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STRATIGRAPHIC AND PALEOGEOGRAPHIC EVOLUTION OF THE NORTHERN ARGOLIS (GREECE) DURING THE CRETACEOUS-PALEOGENE

A. Photiades and V. Skourtsis - Coroneou

ABSTRACT

The northern part of Argolis is consists of three successive ophiolitic-tectonic units.

The Lower Unit includes turbiditic / olistostromatic ophiolitic formations with boninitic features overlying the Triassic-Jurassic limestones and cherts of the Trapezona sequence.

The Middle ophiolitic-"volcanic" tectonic Unit presents M.O.R.B. characteristics and includes cherts of Upper Dogger-Malm age and was overthrust over the Lower Unit during the post-Upper Jurassic phase. On that unit, the Trapezona meso-autochtonous sedimentary sequence was deposited.

The Upper tectonic Unit is composed of an ophiolitic tectonic "melange" of serpentinites, including various boninitic and metamorphic rocks of the substratum. The latter constitutes the basement of a Cretaceous carbonate sequence of Middle Cenomanian-Middle Maastrichtian age. The whole system was thrust over the Eocene flysch of the meso-autochtonous Trapezona sequence during the post-Eocene time.It is, therefore, obvious that the geotectonic position of the Trapezona sequence should not be attributed to the Pelagonian domain s.s. following the classic conception, and that the ophiolitic and the overlying sedimentary formations are in fact superimposed tectonic units. The ophiolites of the Northern Argolis are not originated exclusively in the zone of Axios but in basins, where the boninitic lavas and the coarser-grained boninitic rocks of the Lower and the Upper Units have probably been formed. This took place above the subduction zones, which were active during the Jurassic, both to the east and to the west of the Pelagonian ridge s.l.

ΠΕΡΙΛΗΨΗ

Το βόρειο τμήμα της Αργολίδας δομείται από τρείς διαδοχικές οφιολιθικές τεκτονικές ενότητες. Η κατώτερη ενότητα αποτελείται από τουρβιδιτικούς/ ολιθοστρωματικούς οφιολιθικούς σχηματισμούς με μπονινιτικούς χαρακτήρες υπερκειμένους των τριαδικο - ιουρασικών ασβεστολίθων και κερατολίθων της ακολουθίας της Τραπεζώνας.

Η Ενδιάμεση "ηφαιστειακή" οφιολιθική τεκτονική ενότητα με χαρακτηριστικά MORB, περιλαμβάνει κερατολίθους ηλικίας Ανωτέρου Δογγερίου - Μαλμίου και επωθείται επί της Κατώτερης ενότητας κατά τη διάρκεια της μετα-ανωιουρασικής φάσης. Επί της ενότητας αυτής αποτέθηκε η μεσο-αυτόχθονη ιζηματογενής ακο-

Institute of Geology and Mineral Exploration, 70 Messoghion str., 115 27 Athens - GREECE

λουθία της Τραπεζώνας.

Η Ανώτερη τεκτονική ενότητα συνιστάμενη από ένα οφιολιθικό τεκτονικό "melange" σερπεντινιτών με ποικίλα μπονινιτικά και μεταμορφωσιγενή πετρώματα υποβάθρου, συγκροτεί τη βάση της ανθρακικής κρητιδικής ακολουθίας ηλικίας Μέσου Κενομανίου-Μέσου Μαιστριχίου και επωθείται επί του ηωκαινικού φλύσχη της μεσο-αυτόχθονης ακολουθίας της Τραπεζώνας μετά το Ηώκαινο. Είναι ως εκ τούτου προφανές ότι η γεωτεκτονική θέση της Τραπεζώνας δεν θα πρέπει να αναζητηθεί εντός του Πελαγονικού χώρου s.s. με την κλασσική έννοια και ότι τόσον οι οφιολιθικοί όσον και οι υπερκείμενοί τους ιζηματογενείς σχηματισμοί αποτελούν στην πραγματικότητα επάλληλες τεκτονικές ενότητες.

