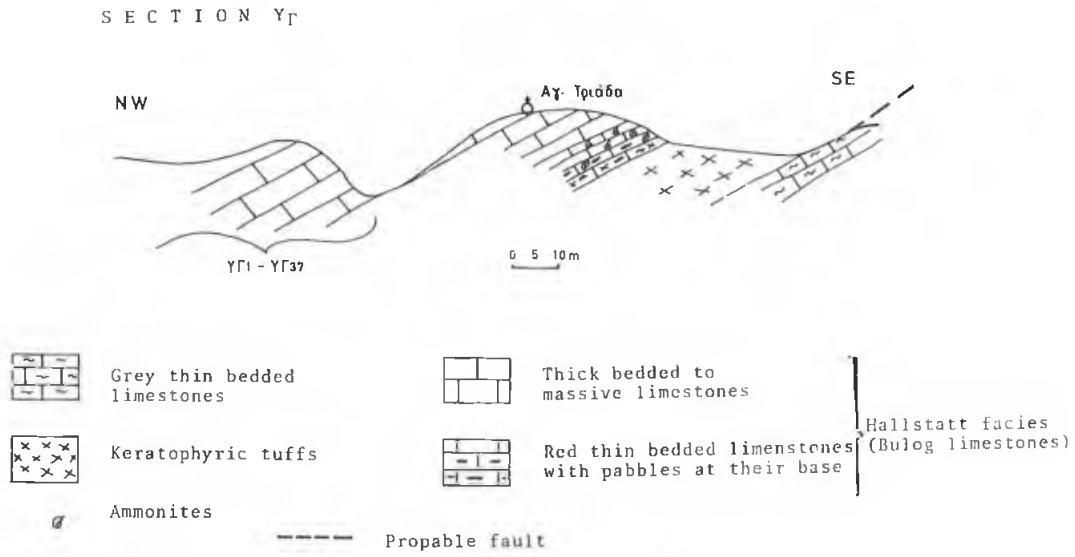

Fig. 3: Geological section ΥΓ at Ag. Triada.

