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ON THE GEOLOGY OF KORCA-KOLONJA REGION IN ALBANIA

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ABSTRACT

In the Korca-Kolonja region in southeast Albana are distinguished several tectonostratigraphic units: Triassic-Jurassic carbonate series, Middle Jurassic ophiolites (ophiolites as a composite part of the western-type ophiolite belt, nappe-type ophiolite and melange-type ophiolite), Tithonian-Lower Cretaceous ophiolite melange and flyschoidal sediments, Cretaceous terrigene-carbonate and Cretaceous basinal-type carbonate series, Maastrichtian-Paleogene and Eocene Flysch, Oligocene and Neogene molasse and Plio-Quaternary deposits.

On the basis of the stratigraphic and structural data we consider Triassic-Jurassic carbonate rocks and Tithonian-Lower Cretaceous deposits on them (western sedimentary periphery of the ophiolite belt) as a basement of the other Cretaceous and Paleogene tectonostratigraphic units, and as an unique zone similar to the Beotian zone in Greece, with some differences in the Cretaceous paleogeographical evolution. We suppose the facial change in the northern continuation of the western sedimentary periphery of the ophiolite from typical basinal conditions in the Pindos zone in more platformal-type conditions during Triassic-Lower Jurassic times and with abundant ophiolite debris, ophiolite slices and nappes caused by the vicinity of the emplacing ophiolites during Tithonian-Lower Cretaceous tectogenesis. During Late Eocene-Oligocene times this zone is thrusted westward onto Paleogene flysch and occasionally on the Oligocene flysch of the Kruja zone (Leskoviku area).

INTRODUCTION

On the geology of the Korca-Kolonja region have been carried out several studies, which have provided new data and clarified several problems regarding the stratigraphy and tectonics of the different units of this region (Kalina 1976, Melo and Kote 1973, Papa et al., 1966, 1979, Petro 1979, Pulaj and Godroli 1983, Shallo 1975, 1990, 1991, Shallo et al., 1980, 1981, 1985). The more complete representation on the geology of the Korca-Kolonja region is given on the Geological and Tectonic Maps of Albania scale 1:200000 (ISPGJ-IGJN 1982, 1983, ISPGJ-IGJN-FGJM 1985, and in Shallo et al., 1982).

In this paper we present new field data and new interpretations on the different tectonostratigraphic units and the regional correlation with other similar surrounding regions.

GEOLOGY OF THE KORCA-KOLONJIA REGION

Korca-Kolonja region is situated at the western border of the Albanian ophiolite belt and has a very complicated geological structure, in which are distinguished several tectonostratigraphic units (Fig. 1,2,3,4):

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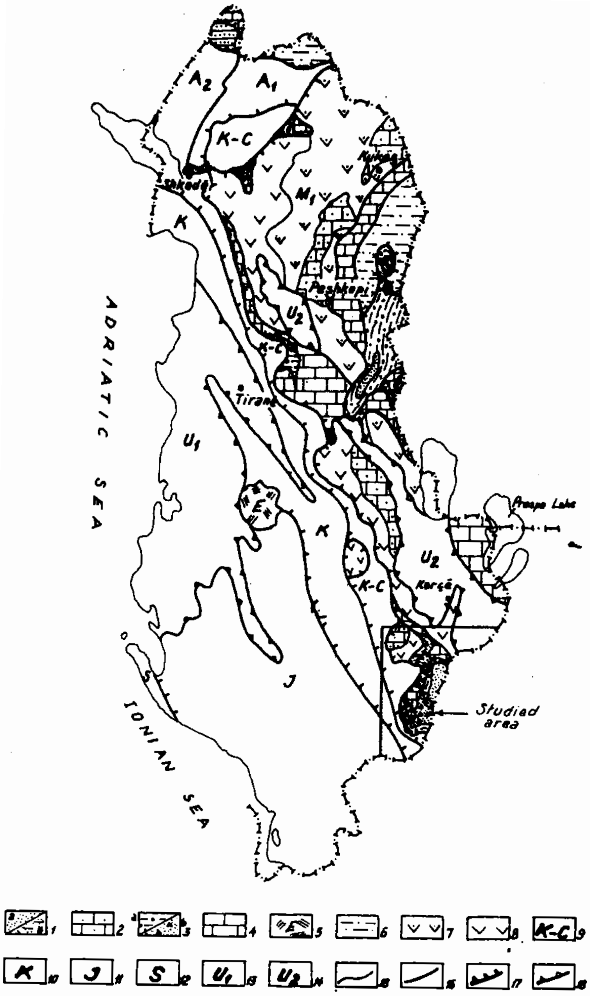

Fig.1: Schmatic geologic map of the Albanian ophiolites and their sedimentary periphery (after Geologic and Tectonic maps of Albania 1983, 1985, scale 1:200.000, and Shallo M. 1991). 1a - Flysch(Cr_2m-$Pg_2$2); 1b. - Cretacous Flysch; 2. - Cretaceous limestone; 3a - Flyschoidal sediments (J3t - Cra); 3b.- Ophiolitic melange (J_3t - Cr_1); 4. - Triassic - Jurassic limestone; 5.- Evaporites; 6 - Paleozoic formations; 7 - Eastern - type ophiolite; 8. - Western - type ophiolite; 9. - Krasta - Cukali zone; 10.- Kruja zone; 11. - Ionian zone; 12. Sazani zone; 13. - Pre Adriatic though; 14. - Inner trough; - 15.- Normal contacts; 16. - Tectonic contacts; 17. - Overthrusts; 18. - Troughs.

