LOOK FOR THE ROOTS OF THE MIRDITA OPHIOLITES (ALBANIA)

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ABSTRACT

The Mirdita zone involves the ophiolites with their sedimentary cover and the boundary with Korabi zone passes after the eastern margin of the ophiolites which extends from Kukësi-Peshkopia region in the north to Mali i Thatë mountain in the south. The Korabi zone is deformed in a large antiform, showing at its core several Kruja and Krasta tectonic windows and the Tithonian-Valanginian marly flysch sequence that overlies the huge ultrabasic bodies around theMali iBardhë tectonic window of Kruja zone. These two settings of ultrabasic bodies could be met in the Korabi zone: i)the ultrabasic bodies observed along normal faults cutting the depositional sequences of Korabi zone, and ii) the imbricated huge ultrabasic bodies transgressively covered by the Tithonian-Valanginian marly flysch sequence met around three sides of Mali i Bardhë tectonic window of Kruja unit: in the Kalle, Vlesh, Dipjakë and Vrenjt in the west, in Biçaja pass (Varri i Sejmenit) and Bjeshka e Shehut stream in the east and in Radomira area in the north of it. The surrounding of Mali i Bardhë tectonic window is the only area proving the presence of huge ophiolite bodies showing the roots of Mirdita ophiolites which underlie the Korabi nappes. Both setting of the ultrabasic bodies prove to the existence of ophiolite massifs underlying the Korabi units. The geological building of Korabi tectono-stratigraphic unit, including into its core several tectonic windows of Krasta and Kruja units, shows the following stack of nappe sheets, from top to bottom: Korabi nappe, Mirdita ophiolite nappe transgressively covered by the Upper Jurassic-Lower Cretaceous marly flysch and Krasta nappe overlying the Kruja "autochthon". All the geological cross-sections transecting across the Mirdita and Korabi tectono-stratigraphic units, from the Radomira-Sllova area in the north to the Leskoviku-Kolonja area in the south, show that the Triassic-Jurassic limestones of Korabi zone overthrust the ophiolites from the Gurre-Lura to Lunik-Klenje tounge up to Mali i Thatë Mt., and in west and east sides of the Mali i Bardhë tectonic window, at the core of Korabi zone, are seen the roots of Mirdita ophiolites overthrust by different Korabi nappe units.
Keywords:*Korabi zone core***,** *Mali i Bardhë tectonic window***,** *Tithonian-Valanginian marly flysch sequence, the huge ultrabasic bodies, roots of Mirdita ophiolites*

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1. INTRODUCTION

The Jurassic ophiolite bodies of the Dinarides s. l. could be divided into "Eastern Ophiolite Belt" coinciding with the Vardar zone and "Western Ophiolite Belt" coinciding with the Mirdita zone (Spray *et al*., 1984; Ferriere*et al*., 2012).
The data on the Vardar zone provide information about the Mesozoic-Early Cenozoic evolution of small oceanic basins. The Vardar Zone rifted in Permian-Triassic times, with the creation of the Almopias oceanic basin during the Late Triassic-Lower Jurassic. During the Mid-Jurassic, this ocean subducted northeastwards beneath the Paikon Zone and the Serbo-Macedonian Zone. A second ocean basin, the Pindos Ocean, opened to the west of Pelagonian Zone also during the Late Triassic-Lower Jurassic. During the Mid–Late Jurassic, ophiolites were emplaced northeastwards from the Pindos Ocean onto the Pelagonian microcontinent (Sharp and Robertson 2006).
Most of Albanian scholars consider the ophiolites as rooted in the Mirdita oceanic basin, implying the location in the Jurassic time of two oceanic basins separated by "Pelagonian Microcontinent": Mirdita oceanic basin to the west and Vardar oceanic basin to the east. Xhomo *et al*., (2002a) underlined that Mirdita oceanic basin and not Krasta-Cukali (=Pindos) basin") is the Genesis Site of Albanian ophiolites. A few of Albanian scholars (Çollaku *et al*., 1990; 1991;Çollaku 1992) and many foreign scholarswho carried out geological studies in Albania (Kilias *et al*., 2001; Bortolotti *et al*., 2004; Gawlick *et al*., 2008; Schlagintweit *et al*., 2008; Tremblay *et al*., 2015) support the scenario that Mirdita ophiolites represent a far-travelled nappe with roots in theVardar zone, brought into its current position in Middle-Late Jurassic time.
Kodra (2016) said that the alternative tectonic models for Mirdita ophiolite genesis are the following: i) the Mirdita ophiolites representing a far-travelled nappe with roots in Vardar zone (Çollaku 1992; Bortolotti *et al*., 2005; Gawlick *et al*., 2008; Tremblay *et al*., 2015), ii) the Albanian ophiolites formed

within the Pindos-Mirdita small oceanic basin above a westward-dipping intraoceanic subduction zone in the Late Jurassic and partly closed in the Late Jurassic-Early Cretacous time, associated with emplacement of the ophiolites onto the Korabi microcontinent; this basin finally closed during the Early Tertiary. The great thickness (up to 14 km locally) of eastern-type ophiolites in the Northern Albania is more consistent with a root zone within the Mirdita zone than a thin-skinned thrust sheet (Roberston and Shallo 2000), iii) the Mirdita oceanic basin opened in the Middle Jurassic time into the vrisera of Krasta/Pindos basin when the Apulian platform broke up into the Ionian basin between the Sazani and Kruja platforms. In the Late Jurassic time the eastward-dipping intraoceanic subduction formed into the Mirdita oceanic basin which afterwards closed at the end of Late Jurassic (Aliaj 1997; Meço *et al*., 2000), iv) the Mirdita ophiolites formed in Mirdita graben megastructure with oceanic basin in between and two pelagic basin-slope: Qerret-Miliska in the west and Mbasdeja (Maliac) in the east. The continental rifting during the Early-Middle Triassic time was associated and followed with continental break-ups of the Vardar and Mirdita basins during Late Anisian time and the oceanic spreading in the Vardar and Mirdita basins during the Ladinian till the Middle Jurassic time. The deformation stages of the Mirdita oceanic basin characterized by the intra-oceanic and marginal bidivergent paleoemplacement during the Middle Jurassic until the beginning of Late Jurassic time when the Mirdita oceanic basin closed (Xhomo *et al*., 2002 a:b; 2005; Kodra 2016).
The Albanian scholars considered the Mirdita ophiolites as rooted in the Mirdita oceanic basin, whereas the foreign ones considered them as rooted in the Vardar Ocean. The data about the Kruja and Krasta tectonic windows within the Korabi Zone are a means to address the search for the roots of Mirdita ophiolites.