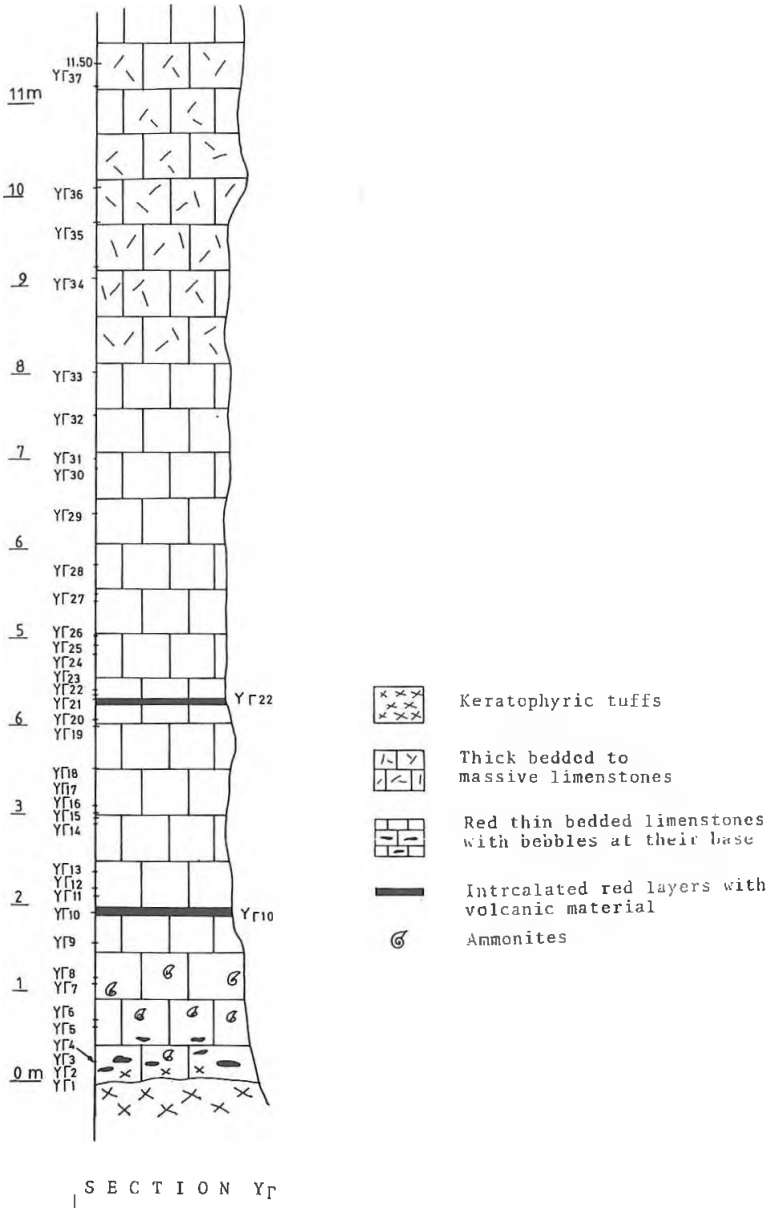

Fig. 4: Geological section ΥΓ with the precise positions of the samples.

The foraminifera in the lower parts are rare and badly preserved (samples ΥΓ3 to ΥΓ6). *Nodosaria* aff. *scyphica* TRIFONOVA, *Calcitornella* cf. *gebzeensis* DAGER, *Glomospira simplex* HARLTON, *Meandrospira* gr. *pusila* (HO), *Nodosaria* spp., *Astacolus* sp., *Gaudryina* sp. and attached froms, have been determined and indicate an upper Sctyhian age.

Upwards (samples ΥΓ7-ΥΓ15) the presence of *Meandrospira pusila* (HO) in association with *Trochammina almtalensis* KOEHN-ZANINETTI, *Glomospirella shengi* HO, *Hemigordius? chialing-chiangensis* (HO), *Verneuilinoides* cf. *triserialis* ZIEGLER, *Earlandia tintiniformis* (MISIK), *Earlandia gracilis* (PANTIC), *Gaudrying triassica* TRIFONOVA, *Gaudryinella* sp., *Spiroplectammina* sp., *Nodosaria* sp., *Pseudonodosaria* sp., *Ichtyolaria* sp., *Glomospira* sp. attached froms and algae imply the deposition of these beds in Aegean-Bithynian.

Finally in the samples ΥΓ16 το ΥΓ30 various species of Duostominidae appear together with *Nodosaria* cf. *erikliensis* DAGER, *Ophthalmidium* cf. *jebeliense* DAGER, *Palaeomiliolina judicariensis* (PREMOLI-SILVA), *Globochaete alpina* LOMBARD and some of the above mentioned species. The age is Pelsonian.

Facies 3

It appears in the upper beds of the section and it is a typical filamentous «Hallstatt» type facies.

It includes filamentous biomicrites with calcified radiolarians and sparse authigenic quartz grains in a micritic matrix. It represents deep water pelagic facies, without any contribution of coarse grained material from the land. The microfauna contains *Duostomina alta* KRISTAN-TOLLMANN, *Pseudonodosaria lata* (TAPPAN), *Earlandia tintiniformis* (MISIK), *Hemigordius? cialingchiangensis* (HO), *Endothyranella* sp., *Calcitornella* sp., attached froms and algae. The age is presumed to be early Illyrian.

CONCLUSIONS

Summarizing the above data we reach the following remarks concerning the stratigraphic organization of the triassic formations of the Hydra island and the paleogeographic conditions in the area during this time.

In the western part of the island (section YA, localities Episkopi-Agia Marina) the triassic sequence starts with oolithic limestones of late Scythian-early Anisian age.

Over this oolithic facies develop the «Eros» limestones composed of biomicrudites, biosparites and biosparudites and characterized by the presence of intensive diagenetic phenomena. They contain abundant algal clasts and fossil fragments and a rich foraminifera microfauna indicating the presence of *Pilammina densa* zone in the upper parts. Three stratigraphic horizons have been determined:

Upper Aegean-Bithynian (samples YA1 to YA3).

Pelsonian (samples YA4 to YA6) with *Meandrospira dinarica* and *Pilammina densa*.

Illyrian (samples YA7 to YA11) with *Endothyra badouxi, Nodosaria ordinata* and *Pilammina densa*.