-Triassic-Jurassic carbonate series;
-Middle Jurassic ophiolites;
-Tithonian-Lower Cretaceous ophiolitic melange and flyschoidal sediments;
-Cretaceous terrigene-carbonate series and Cretaceous basinal carbonate series;
-Maastrichtian-Paleogene flysch and Eocene flysch;
-Oligocene and Neogene molasses and
-Plio-Quaternary deposits.

Triassic-Jurassic series is very widespread in the Korca-Kolonja region: (Gjergjevica-Vithkuqi-Gjanci-Kozeli, Gostivishti-Borova-Barmashi and Gradeci-Leskoviku areas), is a composite part of the western carbonate platform periphery, and represents the oldest formation in this region (Fig. 2,3,4). This series is represented mainly by platformal-type thick-bedded, massive limestones and oolitic and bioclastic lithiotis limestones, partly dolomitized, in which are found Triassina hantkeni, Paleodasycladus mediterraneus Pia, Clypeina Besici, Thaumatoporella parvovesciculifera, Orbitopsella praecursor, Involutinidae, etc., which determine Upper-Triassic Lower-Middle Liassic age. Above them in Gjergjevica, Qesaraka, Gradeci, Leskoviku, Kabashi areas through hardground lie Toarcian-Dogger-Malm condensed pelagic limestones with ammonite fauna, protoglobigerina, pelagic bivalves, etc., covered by Malm age radiolarian cherts and Tithonian-Lower Cretaceous deposits.

Middle Jurassic ophiolites are represented by following types:

a. Ophiolites as a composite part of the western-type ophiolite belt.
b. Nappe-type ophiolite (ophiolite thrust-sheet of the Vithkuqi-Rehova area).
c. Melange-type ophiolite (ophiolite blocks in melange).

a. Ophiolites as a composite part of the western-type ophiolite belt represent the southeast continuation of the western-type ophiolite belt of Albania; the western border of this ophiolite belt, exhibits high-angle west-verging reverse faulting which can be interpreted as thrust of the ophiolite onto western belt carbonate platform (Fig. 1,2,3). They are represented by the Voskopoja and Morava ultrabasic massifs associated with minor amount of the gabbroic and volcanic rocks. In the Voskopoja and Boboshtica areas among peridotite tectonites are found tectonic blocks of the metamorphic rocks (including amphibolites and metasediments), similar to the metamorphic aureole (sole). The ophiolite section consists mainly of mantle sequence (harzburgite-lherzolite tectonite with scarce dunite tectonite on the top of the sequence), on which lie plagioclase lherzolite, plagioclase dunite, dunite, rarely coarse-grained pyroxenite and troctolite and very rare gabbro; basaltic pillow lavas with MORB affinity and their pyroclastics constitute the top of the ophiolite section (Fig. 5), on which lie Upper Jurassic radiolaritic cherts, or transgressively lie Tithonian Lower Cretaceous deposits represented by ophiolitic melange and flyschoidal sediments. In the Morava-Korca areas these ophiolites form the basement of the Albano-Thessalian Molasse Trough.

b. Nappe-type ophiolite (ophiolite thrust-sheet of the Vithkuqi-Rehova area) represents a big thrust-sheet about 1,5-2km thick which occupies about 110 km^2, and lies on the Triassic-Jurassic carbonate rocks, overlying the Tithonian ophiolitic melange; on these ophiolites lie transgressively Cretaceous terrigene-carbonate rocks (Fig. 2,3). This nappe-type ophiolite is made-up of plagioclase lherzolite and dunite, troctolite and gabbro, on which lie diabase subvolcanic rocks and basaltic pillow lavas with MORB affinity covered by the Upper Jurassic radiolaritic cherts; these ophiolitic rocks are very similar to the western-type ophiolite; they are detached from the western-type ophiolite belt and are emplaced southwestward during Late Jurassic-Lower Cretaceous tectogenesis.

c. Melange-type ophiolites (ophiolitic blocks in melange)