2. SHORT SUMMARY OF THE SCHOLAR OPINIONS ABOUT THE MIRDITA OPHIOLITE ZONE FRAMEWORK

Aliaj and Bushati (2018) made the following summary of the scholar opinions about the Mirdita ophiolite zone framework.
Nopcsa (1929) was the first scholar who carried out the tectonic zoning of Dinarides showing that the relations among Dinarides tectonic zones are of overthrust type, with the exception of the border between Mirdita and Shar-Dagh zones passing through the “Drini Fault”. He considered the Mirdita Nappe as an ophiolile pre-Gosaw nappe.
Zuber (1938; 1940) was the first of foreign scholars who said that “Albanian ophiolite nappe”, which often is called “Ophiolite nappe”, underlies the Shar-Dagh (=Korabi zone) nappe in the Peshkopia region. Zuber has formulated the conception of tectonic nappe building of all tectonic zones from NE to SW: the Pelagonia, Shar-Dagh (Korabi), Albanian ophiolite (Mirdita) and Cukali (Krasta) nappe zones overlie successively one over the other as roof-tiles.
Biçoku *et al*., (1965; 1970) and Papa (1971) underlined that the Mirdita zone overthrusts the Krasta-Cukali flysch unit and it delimits with the Korabi one through a normal contact which passes after the eastern margin of ultramafic massifs.
Shehu *et al*., (1983; 1985; 1990) and Shallo (1985; 1999) distinguished an ophiolite subzone and another carbonate subzone in both ophiolite sides in the Mirdita zone. The Mirdita zone overthrusts the Krasta-Cukali zone and its border with Korabi zone, which extends in the Peshkopia region, is indicated as normal contact following the eastern margin of carbonatic periphery.
Xhomo and Kodra (2002b; 2005) distinguished two main units of Mirdita zone: i) Triassic- Jurassic ophiolites and their sedimentary cover, and ii) subzone units at the periphery and at the basement of the ophiolites (the Hajmeli and Qerret-Miliska subzones in the west and Gjallica and Mbasdeja subzones in the easts). The border between Mirdita and Korabi zones passes after the border between the Gjallica and Çaja subzones drawn as a normal contact that follows in Kukësi-Peshkopia region. The Korabi nappe overthrusts the Ostroni unit overlying the Dibra Unit (=Kruja zone), whereas the Mirdita ophiolites overthrust the continental ophiolite periphery to the east (Pz-Mz) and west (Mz), and both Mirdita and Korabi nappes overlie the Ostreni nappe that is supposed to be an imbrication of regional extent.
Aubouin and Ndojaj (1964) considered the border between the Mirdita and Korabi zones as a normal one passing after eastern margin of the ophiolites which extends from Kukësi-Peshkopia region in the north to Mali i Thatë mountain in the south.

Belostockij (1960-1978) reported about the nappe tectonics in Albanian sector of Dinarides met at the boundaries of nappe complexes or main structural zones. Especially the tectonic nappes following the outer extremities of Korabi zone are analyzed in details. The allochthtonous Triassic limestones overlying the ophiolites of Subpelagonian zone (=Mirdita zone) could be observed in many places from Selishta sector in the north to Mali i Thatë mountain in the south. In the Albanian sector are shown from east to west the following nappe units of allochthonous complex: Vardar, Pelagonian, Subpelagonian, intermediary unit and Pindos nappe sheets. Belostockij showed the root levels zones of nappe sheets met in the Albanian sector.

Melo (1966-2002) distinguished the Korabi Paleozoic nappes and the ophiolite belt with two peripheral Triassic-Jurassic limestones belts of Mirdita Zone. The border between Mirdita zone and Korabi is presented as normal contact. The nappe of Mirdita ophiolites overthrusts the Triassic-Jurassic limestones and both Korabi and Mirdita nappes as a common nappe are displaced towards the west over Krasta zone for a distance of tens km, so they can be considered as nappes without roots.

Aliaj (1987-2018) stated that the east verging overturned west plunged folds, consisting mainly of Triassic-Jurassic limestones, overlie the Mirdita ophiolites. The ophiolite bodies found along the normal faults and along nappe boundaries surrounding the Mali i Bardhë window within the Korabi zone could be considered as pulled-up fromthe Mirdita ophiolites underlying it. Meço and Aliaj (2000) pointed out that “the Mirdita Zone overthrusts the Krasta Zone and is itself overthrust by the Korabi Zone”. Aliaj (1987-2018) and Meço and Aliaj (2000) pointed out based on all the data that within the Korabi zone the following nappe sheets could be from top to bottom distinguished: Korabi nappe, Mirdita ophiolite nappe transgressively covered by the Tithonian-Valanginian flysch and Krasta nappe that overlies the Kruja zone “autochthon”.

Kodra (1976-2016) distinguished two main units in the geologic building of the Mirdita Zone and two subzones in the Korabi Zone, which are, from west to east the Muhurr-Çaja and Malësia e Korabit (M.Ç-MK) and Kollovozi (Sharri) Subzones. Melo *et al*., (1990; 1991) made an original interpretation for the nappe sheet structure across theMirdita and Korabi zones. They evidenced two nappe sheets located over one another and over the “autochton unit”. The upper nappe belongs to the Korabi zone which overthrusts the lower one represented by the Krasta zone. Both covers the “Kruja autochtonous unit” that outcropped in Mali i Bardhë tectonic window. The nappe of Mirdita ophiolites eastwards overthrusts the Triassic-Jurassic limestones and both Korabi and Mirdita nappes as a common nappe are displaced towards the west over Krasta zone. Kodra and Xhomo (2002b; 2005) showed that Mirdita ophiolites overlie the Triassic-Jurassic carbonate formation towards the Korabi zone and that the Korabi nappe overthrusts the Ostroni unit overlying the Dibra Unit (=Kruja zone), whereas the Mirdita ophiolites overthrust the continental ophiolite periphery to the east (Pz-Mz) and to the west (Mz), and both Mirdita and Korabi nappes overlie the Ostreni nappe that is supposed to be an imbrication of regional extent. Kodra (2016) showed that the Mirdita Ophiolite Belt (MOB) overthusts the Krasta zone overlain by the Ostreni subunit, and eastwards thrusts the Mbasdeja and Gjallica units that underlies it. Xhomo *et al*., (1991b) underlined that the nappes of Mirdita and Korabi units are totally allochthon.

Çollaku *et al*., (1990; 1991) and Çollaku (1992) concluded that Mirdita and Korabi zones present the separate nappes and that Mirdita ophiolite nappe, brought from Vardar ophiolite zone, overthrusts the Korabi one and both overthrust the Krasta flysch.

Qirinxhi *et al*., (1990;1991) concluded that the Korabi zone overthrusts the Mirdita one and both overthrust the external zones of Albanides. The Korabi nappe overthrusting the ophiolites (serpentinites) covered by Late Jurassic-Early Cretaceous flysch deposits could be observed at the Veleshica River. Mirdita zone consists mainly of ophiolites.