In both the above cases (oolithic and «Eros» limestones), the depositional environment corresponds to the carbonate platform.

The upper part of the «Eros» limestones is brecciated and filled with material of the overlying «Hallstatt» type formation. It is, therefore, presumed that the deposition of the «Hallstatt» type limestones in this area started at the end of the Illyrian. The facies is pelagic consisting of micrites and biomicrites with radiolarians and filaments.

The same facies compose the upper members of the sequence which are chertly limestones. The only characteristic here is the high concentration of macrofossils, forming in some cases «lumachelles».

The age is Ladinian-Carnian.

The «Hallstatt» type and the cherty limestones have been deposited in the foreslope environment.

In the central area of Hydra (section ΥΓ, locality Agia Triada) the triassic limestones are exclusively of «Hallstatt» type facies (Han-bulog Kalke), presenting different features from those of the section ΥΑ.

They consist of micrites and biomicrites with filaments and radiolarians alternating especially in the lower parts with bio-pel-micrites and bio-pel-micrudites. They are characterized by the high concentration of volcanic clasts and fossil fragments, mainly echinoderms and algae. Diagenetic phenomena are also intensive here. The microfauna is rich and diversified permiting the identification of the following stratigraphic horizons:

Upper Scythian (samples ΥΓ3 to ΥΓ6).

Aegean-Bithynian (samples ΥΓ7 το ΥΓ15) with *Meandrospira pusila* and *Trochammina almtalensis.*

Pelsonian (samples ΥΓ16 to ΥΓ30) with abundant Duostominidae and *Paleomiliolina judicariensis.*

Lower Illyrian (samples ΥΓ31 to ΥΓ37).

The depositional environment is the foreslope.

In the eastern, part the facies are different from those identified in the western and central part of the island and no correlation can be made.

They are micrites, fossiliferous micrites and recrystallized micrites with crionoid fragments, radiolarians and rare filaments. No characteristic foraminifera have been found so the age cannot be determined. The depositional environment is probably the foreslope.

In conclusion:

The deposition of the «Hallstatt» type limestones, appearing in different parts of the foreslope, started in the upper Scythian and reached the lower Illyrian in the central areas of Hydra.

At the same time, in the western areas conditions of carbonate platform prevailed and colithic and «Eros» limestones have been deposited, while the formation of the «Hallstatt» type limestones started only at the end of Illyrian and reached the lower Ladinian.

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PLATE I

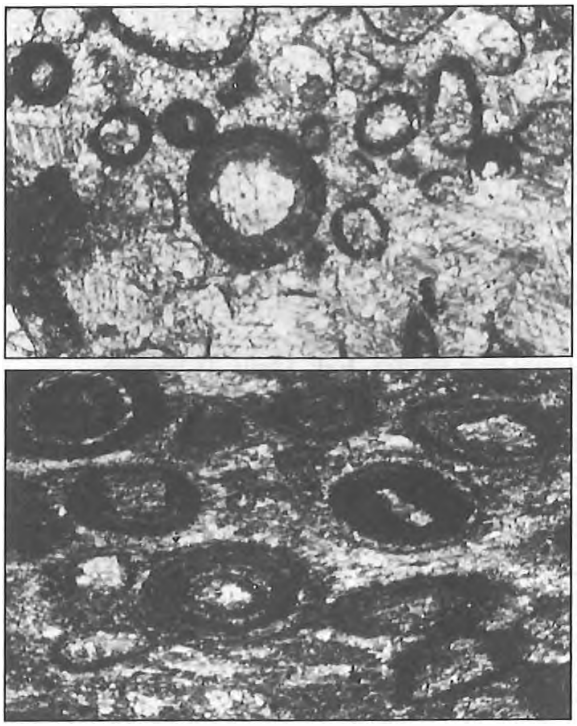

Fig. 1: Oosparites. Normal ooids with several micritic laminae. Section YA, sample YA44, lower part of «Eros limestone». (35x)
Fig. 2: Oosparites. «Deformed» ooids, Section YA, sample YA38, lower part of «Eros limestone». (35x)