Οι οφιόλιθοι της Β. Αργολίδας δεν προέρχνται αποκλειστικά από τη ζώνη Αξιού αλλά από λεκάνες όπου οι ηφαιστειακοί και σωρειτικοί μπονινίτες της Κατώτερης και της Ανώτερης ενότητας, συμπεραίνεται ότι, σχηματίστηκαν υπεράνω ζωνών καταβύθισης οι οποίες ήσαν εν ενεργεία κατά τη διάρκεια του Ιουρασικού τόσον ανατολικώς όσον και δυτικώς του Πελαγονικού υβώματος s.l.

I. INTRODUCTION

The peninsula of Argolis geotectonically belongs to the internal Hellenides that is in the Subpelagonian zone (TATARIS & KALLERGIS 1965; AUBOUIN et al. 1970; VRIELYNCK 1978, 1981-82).

Both the ophiolitic and the cretaceous sedimentary formations of this area were considered by previous investigators to present a single evolution in their entire extension (DERCOURT 1964; TATARIS & KALLERGIS op. cit; DECROUEZ 1975; JACOBSHAGEN et al. 1976; VRIELYNCK op. cit.; BACHMANN & RISCH 1979; BANNERT et al. 1984). Later the differentiation of the ophiolites and the overlying cretaceous beds was, partly, accepted (BAUMAGARTNER 1985; PHOTIADES 1986a, 1987; MERMIGHIS 1989; DOSTAL et al. 1991).

In the present study is proved that the northern Argolis is built up of successive ophiolitic-tectonic units overlaid by sedimentary sequences, deposited during the Cretaceous-Eocene time span and presenting different evolution.

II. GEOLOGICAL SETTING

The studied area includes three tectonic units, tectonically superimposed (Fig. 1).

a. THE LOWER UNIT (the Trapezona series)

The Lower Unit consists of the Trapezona series (Fig. 2/1a) and includes from the bottom to the top the following formations: recrystallized dolomitic limestones, dolomites and loferitic limestones of "Pantokrator" facies, thick-bedded to massive, containing locally, a rich fauna with Megalodon, Gastropods and Corals. They pass upwards to oolitic and locally oncolitic horizons. The maximum thickness reaches 600m. The following bio- associations were determined:

- Tetrataxis inflata KRISTAN, Ammodiscus parapriscus HO, of Carnian age, which is also certified by the presence of conodonts (VRIELYNCK, 1978,1980).
- Agathammina multispira SALAJ, BORZA & SAMUEL, Plamiinvoluta irregularis SALAJ, BORZA & SAMUEL and Turrispirillina minima PANTIC, of Norian-Rhaetian age,
- Aulotortus sinuosus WEYNSCHENK and Aulotortus gaschei KOEHN-ZANINETTI, also of Norian-Rhaetian age and finally
- Paleodasycladus mediterraneus (PIA), Orbitopsella praecursor (GUMBEL),