Melange-type ophiolites are represented by ophiolitic blocks in the homogenous and heterogenous melange, and consist mainly of ultrabasic rocks rarely by volcanics, gabbros and subophiolitic metamorphic rocks lying on the Triassic-Jurassic limestone (Fig. 2,3,4), (Shallo et al., 1980, 1981, 1982, 1985; Shallo 1975, 1980, 1991; ISPGJ-IGJN-FGJM 1985). Previously these ophiolites and associated ophiolitic conglobreccia were considered as a normal continuation of the Albanian ophiolite belt overthrusted on the Krasta-Cukali zone or on the Gramozi subzone (Melo and Kote 1973, Papa et al., 1979, Petro 1979, Pulaj et al., 1983). Ultrabasic blocks are very widespread in Vithkuqi, Qarri and Kolonja areas rarely similar ultrabasic blocks are found among the Paleogene flysch of the Krasta subzone in the Cermerica and Sanjollasi areas (Fig. 2). They have a surface of about several square kilometers and are represented by serpentinized peridotite tectonite or plagioclase lherzolite. In Barmashi area are found blocks of MORB-type basalts associated with metamorphic rocks (amphibolite, garnet micaschists, greenschists and metasediments) similar to subophiolite metamorphic sole. Ophiolitic blocks are associated with ophiolitic conglobreccia and flyschoidal sediments of the Tithonian-Lower Cretaceous age and with rare small blocks of Triassic-

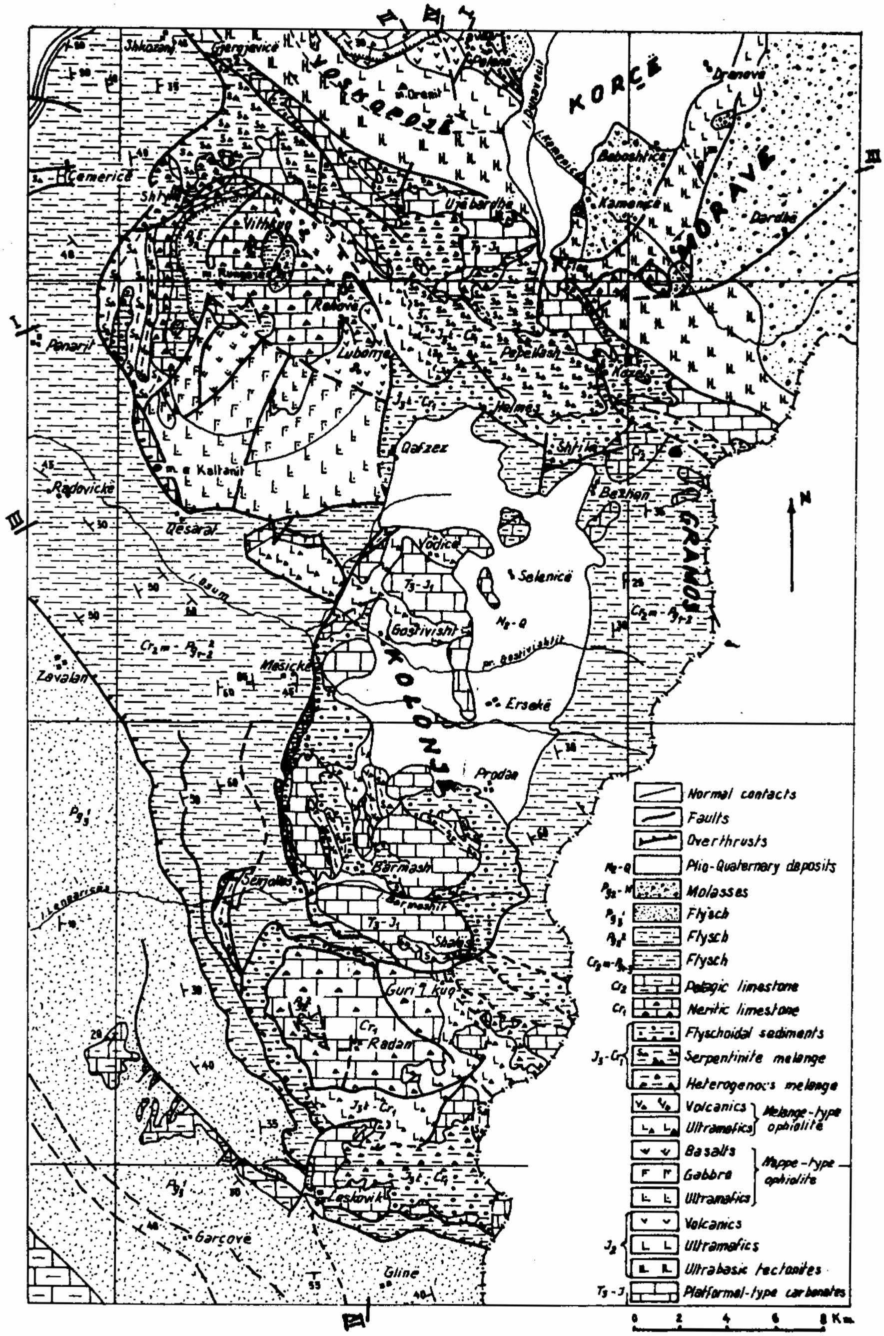

Fig. 2: Geological map of the Korca-Kolonja region. Prepared after Geological and Tectonic Maps of Albania (1983, 1985) scale 1:200.000 improved by Shallo M. and Vranaj A..