PLATE II

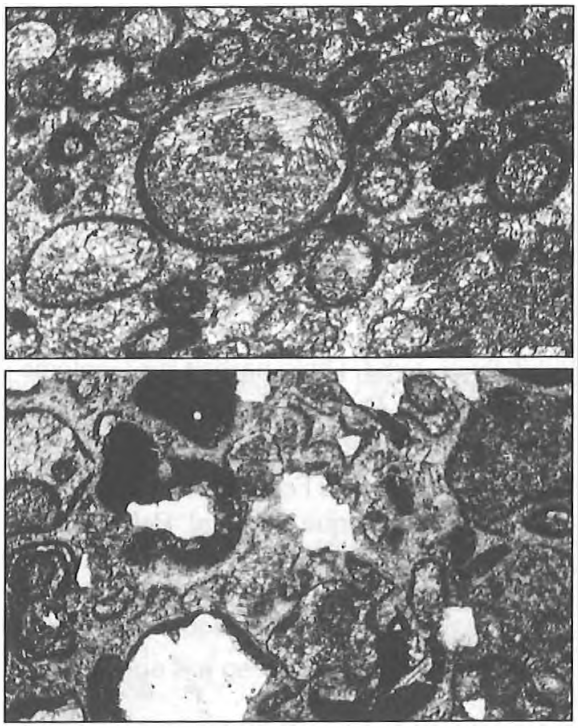

Fig. 1: Oosparites. Superficial oolithes with only one or very few laminae and «half moon» ooids. Section YA, sample YA39, lower part of «Eros limestone». (35x)
Fig. 2: Oosparites «Compound» ooids Note the abundant quartz grains. Section YA, sample YA36, lower part of «Eros limestone». (35x)

PLATE III

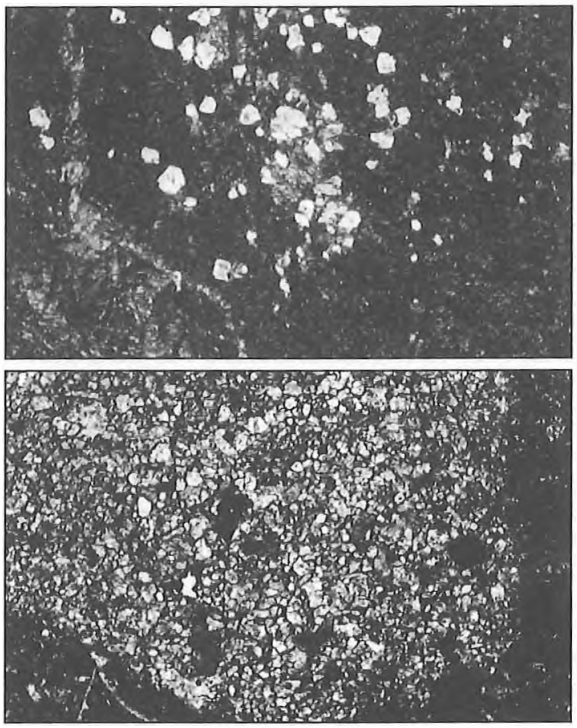

Fig. 1: Micrite with abundant siliceous subrounded rhomboedra, secondary after dolomite crystals. Section YB, sample YB11, «Eros limestone». (35x)
Fig. 2: Lithic component filled with dolomitic rhomboedra. In the center crystals of opaque mineral. Section YT, sample YT10, «Hallstatt» type limestone. (35x)