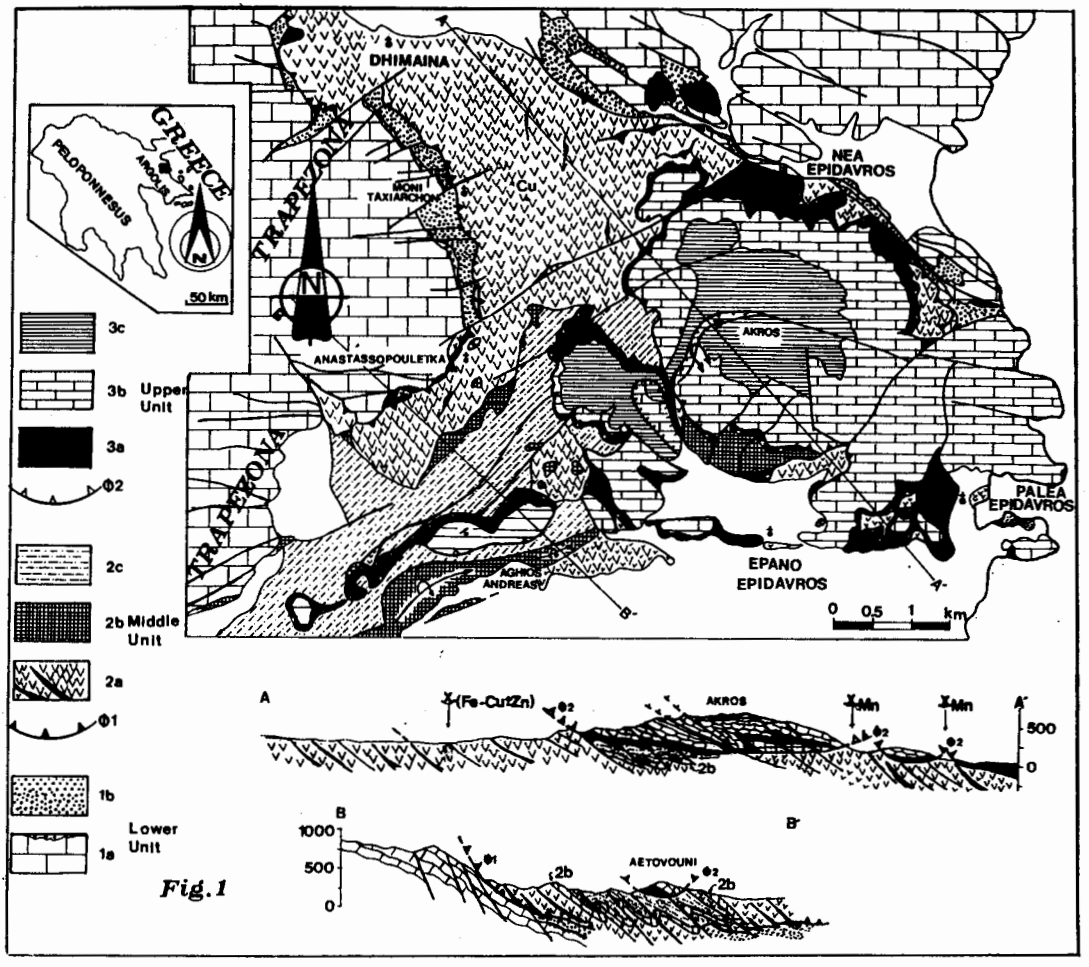

Fig. 1

Fig. 1: Geological map and geological sections A-A and B-B of Northern Argolis (PHOTIADES in preparation).
1. Lower Unit: a.Carnian-Liassic neritic limestones with Upper Liassic-Dogger ammonitico-rosso; b. volcano-sedimentary "melange"; 2. Middle Unit: a. ophiolitic "volcanic" tectonic unit; b: Cretaceous-Ypresian carbonaceous meso-autochtonous series; c: Post-Ypresian flysch; 3: Upper Unit: a: ophiolitic tectonic "melange"; b: Middle-Upper Cenomanian neritic limestones; c: Turonian-Middle Maastrichtian pelagic limestones; Φ_1:post-Upper Jurassic tectonic phase; Φ_2:post-Upper Eocenic tectonic phase.

Mayncina termieri HOTTINGER, "Lituosepta" compressa HOTTINGER and Cayeuxia pia FROLO, determining a Domerian age (Middle Lias).

Over the oolitic horizon of the "Pantokrator" facies limestones and after a period of interruption of the sedimentation followed by a subsidence of the platform due to the action of a fracture tectonism forming tilted blocks, are locally deposited either reddish nodular pelagic limestones of Ammonitico rosso facies, or directly the overlying red to yellow-red ribbon-bedded siliceous formations (siliceous limestones, mudstones, cherts) rich in radiolaria.

The "Ammonitico rosso" facies limestones are biomicrites rich in filaments, radiolaria and Globuligerina oxfordiana GRIGYALIS. The age is considered

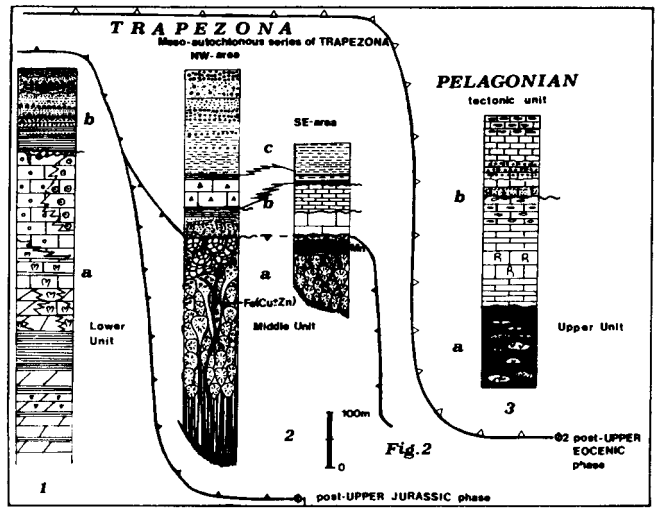

Fig. 2: Tectono-stratigraphic evolution of structural units of Northern Argolis (PHOTIADES, 1986a; PHOTIADES in preparation) (Key as in Fig. 1).