Bushati (1985; 1988; 1994; 1997) stated that the Mirdita ophiolite belt is characterized by intensive Bouguer anomalies and very turbulent magnetic field of relatively low intensity anomalies. The gravity data show that the ophiolite belt is genetically unique, divided into two parts by Shëngjergji corridor of Krasta flysch tongue. The thickest part of the ophiolite belt is 14 km in the Kukës ultramafic massif and towards its west and south, the thickness decreases by 2 km. The presented gravity cross-sections support the allochthonous setting of the Mirdita ophiolites completely detached from their roots.

Frashëri *et al*., (1990; 2009) concluded that the geophysical evidences support the allochthon character of the ophiolitic belt. The gravity data show that the ophiolite massifs are from 6 to 14 km thick to east and less than 2 km thick to the west.

The scholary opinions about the root zones of Mirdita ophiolites could be grouped as follows: some scholars considered the Mirdita ophiolites with a root zone underlying the Korabi nappe (Zuber 1940; Belostockij 1978; Aliaj 1987; 1991; 1993; 2018; Qirinxhi *et al*., 1991), some other with a root zone within Mirdita Zone (Robertson and Shallo 2000) or as rooted in the Mirdita Ocean but not showing their root zone (Xhomo *et al*., 2002a:b; Kodra 2016) and the other ones without roots (Melo 2002; Frashëri *et al*., 2009; Bushati 1994), while a minority Albanian scholars (Çollaku *et al*., 1990; 1991) and many foreign scholars who carried out geological studies in Albania (Kilias *et al*., 2001; Bortolotti *et al*., 2004; Gawlick *et al*., 2008; Schlagintweit *et al*., 2008; Tremblay *et al*., 2015) considered that Mirdita ophiolites represent a far-travelled nappe with roots in Vardar zone, brought into its present position in Middle-Late Jurassic time.

3. GEOLOGICAL BACKGROUND

The geological history in Albania could be classified into: i) the Alpine, ii) Post-Alpine and, iii) Neotectonic Late Miocene to recent time periods. During these time periods were created, developed and established these three completely different structural types: i) the Alpine tectono-stratigraphic units, ii) the Post-Alpine Tertiary molasse basins, and iii) the Late Miocene-Quaternary neotectonic structure and the present-day relief (Aliaj and Kodra 2016; Aliaj *et al*., 2018).

The Albanides could be placed in the segment between Shkodra-Peja and Sperchios transform faults (Aliaj and Kodra 2016). South of the Shkodra-Peja transform fault up to sperchios transform fault, the following arrangement of the main tectono-stratigraphic units could be distinguished in Albanides, from west to east: Sazani-Paxos (Preapulian), Ionian-Ionian, Kruja-Gavrovo, Krasta-Pindos, Guri i Topit-Beotian, Mirdita-Subpelagonian, Korabi-Pelagonian and Vardari-Axios units.

The Figure 1 depicts the Mirdita and Korabi internal tectono-stratigraphic units and the Sazani, Ionian, Kruja and Krasta external zones and Guri i Topit unit, considered as an intermediary unit between the external and internal tectono-stratigraphic units (Aliaj 2018).

The present paper provides information about the internal tectonic zones of Mirdita and Korabi. However, some information about the Ionian and Guri i Topit tectono-stratigraphic units would be necessary as it is for the first time reported.

Based on the thrusting and folding phase, the Ionian Zone could be divided into two sub-zones (Figure 1): i) the internal Ionian Subzone folded at the end of the late Oligocene and ii) the external Ionian Subzone structured at the end of Langhian (Aliaj 1988; Aliaj *et al*., 1991; Aliaj 2012; Meço and Aliaj 2000).

The Guri i Topit zone consisting of a complete section from the Middle Triassic to the Late Tithonian-Valanginian Flysch sequence has developed as an intermediary unit between the Krasta and Mirdita tectono-stratigraphic units, from which the ophiolite debries derived (Aliaj 2018). The Tithonian-Valanginian conglomerate-marly flysch slice can be observed at the front of the Mirdita ophiolite nappe underlying it, as for example at Firza village, west of Rubik (Hajnaj and Aliaj 1975), or at Shtike-Helmes villages delimiting from the north the Gramozi half-window (Papa *et al*., 1978) etc.