PLATE IV

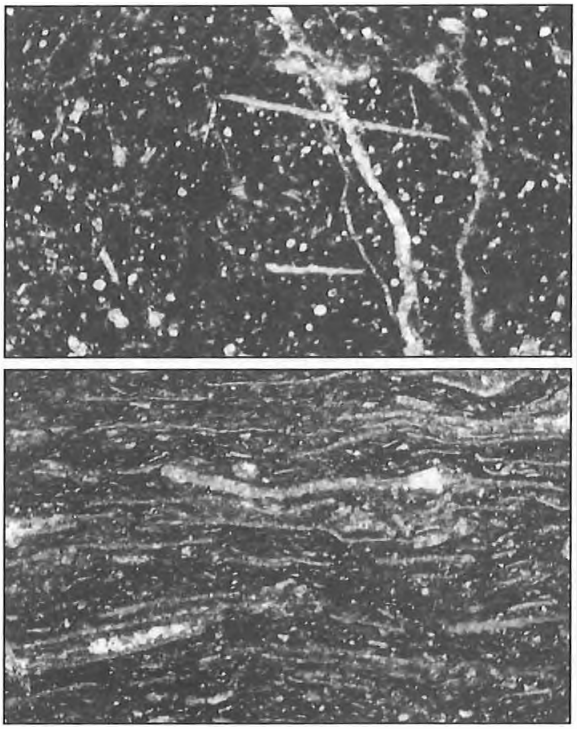

Fig. 1: «Filamentous» micrite with calcified radiolaria. Section YT, sample YT28, «Hallstatt» type limestone. (35x)
Fig. 2: Filamentous micrite. Note the parallel, texture caused by orientation of the fossil fragments parallel to the sea floor. Section YA, sample YA21 «Hallstatt» type limestone. (35x)

PLATE V

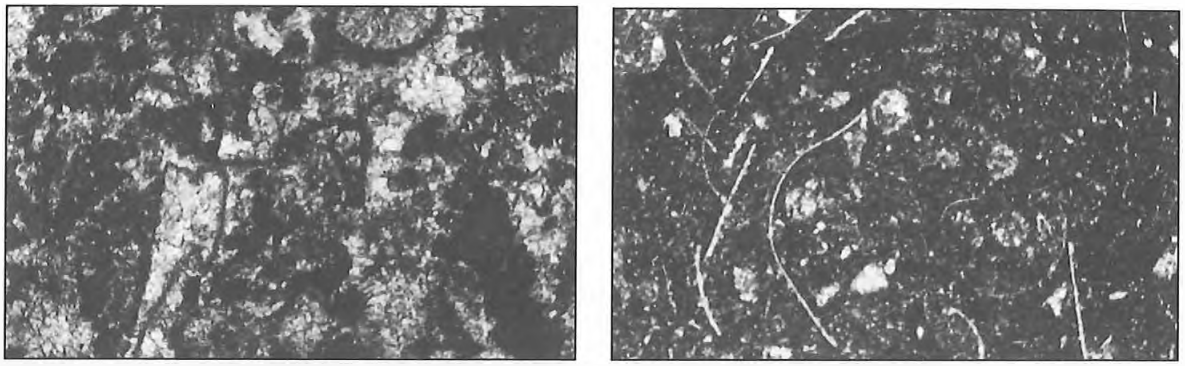

Fig. 1: Algal-crinoidal limestone with sparse filaments in clear washed sparitic cement. Section ΥΓ, sample ΥΓ30, «Hallstatt» type limestone. (35x)
Fig. 2: Typical filamentous micrite with calcified radiolaria, and authigenic quartz grains. Section ΥΓ, sample ΥΓ30, «Hallstatt» type limestone. (35x)