to be Lias-Dogger. Toarcian beds have been determined on the base of an abundant ammonoid fauna, indicative probably of the Hildoceras bifrons (RENZ 1908; DERCOURT 1964) while the Dogger is confirmed by the presence of Gl. oxfordiana. The thickness varies from 0-30m.

The determination of the Oxfordian-Kimmeridgian age of the siliceous formations is based on the presence of index species of radiolaria (BAUMGARTNER 1985, 1987). Their thickness also varies from 10 to 50m. These siliceous formations constitute the basement of the lower ophiolitic unit which forms a volcano-sedimentary ophiolitic "melange" consisting of mudstones and cherts overlaid successively by turbiditic and olistostromatic ophiolitic formations (Fig. 2/1b), rich in boninitic lavas and coarser-grained boninitic rocks which have suffered a static hydrothermal metamorphism in the greenschist grade (PHOTIADES 1986a, 1989) and are connected to ophiolites of supra-subduction zones (SSZ) (DOSTAL et al., 1991).

The age of the entire ophiolitic "melange" does not exceed the Kimmeridgian-Tithonian (BAUMGARTNER 1985, 1987) and its maximum thickness is less than 150m.

b. THE MIDDLE UNIT

The Middle Unit includes the ophiolitic "volcanic" tectonic unit (PHOTIADES 1986a, 1987, 1989). Over this unit, on a pre-formed submarine relief is heterochronously deposited a carbonatic sedimentary sequence of Cretaceous-Eocene age normally overlaid by the flysch sediments (Fig. 2 -2a/2b/2c).

The ophiolitic "volcanic" tectonic unit consists of interthrust series-with a mylonitic serpentinitic sole-of massive dolerites and partly fine-grained veinous dolerites followed by extensive formations of pillow-lavas connected with sulphide mineralizations (PHOTIADES 1986 a,b) and compact pillow-lava collapse breccias. The above rocks present chemical features of M.O.R.B. affinity (DOSTAL et al. 1991) and have suffered static hydrothermal metamorphism under zeolite and pumpellyite facies (PHOTIADES 1986a; PHOTIADES & ECONOMOU 1991). They are locally covered with volcano-sedimentary formations and red radiolarian cherts. The contact of the