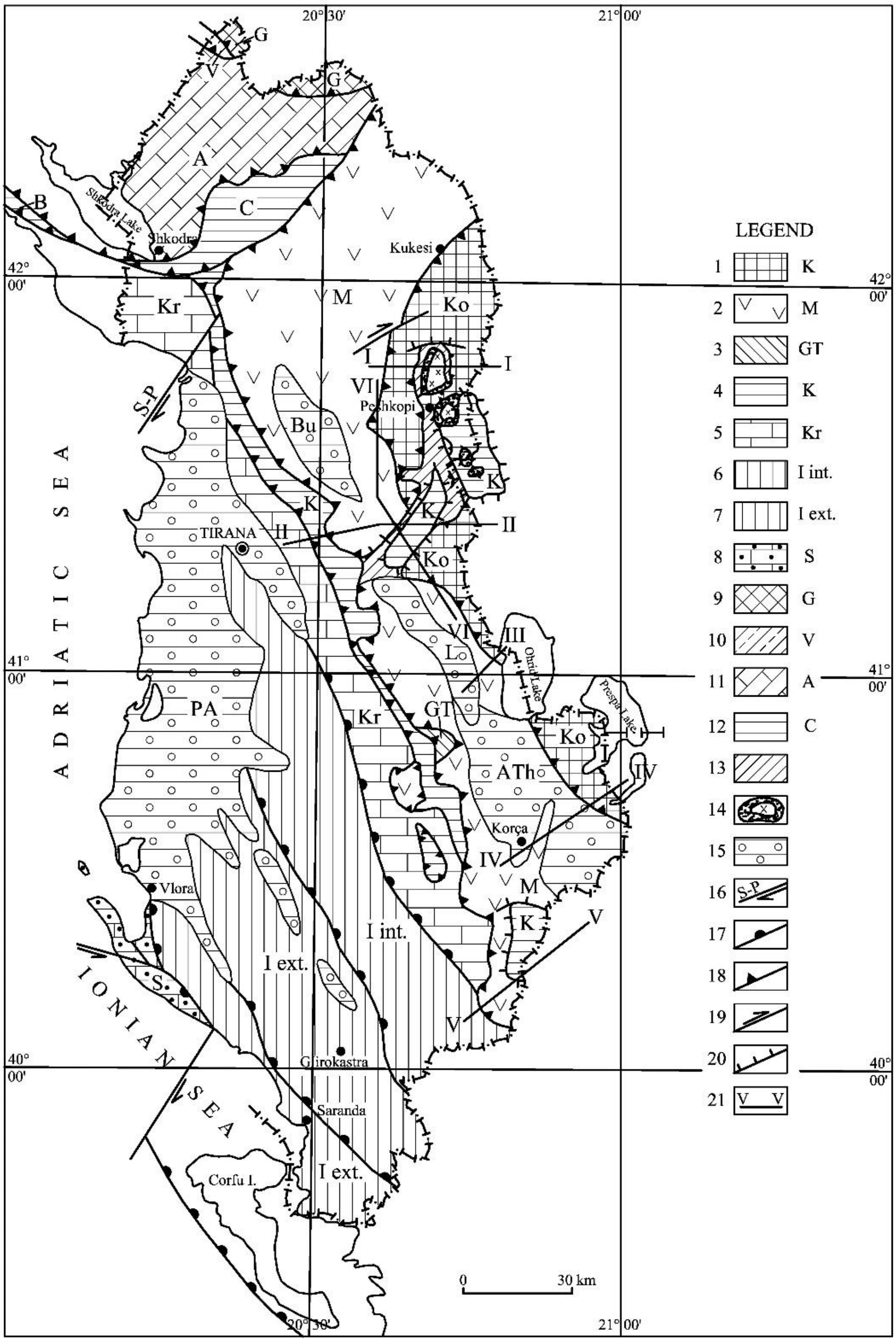


Fig.1: Tectonic Map of Albania. Tectono-stratigraphic units: **1**- Korabi, **2**- Mirdita, **3**- Guri i Topit, **4**- Krasta, **5**- Kruja, **6**- Internal Ionian, 7- External Ionian, **8**- Sazani, **9**- Gashi, **10**- Vermoshi, **11**- Albanian Alps, **12**- Cukali, **13 –** Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **14**- Kruja Zone evaporite dome surrounded by the Upper Eocene-Lower Oligocene flysch, 1**5**- Molassic basins: ATh- Albanian-Thessalian, L-Librazhdi, Bu- Burreli and PA-Periadriatic basins, **16**- Shkodra-Peja transform fault, **17**- Thrust, **18**- Overthrust, **19**-Strike-slip dextral, **20**- Normal fault, **21**- Lines of geological sections transecting the Mirdita and Korabi units that are presented below in the text.

3.1. The Mirdita tectono-stratigraphic unit

Aliaj and Bushati (2018) emphasized that Mirdita zone includes the ophiolites with their sedimentary cover and the boundary with Korabi zone passes after the eastern margin of the ophiolites which follows from Kukësi-Peshkopia region in the north to Mali i Thatë mountain in the south. The border between Mirdita and Korabi zones might pass after a nappe boundary, immediately east of ultramaphic massifs where many examples proving that Mirdita ophiolite nappe underlies the Korabi one (Figure 1 and 2).

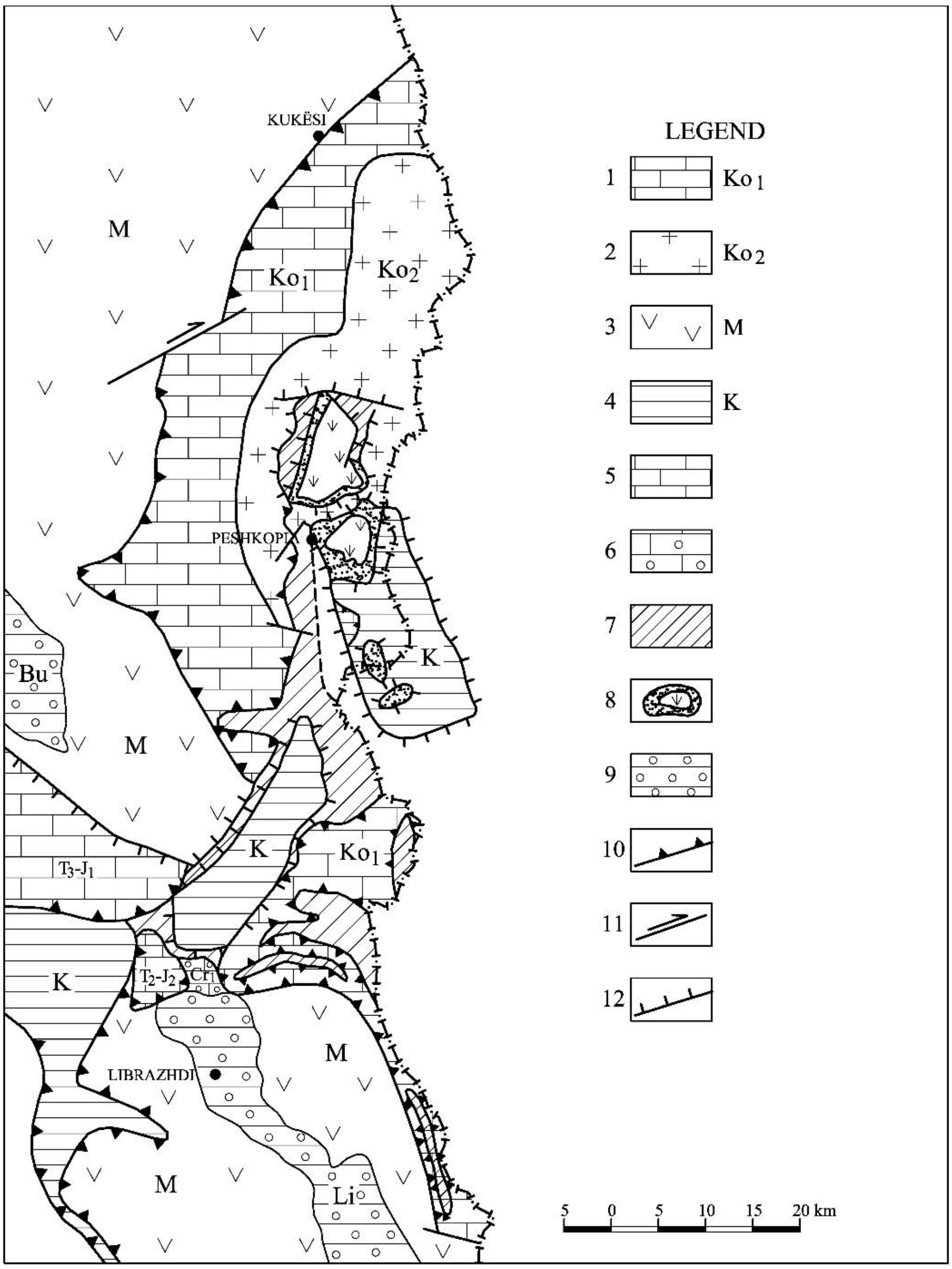


Fig. 2: Tectonic Map of Kukësi-Librazhdi area. Korabi Zone: **1-** Triassic-Jurassic carbonate sequence and **2-** Ordovician-Silurian schist sequence. **3**-Mirdita Zone: ophiolites and their sedimentary cover, **4**- Krasta Zone, **5**- Triassic-Jurassic limestones, **6**- Lower Cretaceous Gosaw, **7**- Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **8**- Kruja Zone evaporite dome surrounded by the Upper Eocene-Lower Oligocene flysch, **9**- Molassic basins: Li- Librazhdi, Bu- Burreli, **10**- Overthrust, **11**- Strike-slip dextral, **12**- Normal fault.