Jurassic carbonates and cherts. All the petrographic varieties of the melange-type ophiolite are very similar to the ophiolitic rocks of the western-type ophiolitic belt of Albania. Melange-type ophiolites represent ophiolitic slices detached from the western-type ophiolite belt, and are

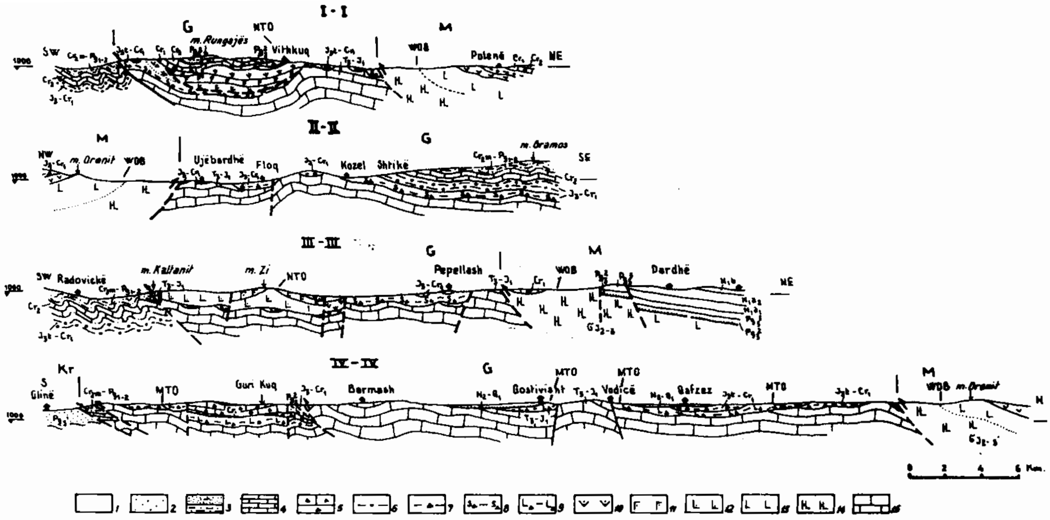

Fig. 3: Geologic sections of the Korca-Kolonja region. (I-I, II-II and III-III cross sections, IV-IV longitudial section).
1. Plio-Quarteranry deposits; 2. - Molasse; 3. - Flysch; 4. - Basinal limestones; 5. - Neritic limestones; 6. - Flyschoidal sediments; 7. - Heterogenous melange; 8. - Ophiolitic conglobreccia and melange - type ophiolite; 9. - Melange - type ophiolite (MTO) mainly ultrabasic rocks; 10 - 12. - Nappe - type ophiolite (NTO); 10. - MORB - type basaltic pillow lavas; 11. - Gabbros; 12 - Ultramafic cumulates; 13 - 14. - Ophiolites of the Western - type ophiolite belt (WOB); 13 - Plagioclase lherzolite rarely dunite and pyroxenite; 14. - Harzburgite - lherzolite tectonite; 15. - Platformal - type carbonate rocks of th Triassic - Jurassic age. M. Mirdita ophiolite zone; G. - Gramosi zone (platform periphery); Kr. - Kruja zone.

associated with Tithonian-Lower Cretaceous ophiolite emplacement when the carbonate platform was subsided to form a depression where deposited clastic sediments and melange (Shallo 1990, 1991).

TITHONIAN - LOWER CRETACEOUS OPHIOLITIC MELANGE AND FLYSCHOIDAL SEDIMENTS

In the Korca-Kolonja region are found the best outcrops of the ophiolitic melange and flyschoidal sediments of the Tithonian-Lower Cretaceous age, where they occupy about 170 km2 (Fig. 2,3). These deposits lie normally or transgressively on the top of the Triassic-Jurassic carbonate series, rarely on the top of the ophiolite sequence; two lithological types of ophiolitic melange are distinguished: ophiolitic conglomerates and breccias and heterogenous coloured melange (Shallo 1990). Ophiolitic conglobreccia are very widespread in Qarri, Vithkuqi, Barmashi, Germenji, Polena, and other areas; they consist mainly of serpentinite peridotite and rarely of basalts (Polena, Barmashi and Qarri areas). Some authors have considered this formation as part of the ultramafic massifs or as volcanic rocks (Melo and Kote 1973, Papa et al., 1979, Petro 1979 etc.); in Greece similar basaltic conglobreccias have been interpreted as a volcano-detritic series (Celet et al., 1976). According to Robertson et al., (1991) the Late Jurassic-Early Cretaceous "Beotian flysch" represents clastic facies shed into a foreland basin, prior to ophiolite emplacement.