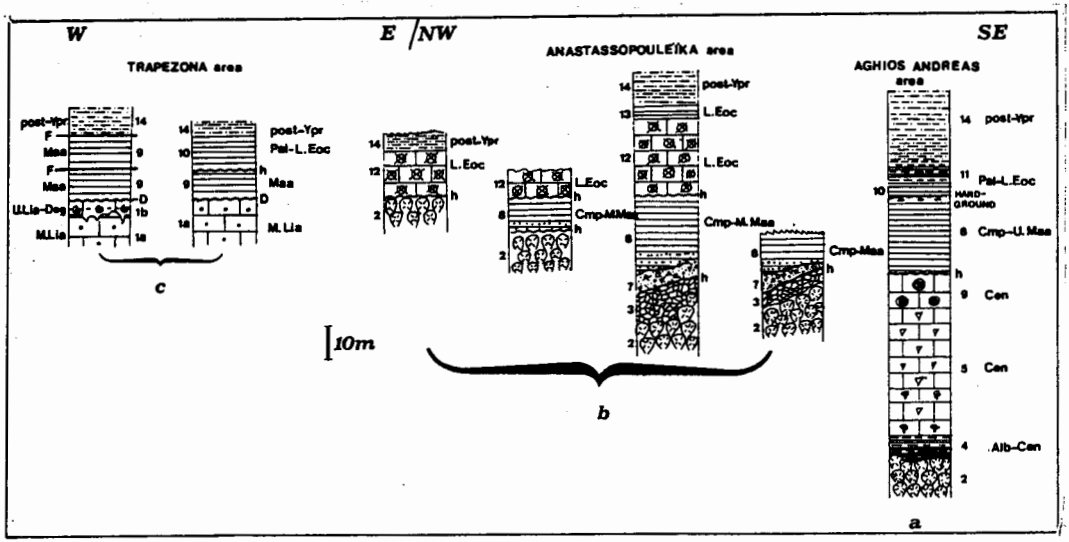

Fig. 3: Meso-autochtonous sedimentary series of Trapezona.
1a: Middle Liassic oolitic limestones; 1b: Upper Liassic-Dogger ammonitico - rosso limestones; 2: pillow-lavas and cherts of Middle volcanic Unit; 3: pillow-lavas collapse breccias; 4: Albian-Cenomanian marl with limestone intercalation; 5: Cenomanian limestones with rudists; 6; Cenomanian limestones with Orbitolinae; 7: polygenic microbreccias with basalt, chert and rudist debris; 8: Campanian-Upper Maastrichtian pelagic limestone; 9: Maastrichtian limestone; 10: Paleocene-Lower Eocene pelagic limestone; 11: Paleocene-Lower Eocene "couches de passage"; 12: Lower Eocene reef limestones; 13: Lower Eocene pelagic limestones; 14: Post-Ypresian flysch; D: discordance; h:hiatus; F: fault.

lower jasper and radiolaritic beds with the pillow-lavas are rich in manganiferrous concentrations (PERSEIL & PHOTIADES, 1993).

The deposition of the radiolarian cherts took place during the Bathonian or Upper Callovian-Oxfordian as implies the presence of radiolarian index species (BAUMGARTNER 1985, 1987).

The entire ophiolitic "volcanic" unit has been tectonically imposed upon the Lower Unit during the compressive phase of the post-Upper Jurassic (AUBOUIN et al. 1970). Its thickness is about 300-500m.

Over this unit and after a period of faulting and gradual subsidence followed by periods of regression and erosion, it took place the deposition of the carbonatic and the flysch sediments (Fig. 3).

The carbonate sedimentation starts in Albian-Cenomanian and continues up to the Lower Eocene. Sedimentation started gradual from the south-east to the north-west. The complete sequence is a 100m thick and is located in the area of Aghios Andreas southwards of Aetovouni (Fig. 1 & Fig. 3a).It includes, from the bottom to the top, yellow-green marls with intercalations of yellow-grey limestones, pel-micrites and bio-pel-micrites with abundant microfauna, containing Praechrysalidina infracretacea (LUPERTO SINNI), Nezzazatinella picardi (HENSON), Daxia cenomana, Miliolidae and Ataxophragmiidae of Upper Albian age.

They are followed by medium-bedded neritic limestones, biomicrites to biosparites full of gastropods and bivalves, in the lower parts, bioclastic with abundant rudist fragments in the upper parts. The lower beds revealed

Nezzazata simplex OMARA, N. conica (SMOUT), N. convexa (SMOUT), Nezzazatinella picardi (HENSON), Sabaudia minuta (HOFKER), while the upper ones contain Orbitolina (Conicorbitolina) conica (D' ARCHIAC). The age is Lower-Middle Cenomanian.

Upon these formations and after a hiatus are deposited red, clastic and bioclastic limestones with abundant fragments of rudists and other macrofossils. In the micritic matrix pelagic microfauna has been found containing:

Globotruncana linneiana (D' ORBIGNY), Globotruncanita stuarti-formis (DALBIEZ), Globotruncana ventricosa (WHITE), Rosita fornicata (PLUMMER), indicating a Campanian-Lower Maastrichtian age. They are followed by pink to red biomicrites with Globotruncanita stuarti (DE LAPPARENT), Gl. stuartiformis (DALBIEZ), Globotruncanita conica (WHITE), Rosita contusa (CUSHMAN), Rugoglobigerina rugosa (PLUMMER), Racemigumbelina fructicosa (EGGER) of Middle-Upper Maastrichtian age and in the upper parts nodular red limestones with indices of sub-aerial exposure and formation of hard-ground, containing beyond the above species Abathomphalus mayaroensis (BOLLI) of the Upper Maastrichtian.

After a recession of sedimentation, the deposition of alternations of white-grey marly limestones and pelites with abundant pelagic microfauna containing among others Morozovella formosa formosa (BOLLI) and Morozovella formosa gracilis (BOLLI) of Paleocene-Lower Eocene, arrives.