Many investigations about geological structure of our country and especially of Mirdita ophiolites, which are the largest and well-exposed in the western Alpine folded belt, have been carried out by foreing geologists since the 90s in close collaboration with the eminent Albanian personalities in the field of geology. The investigations were carried out in the Mirdita and Korabi zones with a subsequent publication of the results. Here, can mention the contributions of Minella Shallo, Vangjel Melo, Alaudin Kodra, Abedin Xhomo, Kadri Gjata, Selam Meço, Pandeli Pashko, Ismail Turku, Lirim Hoxha, Aleks Vranai, Faruk Mustafa, Kujtim Onuzi, Avni Meshi etc. Consequently, better information about the geological profile of the Mirdita ophiolite Zone has been obtained. The recognized post-emplacement deposits lying on top of ophiolite rocks are an important contribution.

In Polena section, west-southwest of Korça, based on the rich ammonite fauna, the age of pelagic limestone sequence on top of volcanic rocks was determined as Kimmeridgian-Tithonian in (Meço 1977; 1980). A limestone horizon, about 25 m thick, lying on top of volcanic rocks, is represented by biomicritic limestones, which are breccio-conglomeratic biomicritic ones at horizon base. They contain ammonites, aptychus and tintinides.

Three biozonal levels for Kimmeridgian and two biozonal levels for Tithonian have been determined, from down to top, based on collected rich ammonite fauna: Isotypum-Platynota, Acanthicum and Beckeri for Lower, Middle and Upper Kimmeridgian respectively, and Hybonotum and Elimatum for Lower and Upper Tithonian respectively. Upper Jurassic limestones are transgressively overlain by Lower Cretaceous flysch (Meço 1977; 1980).

The Mirdita ophiolite belt is overlain by a sedimentary cover of Upper Jurassic radiolaritic cherts and Tithonian-Lower Cretaceous ophiolitic mélange and flyschoidal sediments. In places, transgressive Cretaceous limestones unconformably overlie the Mirdita ophiolitic rocks. The D_1 compressional event acted during the Eocene-Early Oligocene caused the following nappe stacking: the upper plate of Korabi zone and the overlying ophiolitic belts, and the lower plate of the External Albanides. The Korabi zone together with the overlying Mirdita ophiolites overthrust onto the External Albanides (Kilias *et al*., 2001).

The Mirdita ophiolitic nappe includes a subophiolitic mélange, the Rubic complex, overlain by two ophiolite units, referred as the Western and Eastern units. In the Late Jurassic, the marginal stage developed by the emplacement of the ophiolitic nappe onto the continental margin. In the Early Cretaceous, the final emplacement of the ophiolites was followed by the unconformable sedimentation of the Barremian-Senonian platform carbonates (Bortolotti *et al*., 2005). At the top of the pillow lava basalts, a sequence of radiolarites, referred to as Kaluri cherts and ranging in age from late Bathonian/Early Callovian to Middle Callovian/early Oxfordian were reported in (Marcucci *et al*.,1994; Prela 1994; Marcucci and Prela1996). Both ophiolite sequences, from the W and E units, are unconformably covered by a thick sedimentary sequence that includes the late Oxfordian to Tithonian Simoni mélange (Bortolotti *et al*., 1996) and Berriasian-ValanginianFirza flysch which occurs as a slice into the Rubiku complex (Gardin *et al*., 1996). The Simoni mélange is a sedimentary mélange around 200-300 m thick, characterized by bloks ranging from several centimeters to several hundreds of meters in size, set in a shaly matrix (Kodra *et al*., 1996).

In the Lumi i Zi area, south of Puka, the age of Simoni Mélange based on the dating a cherty-silty level found at the top of the Kaluri Cherts is defined as Late Oxfordian-Kimmeridgian/early Tithonian (Chiari *et al*., 2007).

The Late Jurassic (Kimmeridgian-Tithonian) platform carbonates, detected by clasts in the mass-flow deposits of Kurbnesh area, were deposited on top of the Mirdita ophiolite zone nappe stack, which formed during the Middle to Late Jurassic Kimmeridian orogeny. The shallow-water limestones of Berriasian-Valanginian unconformably overlie the ophiolites from ultramafites to volcanics (partly in Munella Mt.) in the eastern belt of Mirdita region, significally earlier than previously reported (Schlagintweit *et al*., 2008; Gawlick *et al*., 2008). Peza and Marku (2002) assumed a Barremian to Aptian age for the whole Munella carbonate platform.

The compressional deformation stages and tectonic style of Mirdita oceanic basin closure are characterized by interoceanic and marginal bidivergent paleoemplacement during Middle Jurassic until beginning of Late Jurassic time. Triassic and Jurassic ophiolites together with metamorphic sole in between are obducted over the continental margin on both sides of the Mirdita graben megastructure during the Callovian-Oxfordian time interval, named as Mirdita Callovian-Oxfordian deformation stage 2 (M-2 J_2^c-J_3^{ox}). Ophiolites are covered by Middle Jurassic Kaluri radiolarian cherts, the Upper Jurassic