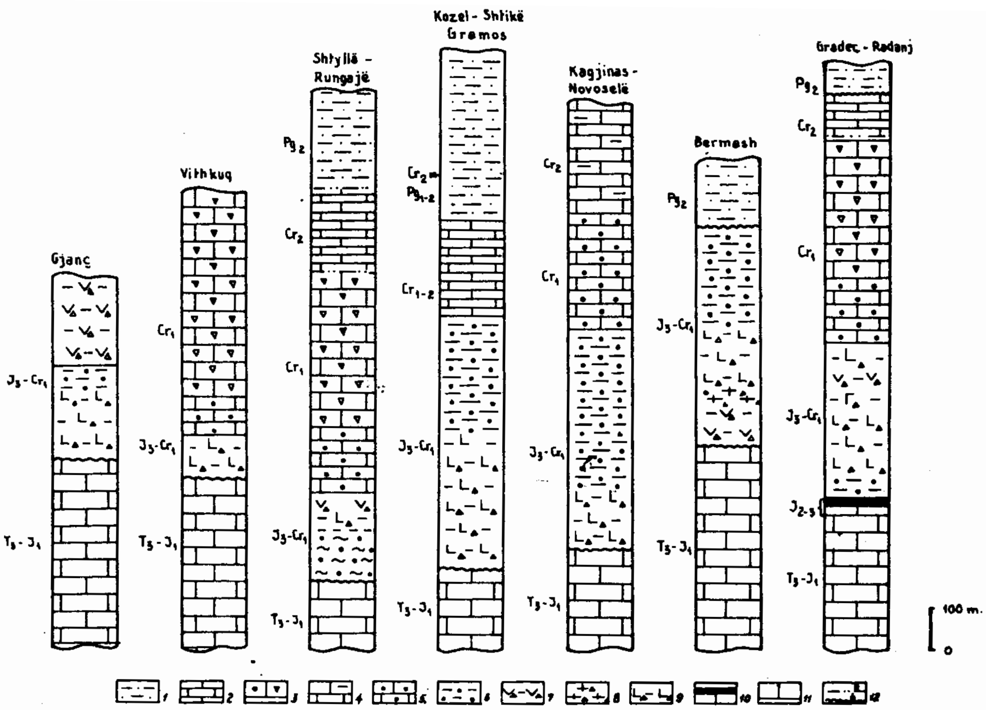

Fig. 4: Schematic stratigraphic sections from the Korca-Kolonja region. 1. Flysch; 2. - Basinal limestone; 3. - Neritic limestone; 4. - Partly basinal limestone; 5. - Terrigene - carbonate deposits; 6. - Flyschoidal sediments; 7, 8, 9. - Ophiolitic melanga; - 7. - Mainly basaltic conglobreccia and blocks; 8. - Mainly blocks of sybophiolitic metamorphic rocks (amphibolite and micaschists); 9. - Mainly serpentinized ultramafic conglobreccia and blocks; 10. - Basinal limestone and radiolaritic cherts; 11. - Platformal - type carbonate rocks; 12.a. - Stratigraphic uncomformity; 12.b. - Transgressive setting.

Cretaceous terrigene-carbonate series and Cretaceous basinal-type carbonate. Cretaceous terrigene-carbonate series lie transgressively on different parts of the ophiolite suite and nappe-type and melange-type ophiolite as well as on the Triassic-Jurassic carbonates usually through Tithonian-Lower Cretaceous deposits, in the Vithkuqi-Rungaja and Germenji-Radanji areas (Fig. 2,3,4). Terrigene-carbonate interbedding forms the lower part of this series, above which continue neritic carbonate rocks, abundant fauna determine Barremian-Aptian age; on these carbonate rocks in Rungaja, Novosele and Radanji areas (Fig. 4) with stratigraphic unconformity lie mixed to bassinal-type globotruncana limestones of Upper Cretaceous age, covered by the Paleogene flysch.

Cretaceous basinal-type carbonate crop out in the Gramozi Mtn. (Shtika, Bezhani and Selenica areas); the lower part of the section consists of pelagic thinbedded limestone lying on the Lower Cretaceous flyschoidal sediments; main part of the section consists of thinbedded globoruncana limestone of the Upper Cretaceous age covered by Maastrichtian-Paleogene (Paleocene-Eocene) flysch.

Unlike other regions in the Mirdita zone in Korca-Kolonja region are characteristic Upper Cretraceous pelagic carbonate deposits.

MAASTRICHTIAN-PALEOGENE AND EOCENE FLYSCH

Maastrichtian-Paleogene flysch is widespread in the Gramozi Mtn. and in the western part of the Korca-Kolonja region. This flysch is represented by sandstone-marlstone-conglomerate interbedding with rare limestone layers; lies on Upper Cretaceous globotruncana limestone through a transitional facies of the Maastrichtian-Paleogene age which marks a change from purely carbonate deposition to an environment with increasing clastic inputs during Paleocene and Lower Middle Eocene, is similar to the Pindos flysch in Greece.