The calcareous beds disappear upwards, where the sandstones and pelites of the flysch sedimentation prevail.

The entire sedimentary sequence is developed above the pillow-lavas with red cherts of the Middle ophiolitic "volcanic" Unit.

In the area of Anastassopouleika, to the NW, the main mass of the calcareous sediments is developed above the compact pillow lava collapse breccias (Fig. 3b) which constitute the higher members of the Middle Unit. It consists of alternations of red-pinky pelagic micritic and microclastic limestones (rich in basaltic and cherty clasts) with micritic matrix. In their base, a polymictic microbreccia appear (with dolerites, basalts, cherts and limestones clasts) of small thickness. The formation included fragments of rudists and other macrofossils and planktonic foraminifera among which Globotruncana linneiana (D' ORBIGNY), Gl. arca (CUSHMAN), Gl. bulloides VOGLER of Campanian-Lower Maastrichtian age, as well as Minouxia lobata (GENDROT), Pithonella ovalis (KAUFMANN) and "Stomiosphaera" sphaerica (KAUFMANN).

Over them and after a hiatus covering the Middle Maastrichtian-Upper Paleocene time-span margin facies develop with plentifull corals and many other macrofossils as bryozoans, echinoids, algae and benthonic foraminifera Planorbulinidae, Rupertiidae and the species Cuvillierina vallensis (RUIZ DE GAONA) which determine an Ypresian age.

In addition, these facies are overlain by biomicrites with Elphidiidae (Cuvillierina sp), Planorbulinidae, Rupertiidae and Globigerinidae of Ypresian age .Finally the sediments of the Eocene (post-Ypresian) flysch are deposited. They contain Nummulites sp. and their thickness is about 200m.

In the NW localities the eruptive formations of the Middle Unit are directly overlaid by reefal facies of the Lower Eocene followed by the flysch deposition. No Upper Cretaceous sediments have been observed.

In the eastern flanks of Trapezona (relatively more to the NW of the above mentionned outcrops) the sedimentary sequence of the Cretaceous-

Eocene is directly overlying the "Pantokrator" facies limestones (Fig. 3c). They consist of biomicrites with plentifull planktonic foraminifera, among others Globotruncanita conica (WHITE), Gl. stuarti (DE LAPPARENT), Rugoglobigerina rugosa (PLUMMER), Pseudotextularia elegans (RZEHAK) and Gansserina gansseri (BOLLI) of Maastrichtian age. These limestones are overlaid by biomicrites with Globigerinidae and Heterohelicidae of Paleocene-Eocene age, followed by flysch.

During the Albian-Lower Cenomanian the deeper SE parts of the relief are partly covered by the sea. The produced facies implie the formation of an internal platform sub-to intratidal and locally restricted environment which successively developed to marginal and finally peri-marginal conditions. After the Middle Cenomanian a regression takes place until the Lower Senonian. During the Campanian and until the Upper Maastrichtian the entire region is overflooded gradually by the sea-water.

The produced facies are mainly pelagic with plenty of clastic elements of the volcanic substratum in the lower horizons of the higher parts of the paleorelief.

At the end of the Maastrichtian a new interruption of the sedimentation with intensive erosion in the "higher" and hard-ground formation of in the "deeper" areas takes place.

During the Paleocene-Lower Eocene the area gradually sunks again from the SE towards the NW with pelagic to reefal facies depending on the relief. The calcareous sedimentation gradually withdraws up to the end of the Ypresian when the deposition of the flysch sediments starts.

c. THE UPPER UNIT

The Upper Unit constitutes the pelagonian nappe of the area and is thrust over the flysch of the Middle Unit (PHOTIADES 1986a, 1987). It includes an ophiolitic tectonic "melange", similar to the one of Edhessa (MERCIER & VERGELY 1972). Over this "melange" (Fig. 1 and 2) a sequence of carbonate rocks develops from the Middle Cenomanian to the Middle Maastrichtian, with total thickness 350m.