“blocks in matrix” Simoni mélange and the Upper Tithonian-Valanginian Firza flysch overlying them with unconformity (Kodra 2016).
From the well recognized post-emplacement deposits lying on top of ophiolite rocks these conclusions could be drawn: i) the sedimentary sequence of different facies from pelagic limestone (Polena section, Korça area) and cherty silty deposits referred to as Simoni mélange (Lumi i Zi, Puka area) to platformic carbonates (Kurbnesh area) found on top of ophiolitic rocks of Mirdita Zone dates the Late Jurassic (Kimmeridgian-Tithonian) age which proves that nappe stacking of Mirdita ophiolites occurred during the Middle to Late Jurassic time, and ii) the shallow-water limestones of Berriasian-Valanginian age, which unconformably overlie the eastern ophilite nappe(Munella, Mali i Shenjtit areas), were deposited on its uplifted flat relief.
The marly flysch sequence of Tithonian-Valanginian, underlying the different Korabi nappe sheets, and transgressively overlying the imbricated huge ultrabasic bodies found around the Mali I Bardhë tectonic window, is observed southwards up to the periphery of Okshtuni window; it can be consideredthat was accummulated on eastern gently dipping slope of the eastern ophiolite nappe. The shallow-water limestones of Berriasian-Valanginian and the marly flysch sequence found on top of eastern ophiolite nappe unit as two different facial deposits maybe of theLower Cretaceous Age. The new biostratigraphic studies are necessary for better age determination of the marly flysch sequence which overlies the eastern ophiolite nappe.
The stratigrahic data about the ophiolite-bearing conglomerate-marly flysch underlying the Mirdita ophiolite nappe are reviewed based on the data reported in Albania and the stratigraphic data about the Beotian Flysch in Greece. Based on the most recent stratigraphic data from Albania, the ophiolite-bearing conglomerate-marly flysch sequence underlying the Mirdita ophiolite nappe datestheBerriasian-ValanginianAge in GuriiTopit area (Aliaj and Gjata 1979) and at Firza village, west of Rubik (Gardin*et al*., 1996), and from Greece, north of Sperchios transform fault, the Beotian Flysch datesBerriasianage (Terry and Mercier 1971) and Lower Cretaceous age (Aubouin and Bonneau 1977), whereas the Beotian Flysch in Central Greece (south of Sperchios transform fault) is represented by the Lower Beotiandating Tithonian (?)-Aptian Age and the Upper Beotian of Cenomanian-Conacian Age (Nirta *et al*., 2015).
As the Albanides could be placed in the segment between the Shkodër-Peja and Sperchios (Kremasta-Sperchios) transform faults comprising a big folded segment with the same tectono-stratigraphic units in Albania and Greece (Aliaj and Kodra 2016), the stratigraphic data of the ophiolite-bearing conglomerate-marly flysch underlying ophiolites into the segment of Albanides (Albania and Greece) are consistent with their Lower Cretaceous age.
The upper Tithonian-Valanginian flysch sequence overlying the volcanic rocks evidenced in Rreshen-Derveni area of Mirdita zone (Gjata *et al*., 1989). Shallo (1991) reported that ophiolite mélange and Tithonian-Early Cretaceous conglomerate-sandstone-marly flysch with abudant ophiolitic detritus are widespread in the Eastern Albania, overlying transgressively or normally on top of ophiolite sequence through radiolarian cherts of Kimeridgian-Tithonian age, or on the top of carbonate sequence of the periphery of ophiolites.
The two different flysch settings, overlying and underlying the Mirdita ophiolite nappes, are closely related to the development of two Mirdita ophiolite nappe units. New biostratigraphic studies are necessary for better age determination of the ophiolite-bearing conglomerate-marly flysch sequences.

3.2 The Korabi tectono-stratigraphic unit

The Korabi zone is characterized by a Paleozoic basement consisting of the Ordovician to Devonian sequence unconformably covered by a Permo-Triassic clastic sequence grading upward to Triassic-Jurassic carbonate sequence. The Korabi units are deformed in a large antiform showing at its core several Kruja and Krasta tectonic windows and the Tithonian-Valanginian marly flysch sequence underlying the Korabi nappe sheets (Figure 1 and 2).
Xhomo *et al*., (1991b) pointed out that in the region of Peshkopia under the Korabinappeencounter the nappe of Tithonian-Lower Cretaceous flysch, and the Mali i Bardhë and Peshkopia tectonic windows consisting of gypse covered in the periphery by the Paleogene flysch.
The Muhurri nappe boundary, which is bordered by the tectonic windows in the west, extends from Zerqan in the south to Kalla in the north, overthrusting the Tithonian-Valanginianmarly flysch from

Zerqan to Dohoshisht and further the Grama nappe from west of Peshkopia to Vrenjt and the Tithonian-Valanginian marly flysch from Dipjaka to Veleshica River. The Grama subunit nappe, underthrusting the imbricated Korabi subunit nappe, is bordered by Mali i Bardhë tectonic window in the east (Figures 1- 3). Kodra (1986) said that a north dipping normal fault, west-east striking along the VeleshicaRiver, has buried northwards under Korabi nappe the continuation of Peshkopia-Mali i Bardhë evaporite dome that is shown by the uplifted domal shape of the Paleozoic deposits at Vau i Çajës (Figure 3).