Eocene flysch lies transgressively on the Upper Cretaceous limestone in Rungaja, Novosele and Radanji areas or on the Lower Cretaceous limestones and rarely on ophiolitic conglobreccia and is represented by thinbedded sandstone-mudstone layers very similar to the Maastrichtian-Paleogen flysch.

OLIGOCENE AND NEOGENE MOLASSES

Oligocene molasses from the lower part of the Molasse section of the Albano-Thessalian Trough, in Morava Mtn. lie trangressively on ultramafic rocks of the western-type ophiolite belt (Fig. 1). They are represented by conglomerate-sandstone interbedding, and are covered by Neogene Molasse, which consists the main part of the Molasse siute of the Albano-Thessalian Trough.

Plio-Quaternary deposits occupie Erseka area covering transgressively different more older tectonostratigraphic units.

TECTONICS

The Korca-Kolonja region has a very complicated structure expressed by folding, faulting and thrusting, caused by several tectogenese phases. Stratigraphic and structural data allow to clarify main structural features of this region. There are evidenced several anticlinals which core consisits of Triassic-Jurassic carbonate rocks, complicated by reverse faults and thrusts; intense folding is expressed in the Maastrichtian-Paleogene flysch in Gramozi Mtn. and in western border of this region. Large scale normal faults and reverse faults trending NW-SE and dipping NE along the contact between ophiolites and Triassic-Jurassic carbonates observed along Gjergjevica-Gjanci-Floqi-Qafa e Kazanit. In this region are well expressed all the tectonic events evidenced for Albanian Ophiolites and surrounding geological units (Mountrakis et al.,1992): streching lineation trending NW-SE as a probably remnant of the initial tectonic event evidenced in tectonic contact of the metamorphic rocks in Boboshtica area. Nappe-type ophiolite of the Vithkuqi-Rehova area and other melange-type ophiolite detached from the western type ophiolite belt are linked with the Late Jurassic tectogenesis which caused fragmentary uplift of the ophiolites. Intense folding and thrusting with WSW direction caused by the important compressional tectonic event overthrusts the ophiolites on the western sedimentary belt during Late Eocene, accompanied by Early Oligocene extensional tectonic event in more eastern part which caused normal faults and formation of the Albano-Thessalian Trough. Younger tectonic event caused several strike-slip faults and reverse faults which are expressed among Eocene, Oligocene and Plio-Quaternary deposits.

The structure of the Korca-Kolonja region was interpreted as a stack of several thrust sheet of the ophiolites and Triassic-Jurassic carbonates on the Krasta-Cukali zone or Gramozi subzone formations (Melo and Kote 1973, Papa et al., 1979), other studies argue the normal relations between several units and consider that the Triassic-Jurassic carbonate rocks in general consist the basement of this zone (ISPGJ-IGJN 1983, ISPGJ-IGJN-FGJM 1985, Shallo et al.,

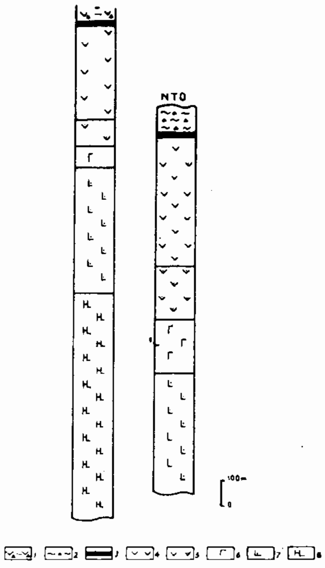

Fig. 5: Schematic sections of the W. ophiolite belt (WTO) and of the nappe - type ophiolite (NTO). 1. - Ophiolitic melange (mainly basaltic conglobreccia); 2. - Heterogenous melange; 3. - Radiolaritic cherts; 4. - MORB - basalts; 5. - Diabase; 6. - Gabbro-troctolite and pyroxenite; 7. - Plagioclase ultrabasic rocks; 8. - Hartzburgite - lherzolite tectonite.

1980, 1981, 1982, Shallo 1990, 1991). On the basis of the stratigraphic and structural data, on the presence of the normal continuation from Tithonian-Lower Cretaceous deposits to the Cretaceous pelagic limestones and to the Maastrichtian-Paleogene flysch, on the presence of the normal stratigraphic relations between Cretaceous carbonate rocks and Paleogene (Eocene) flysch and on the presence of the ophiolitic melange and Triassic-Jurassic carbonate rocks in the more western area consisted by Paleogene flysch, we consider Triassic-Jurassic carbonate rocks and Tithonian-Lower Cretaceous deposits as a basement of the Krasta or Gramozi subzone in general. Such interpretation allow us to consider the western sedimentary belt of the western-type ophiolite (i.e. carbonate platform periphery and Krasta subzone) as an unique zone which is very similar to the Beotian zone in Greece, with some differences in paleogeographical evolution during Cretaceous expressed by the development of melange-type and nappe-type ophiolite and neritic and pelagic carbonate facies, and in places by gradded Paleogene transgression. According to Robertson et al., (1991) the Beotian zone is reinterpreted as part of the Pelagonian zone that exhibited contrasting subsidence history, relative to the adjacent Pelagonian carbonate platform. We suppose the facial change in the northern continuation of the western sedimentary belt of the ophiolites from typical basinal conditions in the Pindos zone in Greece into more platformal-type conditions during Triassic-Lower Jurassic with an abundant ophiolite debris and ophiolite slices and thrust caused by the vicinity of the emplacing ophiolites during Tithonian-Lower Cretaceous.