The ophiolitic-tectonic "melange" (Fig. 2/3a) is a formation of tectonized, schistosed, mylonitized and fractured serpentinites enclosing various tectonic xenolithic elongated or spindle-shaped fragments of **ophiolitic** (harzburgites, metadunites, boninite lavas, coarser-grained boninitic rocks and rodingites-metamorphosed under greenschist grade), **sedimentary** (red radiolarites, recrystallized biomicrites with filaments and biosparites with fragments of gastropods, lamellibranches, echinodermes as well as Hemigordius chialinchiangesis (HO) and Nodosariidae of triassic age originated from the Trapezona and the Epidaurus series) and **metamorphic rocks** (marbles, mica bearing marbles, metaquartzites, metagraywackes, various micaschists and amphibolites).

These xenolithic bodies of substratum origin are orientated and accumulated along the base of the tectonic-ophiolitic sequence and contain barrow-type parageneses of the high-grade greenschist facies to middle-grade amphibolite facies, probably of pre-alpine age (PHOTIADES 1986a), while the presence of boninitic lavas and coarser-grained boninitic rocks suggests that they were formed only in supra-subduction zone settings (DOSTAL et al. 1991).

The carbonatic sequence (Fig. 2/3b) is unconformably lying over the serpentinites s.l. (DERCOURT 1964; DECROUEZ 1975; VRIELYNCK 1978; MERMIGHIS 1989; PHILIP et al. 1989; MERMIGHIS et al. 1991).

The lower horizons consist of rudist-bearing white-grey to dark-grey,

biomicritic to bioclastic limestones with Chrysalidina gradata D' ORBIGNY, Pseudolituonella reicheli MARIE, Nummoloculina heimi BONET, Peneroplis turonicus SAID & KENAWY, Cuneolina gr. pavonia D' ORBIGNY, Nautiloculina oolitica MOHLER, Nezzazatinella picardi (HENSON), Nezzazata gyra (SMOUT), N. simplex OMARA, Biconcava bentrori HAMAOUI which are developed upwards to red nodular with lateritic iron concentrations; their age is Middle to Upper Cenomanian.

Above these limestones, and on a surface of transgression which does not pass the Lower Turonian, are deposited red pelagic biomicrites rich in iron nodules, red cherts and serpentinite fragments with local appearance of clastic facies (debris flow), mainly to the lower members and dark-grey nodules of silex in the upper members.

The biofacies contain macrofossil fragments (rudists, echinoderms e.t.c.), benthonic foraminifera of the families Miliolidae and Ataxophragmiidae and mainly planktonic foraminifera among which Helvetoglobotruncana praehelvetica TRUSILLO and H. helvetica (BOLLI) of Middle Turonian age, Marginotruncana pseudolinneiana PESSAGNO, M. coronata (BOLLI) of Upper Turonian-Santonian and Dicarinella concavata (BROTZEN), Marginotruncana angusticarinata, Globotruncana linneiana (D' ORBIGNY) of Coniacian-Santonian age. Gl. arca, Gl. stuartiformis and Gl. subspinosa of Campanian-Middle Maastrichtian age are also described.

The area of deposition of the above carbonate formations is covered by the seawater not earlier than the Middle Cenomanian. The facies are indicating an environment of an internal platform in the borders of a rudist reef and on the reef. During the Upper Cenomanian-Lower Turonian the sedimentary environment is influenced by the wide range general phenomena of paleogeographic disturbance (tectonic , eustatic, climatic e.t.c. in PHILIP 1982; MERCIER 1966). This is evident by the development of a land surface with simultaneous formation of lateritic concentrations.

During the Middle Turonian the area is again submerged and an environment of pelagic sedimentation of slope with frequent supply of clastic material of the higher regions is deposited. The clastic episodes are gradually diminishing and about the Campanian-Lower Maastrichtian totally pelagic conditions prevail going up to the Middle Maastrichtian. Evidences about the flysch sedimentation, the beginning of which is considered to start in the Upper Maastrichtian in the Pelagonian Zone (MERCIER 1966) have not been observed.

III. CONCLUSIONS

From the above detailed description is resulted that in the area of the northern Argolis the following units are successively distinguished :

1. A Lower Unit of turbiditic and olistostromatic ophiolitic formations, rich in boninitic lavas and coarser-grained boninitic rocks, originated to supra-subduction zones, which is deposited above the triassic-jurassic limestones and cherts of Trapezona.