PLATE VI

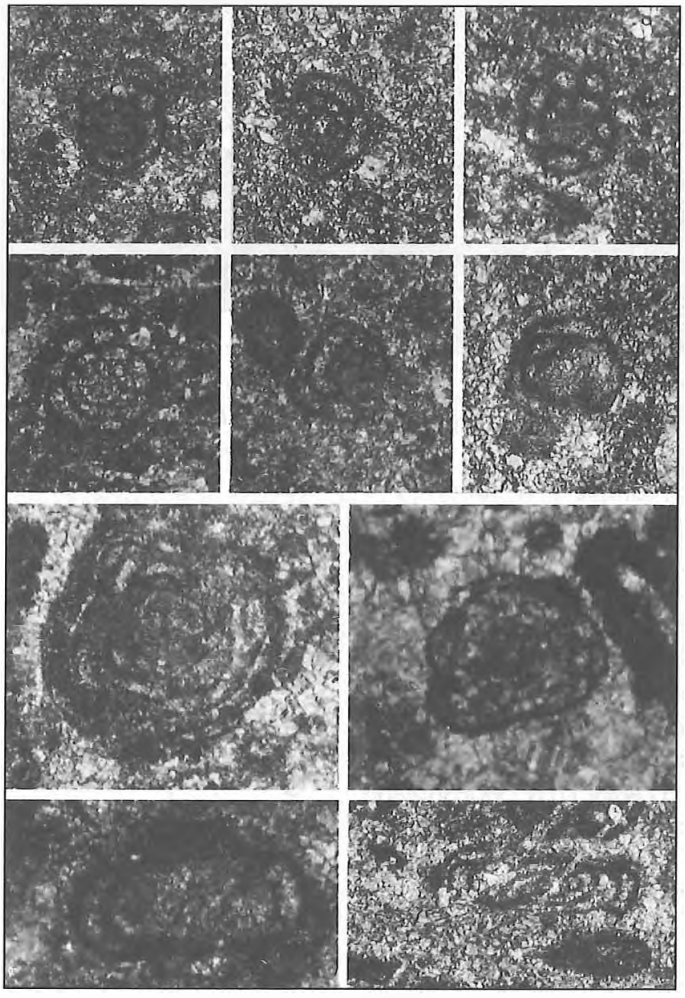

Fig. 1: *Meandrospira* gr. *pusila* (HO), Agia Triada, «Han-bulog» limestones, sample ΥΓ7. (150x)
Fig. 2,3: *Meandrospira pusila* (HO), Agia Triada, «Han-bulog» limestones, sample ΥΓ10. (150x)
Fig. 4: *Meandrospira dinarica* KOCHANSKY-DEVIDE & PANTIC, Episkopi, «Eros» limestones, sample YA6. (60x)
Fig. 5: *Glomospira simplex,* HARLTON, Agia Triada, «Han-bulog» samples ΥΓ5 FT1. (150x)
Fig. 6: *Glomospira* sp., Agia Triada, «Han-bulog» limestones, sample ΥΓ9 FY2. (150x)
Fig. 7: *Pilammina densa* PANTIC, Episkopi, «Eros» limestones, sample YAS/2. (60x)
Fig. 8: *Pilammina densa* PANTIC, Episkopi, «Eros» limestones, sample YA11. (60x)
Fig. 9: *Glomospira sinensis* HO, Episkopi, «Eros» limestones, sample YA12. (150x)
Fig. 10: *Gloospirella* sp., Episkopi, «Eros» limestones, sample YA3. (60x)