The western border of this zone is marked by its thrusting onto the Oligocene flysch of the Kruja-Ionian zone (Frasheri-Leskoviku areas).

GEOLOGICAL EVOLUTION OF THE KORCA-KOLONJA REGION

On the basis of the tectonostratigraphic data and the correlation with the neighbouring regions in Albania and in Greece (ISPGJ-IGJN 1982, 1983, ISPGJ-IGJN-FGJM 1985, Shallo et al., 1982, Shallo 1992, Celet et al., 1976, Jones and Robertson 1991, Mountrakis et al., 1992, Robertson et al., 1991 etc.) we can give a schematic reconstruction of the geological evolution of Korca-Kolonja region. Upper Triassic-Middle Liassic time are dominated by shallow-water carbonate sedimentation represented by thick-bedded to massive carbonates with Megalodonts of Upper Triassic age and oolitic and bioclastic lithiotis limestone of Lower Liassic age. After Middle-Upper Liassic times rifting and regional subsidence until Upper Jurassic formed hardgrounds on seamounts and ammonitico rosso type carbonates. During Middle Jurassic times oceanic spreading occured which caused the formation of the western-type ophiolite, followed by regional radiolarite sedimentation on the top of the ophiolite and Triassic-Jurassic carbonate sequence during Upper Jurassic Times. The presence of the metamorphic rocks among ophiolites shows for an initial ophiolite displacement during Upper Jurassic times, continuing during Tithonian-Lower Cretaceous times with a partial closure of the ophiolite formation of the system of active horsts and grabens, which caused the formation of the ophiolitic melange, melange-type and nappe-type ophiolite of the Vithkuqi-Rehova area, along the western platform margin (Korca-Kolonja region), in contrast with the Pindos zone in Greece where emplacement of the ophiolites during Late Jurassic, had little effect along the western margin of the Pindos ocean (Degnan and Robertson 1991). During Cretaceous times a gradded transgression occurs and terrigene-carbonate and platform-type and basinal carbonates cover partialy western sedimentary margin of the ophiolites; during the Upper Cretaceous (mainly) Maastrichtian times prevailing basinal conditions caused the formation of the pelagic globotruncana limestones, followed by the flysch sedimentation during Late Maastrichtian-Paleogene times (Gramozi Mtn. and more western part of the region), besides the accidental topography of this region in the more highest areas flysch sedimentation occures during Eocene times (Rungaje, Novosele, Radanj); this paleogeography of the western border of the ophiolites, during Cretaceous and Paleogene times caused a confusion in geological interpretations of the correlations with different tectonic zones.

During Late Eocene-Oligocene times when the main collision event occurs, Korca-Kolonja region (sedimentary periphery and ophiolites) were thrusted westward onto Paleogene Flysch and occasionally on the Oligocene flysch of the Kruja zone (Leskoviku area). This thrusting was accompanied by extention behind the thrust front and sedimentation of the Paleogene molasse continuing during Neogene.

Several compressive phases took place in Later Cretaceous-Paleogene, Late Eocene-Oligocene-Middle Miocene etc., which migrated from East to West, and causing general westward overthrusting.

CONCLUSIONS

- Korca-Kolonja region consists of several tectonostratigraphic suits: Triassic-Jurassic carbonate series; Middle Jurassic ophiolites; Tithonian-Lower Cretaceous ophiolite melange and flyschoidal sediments; Cretaceous terrigene-carbonate and basinal-type carbonate series; Maastrichtian-Paleogene and Eocene flysch and Oligocene and Neogene molasses.
- Middle Jurassic ophiolites are represented by following types: Ophiolites as a composite part of the western (MORB)-type ophiolite belt; nappe-type ophiolite and melange-type ophiolite associated with ophiolitic conglobreccia and flyschoidal sediments which are detached from western-type ophiolite belt and are emplaced on the Triassic-Jurassic carbonate periphery during Tithonian-Lower Cretaceous tectogenesis.
- On the basis of the stratigraphic and structural data we consider the western sedimentary belt of the western-type ophiolites as an unique zone which is similar to the Beotian zone with some differences in paleogeographical evolution during Cretaceous times.

REFERENCES

CELET P., CLEMENT B., FERRIERE J., (1976) - La zone Beotiene en Grûce: Implications paleogeographiques et structurales. Ecl. Geol. Helvet., 49, 577-593.