2. A Middle ophiolitic "volcanic" tectonic Unit, characterized by sulphide and manganiferous mineralizations, with M.O.R.B. affinity and cherts of Upper Dogger-Malm age, thrust over the above unit during the early compressive tectonic phase of post-Upper Jurassic; over this unit on an already formed submarine relief starts heterochronusly the deposition of the meso-autochtonus sequence of sedimentary formations of Trapezona. Its maximum development includes calcareous rocks and flysch and covers the time-span from the Albian to the Lower-Middle Eocene included, with events of emergence and

intensive erosion during the Upper Cenomanian-Lower Senonian and Upper Maastrichtian-Paleocene.

3. An Upper tectonic Unit which includes an ophiolitic tectonic "melange" of serpentinites with various boninitic-derived from supra-subduction zones-and metamorphic rocks of the substratum. This melange which consists the basement of a Cretaceous carbonatic series of Middle Cenomanian to Middle Maastrichtian age with stratigraphic hiatus during the Upper Cenomanian-Lower Turonian.

This upper allochtonous pelagonian unit was thrust over the Eocene flysch of the meso-autochtonous subpelagonian series of Trapezona during a compressive and transverse tectonic phase which took place in post-Upper Eocene.

It is, therefore, obvious that during the compressive tectonic phase of the post-Upper Jurassic the ophiolitic formations of the Middle Unit are thrust over the Lower Unit of the Trapezona series, while those of the Upper Unit overthrust the metamorphic rocks of the Pelagonian zone of which fragments they trapped and transported as they were thrusting over the flysch of the meso-autochtonous series during the second post-Upper Eocene compressive phase.

This composed tectonic evolution implies, on one hand that the geotectonic

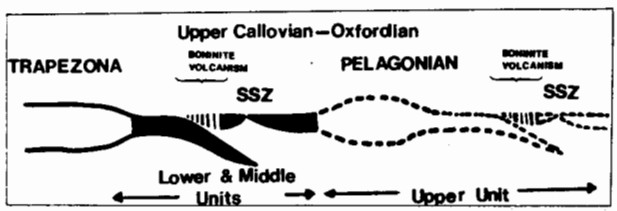

Fig. 4: Model showing the paleogeographic position of the Subpelagonian and Almopian ophiolites during the Jurassic.

position of Trapezona cannot be attributed to the Pelagonian domain s.s. according to the classic notion, formerly suggested (JACOBSHAGEN et al. 1976, 1978; BACHMANN & RISCH 1979; VRIELYNCK 1978, 1981-82; BAUMGARTNER 1985) and on the other hand that the ophiolitic and the overlying sedimentary formations constitute, in fact, superimposed tectonic units. The ophiolites are not derived exclusively from the Axios zone (sub-zone of Almopias), as it was suggested (AUBOUIN et al. 1970; JACOBSHAGEN et al. 1976, 1978) but from different basins to the east and to the west of the Pelagonian ridge s.l. (MOUNTRAKIS 1986; VERGELY 1984) in which the boninitic lavas and the coarser-grained boninitic rocks of the Lower and the Upper units were, associated with the various MORB-like basalts of the Middle Unit (DOSTAL et al. 1991), acting during the Bathonian (Upper Callovian)-Oxfordian (Fig. 4).

Finally the tectonically disrupted sedimentary sequences of Ermioni-Adheres (SE Argolis) consisting of pelagic limestones of Campanian-Maastrichtian age, overlying basaltic lavas rich in sulphide and manganiferous concentrations, as well as, block-bodies of serpentinites and neritic limestones (e.g. VARNAVAS & PANAGOS 1984, 1989; ROBERTSON et al. 1987; CLIFT & ROBERTSON 1989) in the flysch of Adheres (of Paleocene-Eocene age, BACHMANN & RISCH 1979) are comparable and equivalent to the metalliferous basalts of the Middle "volcanic" tectonic Unit, as well as, to the studied meso-autochtonous sedimentary series of Trapezona. Therefore, it cannot be supported that they constitute sequences deriving from the Axios basin

with an extended oceanic crust, up to the Upper Cretaceous and that the structure of the above formations is the product of a subduction during the Paleocene-Eocene (e.g. CLIFT & ROBERTSON 1989, 1990; ROBERTSON 1990; ROBERTSON et al. 1991).

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