PLATE VII

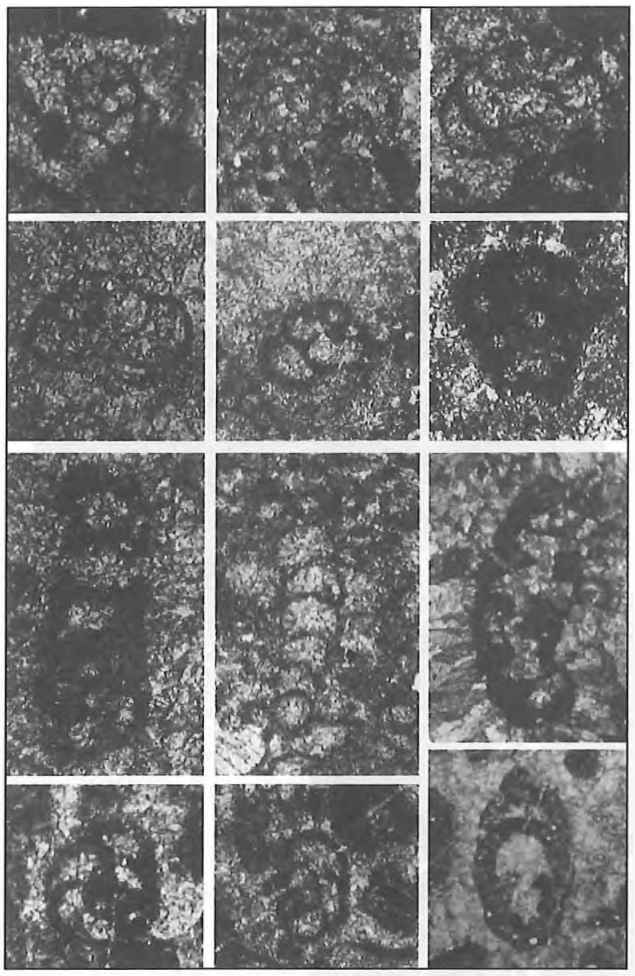

Fig. 1: *Diplotremina astrofimbriata* KRISTAN-TOLLMANN, Episkopi, «Eros» limestones, sample YA6. (60x)
Fig. 2: *Diplotremina astrofimbriata* KRISTAN-TOLLMANN, Episkopi, «Eros» limestones, sample YA7. (60x)
Fig. 3: *Duostomina alta,* KRISTAN-TOLLMANN, Episkopi, «Eros» limestones, sample YA6. (60x)
Fig. 4: *Trochammina almtalensis* KOEHN-ZANINETTI, Episkopi, «Eros» limestones, sample YA6. (150x)
Fig. 5: *Trochammina almtalensis* KOEHN-ZANINETTI, Episkopi, «Eros» limestones, sample YA3, FY3. (60x)
Fig. 6: *?Tuuriiglommina* sp., Agia Triada, «Han-bulog» limestones, sample YΓ9. (150x)
Fig. 7: *Endothyranella alpina* ZANINETTI & BROENNIMANN, Episkopi, «Eros» limestones, sample YA5/1. (60x)
Fig. 8: *Endothyranella* cf. *wirzi* (KOEHN-ZANINETTI), Episkopi, «Eros» limestones, sample YA4. (60x)
Fig. 9: *Reophax* sp., Episkopi, «Eros» limestones, sample YA5/1. (35x)
Fig. 10: *Endothyra kuepperi* OBERHAUSER, Episkopi, «Eros» limestones, sample YA6. (60x)
Fig. 11: *Endothyra badouxi* ZANINETTI & BROENNIMANN, Episkopi, «Eros» limestones, sample YA6. (60x)
Fig. 12: *Reophax* sp., Episkopi, «Eros» limestones, sample YA9. (35x)