CELET P., CADET J., CHARVET J., FERRIERE J. (1976)-Volcano- sedimentar and volcano-detritic phenomena of Mesozoic age in the dinaride and Hellenic ranges: A comparison.In:Structural History of the Mediterranean basins (B. Biju-Duval, L. MOntaredt eds.) Edition. Techniq. Paris.

DEGNAN P. and ROBERTSON A.H.F. (1991)-Tectonic and sedimentary evolution of the Western Pindos Ocean, evidence from the Pindos zone, Peloponnese, Greece. 5th Congres. Geol. Soc. of Greece, Thessaloniki, p. 263-274.

ISPGJ-IGJN (1982)-Gjeologjia e Shqiperise, Tirana, Albania. 492 p.

ISPGJ-IGJN (1983)-Harta Gjeologjike e Shqiperise. Tirana, Albania. Scale 1:200000

ISPGJ-IGJN-FGJM (1985)-Harta Tektonike e Shqiperise. Tirana, Albania. Scale 1:200000

ISPGJ-IGJN-FGJM (1985)-Tektonika e Albanideve. Tirana, Albania, 420 p.

JONES G. and ROBERTSON A.H.F. (1991)-Tectonostratigraphy and evolution of the Mesozoic Pindos ophiolite and related units, Northwestern Greece. Journ. GEol. Soc. Lond. 148, p.267-288.

KALINA P. (1976)-Disa vecori te pakos "argjilite me copa" te rajonit te Lubonjes, pjesa jugore e zones se Mirdites. Permb. Stud. 3.

KEMP A.E.S. and McCAIG A.M. (1985)-Origins and significance of rocks in an imbricate thrust zone beneath Pindos ophiolite, northwestern Greece. In: The geological evolution of the Eastern Mediterranean (Dixon J.E. and Robertson A.H.F. eds), Sp. publ. Geol. Soc. London 17. 569-580.

MELO V., KOTE DH. (1973)- Gjeologjia dhe tektonika e njesise se Gramozit ne sektorin Helmes-Shtike-Kozel dhe marredheniet me zonen e Mirdites. Permb. Stud. 4, 41-50.

MOUNTRAKIS D., KILIAS A., ZOUROS N. (1992)-Kinematic analysis and Tertiary evolution of the Pindos-Vourinos ophiolites (Epirus-Western Macedonia, Greece). 6th Congress, Geological Society of Greece, Athens (in press).

MOUNTRAKIS D., SHALLO M., KILIAS A., VRANAJ A., ZOUROS N., MARTO A. (1992)-Postemplacement tectonics and kinematic analysis of the Albanian ophiolites. 6th Congress, Geol. Soc. of Greece, Athens (in press).

PAPA A., CILI P., STEFI M. (1966)-Te dhena paraprake mbi depozitimet transgresive te rajonit Kagjinas-Novosele. Perb. Stud. 4.

PAPA A., XHOMO A., PIRDENI A., JAHJA B. (1979)-Kumtime mbi stratigrafine e tektoniken e sektorit Helmes-Bezhan (nenzona e Gramozit). Permb. Stud. 2.

PETRO TH. (1979)-Fakte dhe interpretime te reja per gjeologjine e rajonit te Korces. Permb. Stud. 2.

PULAJ H. and GODROLI M. (1983)-Ndertimi gjeologjik dhe mineralet e dobishme te rajonit Kolonje-Leskovik. Tirana, Albania.

ROBERTSON A.H.F., CLIFFT P.D., DEGNAN P.J., JONES G. (1991)- Tectonic evolution of the Mesozoic-Cenozoic Pindos ocean Greece. Bulletin of the Geol. Soc. of Greece, vol. XXV, Thessaloniki 55-64.

SHALLO M. (1975)- Mbi suiten argjilito-copezore te Mirdites. Permb. Stud., 1. 27-46. SHALLO M. (1990)- Ophiolitic melange and flyschoidal sediments of the Tithonian-Lower Cretaceous in Albania. Terra Nova, 2, 476-483.

SHALLO M. (1991)- Ofiolitet e Shqiperise. Tirana, Alabnia, 247 pp. SHALLO M. (1992)- Geological evolution of the Albanian Ophiolites and their platform periphery. Geologische Rundschau 81/3, 681-694.

SHALLO M., GJATA TH., VRANAI A. (1980)-Perfytyrime te reja mbi gjeologjine e Albanideve Lindore. Permb. Stud., 2, 31-59.

SHALLO M., VRANAI A., GJATA TH., LLESHI B., THEODHORI P. (1982)- Gjeologjia e rajonit Korce-Kolonje-Leskovik. Bul. Shkenc. Gjeol., 3, 23-43.

SHALLO M., VRANAI A., DOBI A., KARKANAQE XH. (1981)-Vendosja hapsinore e shkembinjve ultrabazike te vendit tone. Permbledhje Studimesh 2, 13-29.

SHALLO M., KOTE DH., VRANAI A., PREMTI I. (1985)-Magmatizmi ofiolitik i Shqiperise. Tirana, Albania. 362 pp.