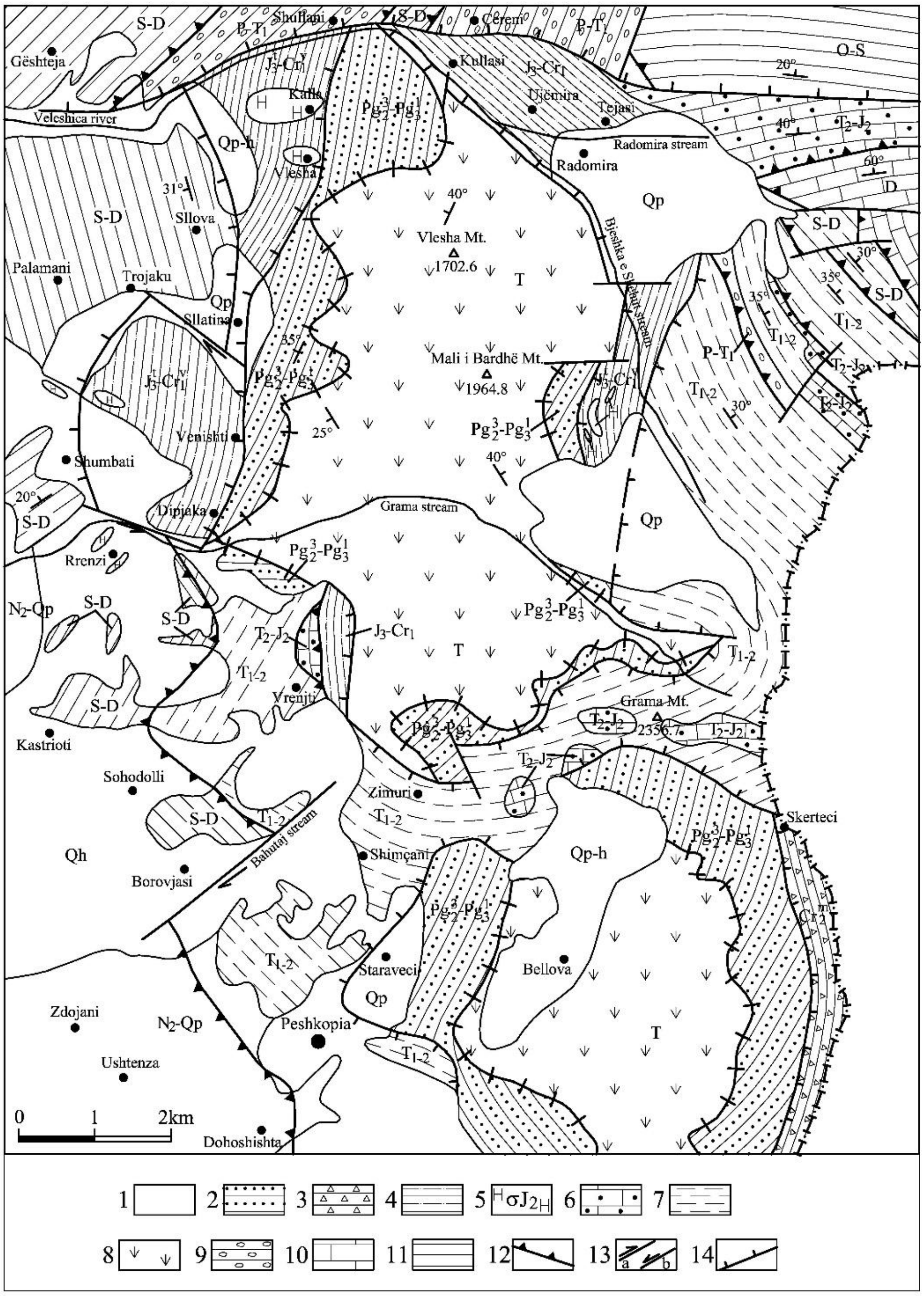


Fig. 3: Geological map of Radomira-Peshkopia area. **1**- Quaternary and Pliocene-Pleistocene sediments, **2**- Upper Eocene-Lower Oligocene flysch, **3**- Maastrichtian flysch sequence, **4**- Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **5**- Middle Jurassic huge ultrabasic outcrops, **6**- Middle Triassic-Middle Jurassic limestones, **7**- Lower-Middle Triassic volcano-sedimentary deposits, **8**- Triassic evaporites, **9**- Permian-Lower Triassic Verrucano, **10**- Devonian limestones, **11**- Ordovician-Silurian-Devonian deposits, **12**- Overthrust, **13**- Strike-slip: a- dextral and b-sinistral, **14**- Normal fault.

It is important to point out that the normal faulting has dislocated the internal domain of Albania during its neotectonic stage of development and has deformed the structure of the Mirdita and Korabi tectono-stratigraphic units and of theCenozoic molassic basins (Aliaj*et al*., 1996;Aliaj 2012; 2018). Here, we can mention the structure within the Korabi Zone where the tectonic windows of Kruja and Krasta tectonic zones are observed due to the extensional collapse of its nappe pile.
The structure of the external zones windows in the region of Peshkopi (Eastern Albania) has been described in (Aliaj 1993). A horst structure has been developed to the east of Dibra graben depression from the Kërçina and Velivari mountains in the south to Mali i Bardhë mountain in the north where several Kruja and Krasta tectonic windows outcrop within Korabi zone terrains. The Okshtuni window northeast extending and the Velivar-Kërçinewindow north extending, developed also to the east of Albanian state border, belong to Krasta zone (Figure 1 and 2).
The Peshkopia, Kërçishti and Dibra e Madhe tectonic windows of Kruja Zone could be met within the Krasta unit of Velivari-Kërçina window. The geological section of Kërçisht window, consisting of Senonian neritic limestones and Paleogene flysch (Kici 1988), shows that it belongs to the Kruja tectono-stratigraphic unit. In Vlesha village, nearby to the Mali i Bardhë tectonic window, an imbricated slice of Krasta unit, consisting of Senonian pelagic limestones and Albian-Cenomanian flysch, overthrusts the Eocene-Lower Oligocene flysch of Kruja unit (Aliaj 1991).
The surrounding of Mali i Bardhë tectonic window is the only area proving the presence of huge ultrabasic bodies showing the roots of ophiolites underlying the Korabi zone. The ultrabasic bodies covered by the Tithonian-Valanginian marly flysch sequence that underlie the nappe sheets of Korabi zone could be only around three sides of Mali i Bardhë tectonic window: in the Kalle, Vlesh, Dipjake and Vrenjt to the west, in Biçaja pass (Varri i Sejmenit) and Bjeshka e Shehut stream to the east and in Radomira area to the north of it (Figure 1 and 2 and Figures 3-9).
The Grama nappe borders on the west, the south and the east the Mali iBardhë tectonic window with the exception of a sector from the Veleshica river to Dipjaka village where the Muhuri nappe contacts the Tithonian-Valanginian marly flysch whereas further to south it follows from Vrenjt to the Bahutaj stream dextral strike-slip (Figure 3). The imbricated sequences of Grama subunit nappe, underthrusting by the imbricated sequences of Korabi subunit nappe, border from the east the Mali i Bardhë window. It is bordered by Mali i Bardhë window in the south and the Peshkopia window in the north (Figure 3).
The Vrenjti ultrabasic body,transgressively overlain by the Upper Jurassic-Lower Cretaceous marly flysch, is thrust by Grama nappe which in its turn is thrust by the Muhurri nappe which shows that the same geological situation could be followed in the sector on its north, from the Dipjaka village to Velshica River where the Grama nappe sequences underthrust the Muhurri nappe (Figures 3-7).
The Tithonian-Valanginian marly flysch sequence of grayish colour with the Kostenje-Okshtun-Çerenec region (Naço *et al*., 1987) to the Mali i Bardhë tectonic window extention (Naço *et al*., 2012; Aliaj 1991; 1993) underlies the Triasic-Jurassic limestone and Silurian-Devonian terrigenous formations of Korabi zone (Figures 1- 3).
Two important issues in Naço *et al*., (1987) are here pointed out. The marly flysch sequence of Tithonian-Valanginian age delimits with the new flysch of Maastrichtian-Middle Eocene through normal faults that are observed into two cases: i) the normal fault of very high dipping angel north of Sebisht, and ii) the high dipping angel (50^o) normal fault in the eastern flanc of Kostenja anticline (Naço *et al*., 1987). Such data prove that the Okshtuni tectonic window, consisting of Maastrichtian-Middel Eocene flysch deposits, has been formed due to the normal faulting that has dislocated it during Late Miocene to recent extensional tectonism, as the all tectonic windows could be met within Korabi zone. Two enechelon Kostenja and Okshtuni anticlines prove that the normal faults having a marked strike slip component, i.e. transtensional faults, have conditioned the formation of Okshtuni window.
The fault created by the earthquake of November 30, 1967, 10 km long, northeast striking 40^o, from Pervalla pass to Prodan quarter of Zabzun village, caused the subsidence of northeastern block. It was 30-50 cm wide and its vertical displacement varied from 20cm to 50 cm. In Prodan, a two-story stone building was distroyed, eastern part of which subsided 50 cm compared with its western part (Sulstarova and Koçiaj 1980). The seismic fault determined from focal mechanism solution of the earthquake of November 30, 1967 shows a normal fault-dextral strike-slip (Sulstarova 1997) or a normal fault-strike slip (i.e. a transtensional fault) (Muço 2007) that generated this earthquake. All the aforementioned data prove that the transtensional faults created the Okshtuni window of Krasta unit (Figure 2 and 12).