PLATE VIII

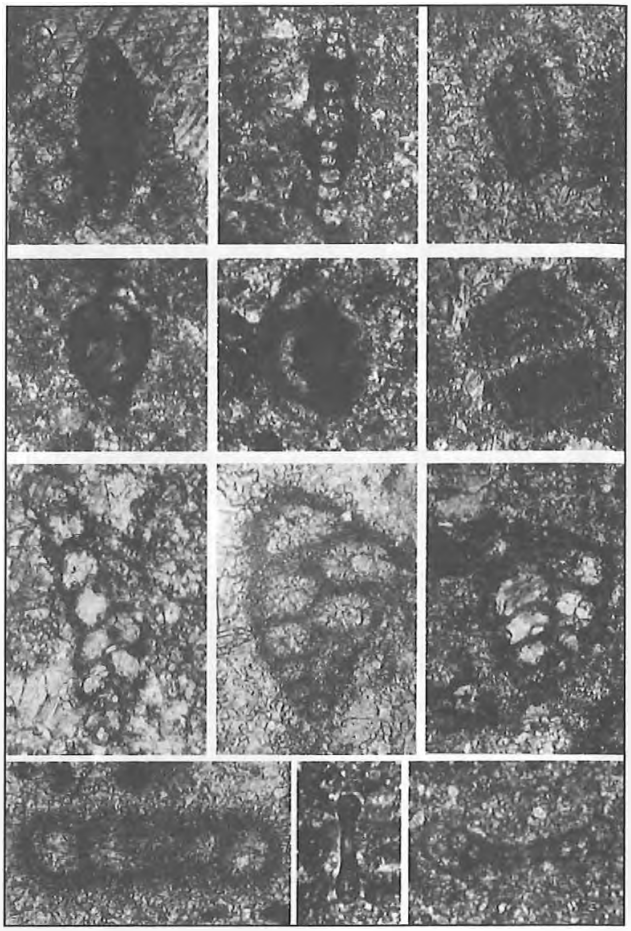

Fig. 1: *Hemigordius? chialingchiangensis* (HO), Episkopi, «Eros» limestones, sample YA11. (150x)
Fig. 2: *Hemigordius? chialingchiangensis* (HO), Agia Triada, «Han-bulog» limestones, sample YA31. (150x)
Fig. 3: *Agathammina* cf. *austroalpina,* KRISTAN-TOLLMANN & TOLLMANN, Episkopi, «Eros» limestones, sample YA27. (150x)
Fig. 4: *Ophthalmidium* sp., Agia Triada, «Han-bulog» limestones, sample YΓ9. (150x)
Fig. 5: *Ophthalmidium* sp., Agia Triada, «Han-bulog» limestones, sample YΓ7. (150x)
Fig. 6: *Ophthalmidium tricki* (LANGER), Agia Triada, «Han-bulog» limestones, sample YΓ33. (150x)
Fig. 7: *Spiroplectammina* sp., Agia Triada, «Han-bulog» limestones, sample YΓ8. (150x)
Fig. 8: *Gaudryina* sp., Episkopi, «Eros» limestones, sample YA7. (150x)
Fig. 9: *Gaundryina* sp., Agia Triada, «Han-bulog» limestones, sample YΓ7. (150x)
Fig. 10: *?Ammodiscus* sp., Episkopi, «Eros» limestones, sample YA11. (150x)
Fig. 11: *Ammodiscus* sp., Agia Triada, «Han-bulog» limestones, sample YΓ25. (150x)
Fig. 12: *Ammodiscus* sp., Agia Triada, «Han-bulog» limestones, sample YΓ7. (150x)

PLATE IX

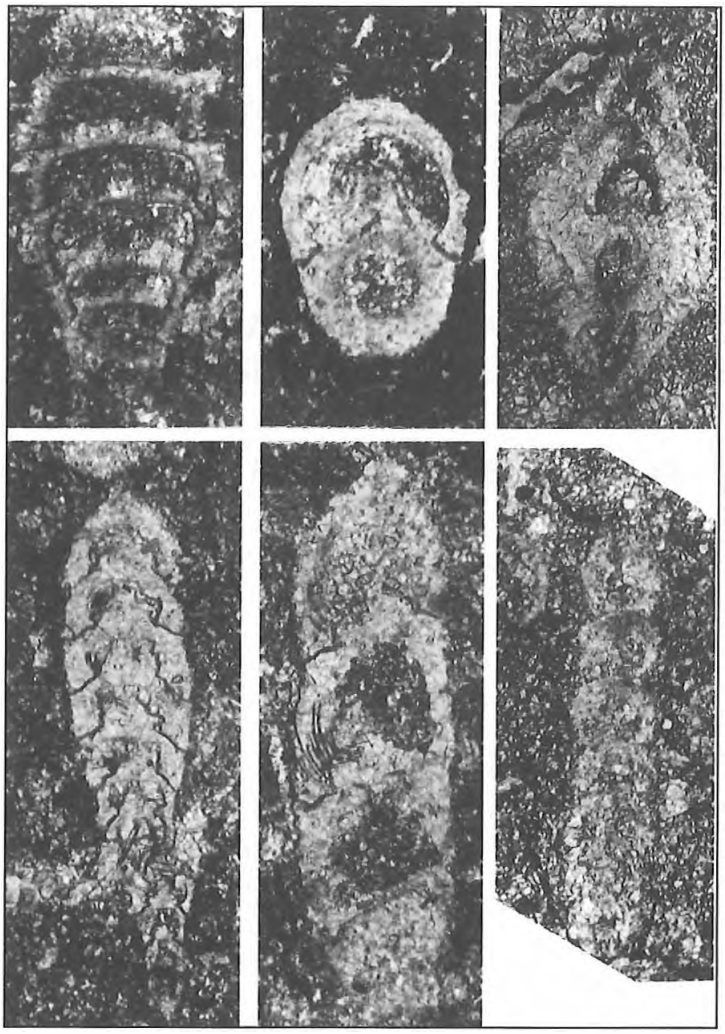

Fig. 1: *Austrocolomia* sp., Agia Triada, «Han-bulog» limestones, sample ΥΓ26. (150x)
Fig. 2: *Pseudonodacaria lata* (TAPPAN), Agia Triada, «Han-bulog» limestones, sample ΥΓ25. (60x)
Fig. 3: *Lenticulina* sp., Agia Triada, «Han-bulog» limestones, sample ΥΓ7. (150x)
Fig. 4: Nodosaridae, Agia Triada, «Han-bulog» limestones, sample ΥΓ10. (150x)
Fig. 5: Nodosaridae, Agia Triada, «Han-bulog» limestones, sample ΥΓ9. (150x)
Fig. 6: Nodosaridae, Agia Triada, «Han-bulog» limestones, sample ΥΓ9. (60x)