The breccio-conglomerate packet consisting of a mixture of the broken into the pieces of the ophiolite rocks mainly rich in ultrabasic rocks (dunite, serpentinised peridotite etc.) could be met in some places e.g. in Ballenja where probably a broken massif of ultrabasic rocks exists. The same geologic situation is found in other places where effusive rocks have broken into pieces (Naço *et al*., 1987).
The Russian word 'tectoniceskoemesivo'and the French tectonic "mélange", mainly of ophiolite content refer to the "breccio-conglomerate packet". The ophiolitic mélange is generally formed at the floor of tectonic nappes consisting of ophiolite rocks.
The observed "breccio-conglomerate packet" (i. e. "the ophiolitic mélange") shows in the Lunik-Klenje area the presence of an ultrabasic massif broken into the pieces on its upper part due to the displacement onto its surface of the Korabi Triassic-Jurassic nappe. It is also proved by the ophiolite outcrops here occured.
The tectonic windows of Kruja and Krasta units within the Korabi Zone have been formed due to the Late Miocene to present extensional tectonism, accompanied by normal faulting and evaporite diapirism which created cupola pattern horsts, that favoured the erosion of the Mirdita and Korabi upper nappe sheets, that are seen only at the margins of the Mali i Bardhë tectonic window of Kruja Zone and of the Okshtuni and Velivar-Kërcine tectonic windows of Krasta Zone.
The geological profile of Korabi tectono-stratigraphic unit, including the several tectonic windows of Krasta and Kruja units into its core, shows from top to bottom the following stack of nappe sheets: Korabi nappe, Mirdita ophiolite nappe transgressively covered by the Upper Jurassic-Lower Cretaceous marly flysch and Krasta nappe overlying the Kruja "autochthon".

4. THE ULTRABASIC BODIES OBSERVED IN THE FIELD OF KORABI ZONE

The tectonic structure of the Korabi zone shows many examples of nappe structures deformed by normal faulting. The ophiolite bodies could be met along the normal faults, at the frontal part of Korabi zone up to Korabi Highland and at the nappe boundaries surrounding the Mali i Bardhë tectonic window of Kruja zone. Many serpentinite belts of tens meters wide and some km long, could be met in the carbonatic periphery, in the east of Mirdita ophiolites (Aliaj 1991; 1993).
The data in the forthcoming paragraph provide information about the ultrabasic rock outcrops found around the Mali i Bardhë tectonic window and were first reported in (Hoxha 2000; 2001; Hoxha *et. al*., 2003; 2007; Gjata *et. al*., 1984; 1987).
The ultrabasic rocks are generally found in limited dimensions. In Radomira-Bjeshka e Zonjave area, the ultrabasic outcrops, rarely with considerable dimensions and large extent, are observed from Korabi Highland, Kalle, Vleshë, Dipjakë, Trojak, Shumbat and Renz up to the Pocest and Katund i Vogël of Maqellara area in the south. The ultrabasic rock bodies could be met in the Rosniku pass, Panaire field, Krasta e Preshit, Bjeshka e Shehut stream, Upper Rocks of Pëllumbave in Bjeshkët e Shehut, and in the surroundings of the Varri i Sejmenit. The most ultrabasic rock outcrops considered of diapiric type could be found along normal faults dislocating the Triassic-Jurassic limestones and Paleozoic (Ordovician-Devonian) terrigenoues deposits of Korabi zone.
Information about the buried ultrabasic rocks was obtained applying the prospecting magnetometric method. Here, we can mention the buried ultrabasic rocks in Panaire field, Krasta e Preshit, Upper Rocks of Pëllumbave in Bjeshka e Shehut where the BH-4 revealed the serpentinites or serpentinized peridotites at a depth of 11 m (Kodra *et al*., 1986; Hoxha 2001).
The serpentinized ultrabasic manifestations are found at the Sorokoli mountain-foots, in the east of Ujëmira village and in northeast of Tejs village between the Jurassic-Cretaceous flysch deposits with tens meters long and over 10 m wide (Bushi *et. al*., 1980; Gjata *et. al*., 1984; Hoxha 2001).
The most studied outcrops of ultrabasic rocks are found in the Radomira-Bjeshka e Zonjave area as follow: the Rosnik pass (Pyramid No 2), Panaire field, Krasta e Preshit, Preshi dairy-huts,Varri i Sejmenit with the greatest lense of ultrabasic rocks (750 m long and over 75 m wide) and some other outcrops of small dimensions as Bjeshka e Shehut (40 m long and over 10 m wide) (Kodra *et. al*., 1986; Hoxha 2001), as well as those over Ujëmira and Tejs villages (50x20 m) (Gjata *et. al*., 1984; 1987; Hoxha 2001).
The ultrabasic bodies found in Radomira-Bjeshka e Zonjave area have an imbricated shape (Kodra *et al*., 1986). Of great interest is the study of the Kalla village outcrop of 1200 x 700 m associated with 6 outcrops of 750 x 100 m, some 100 x 50 m up to 70 x 30 m dimensions; the Vlesha village with two

separate outcrops of 250 x 30 m; the Dipjaka village with some outcrops of small dimensions up to tens meters, and the Shumbat village with some outcrops of 100 x 50 m dimensions.
The ultrabasic outcrops with average dimensions 300 x 20 m and of lens type encounter to the east of Rrenz village and to the west of Vrenjt village. The outcrops of small dimensions; some metres wide and 15-20 m long could be met in the Maqellara area, at the Maqellara stream to the northwest of Kërçishti i Poshtëm village, where the Pleistocene deposits are developed, and the Middle Triassic-Middle Jurassic limestones are north-south extended on both sides of the stream.
The ultrabasic rock outcrops in the Muhurri-Çaja subzone, nearby to Bulaçi stream are found of some meters wide within the Silurian-Devonian schists (Qirici *et al*., 1982; Hoxha 2001), as well as in the area of Draj pass of Reç i Dibrës, near to the Doda most-Skavice road, and near to the Veleshica River.
The ultrabasic outcrops could also be met in North Macedonia, in the Western region of the Macedonian Zone (=Korabi Zone), which is dislocated by the regional faults deviding it into 5 segments with characteristical rock formations, from east to west as follows: Pelister-Shar, Dibër-Stogo, one part of Krasta-Cukali zone, Petrin-Karaorman and Jablanica segments. The Petrin and Jablanica western segments consistingmainly of Middle-Upper Triassic limestones have the eastern vergence (Arsovski 1997),like in Peshkopia, and they aresouthwards extended up to Prespa lakes.
The Jurassic complex observed in most western sectors of North Macedonia which belongs to the Mirdita zone comprises the ophiolites and the flyshoids considered dating Jurassic-Lower Cretaceous age (Arsovski 1997). The ophiolite outcrops are evidenced in Jablanica and Stogo as well as into the separate bodies in Suteska Reka, Karaorman and to the south of Kicevo (Kërçova). The serpentinised peridotites are found in the shape of small diapiric bodies along the regional faults cutting the old Paleozoic deposits. The diapiric serpentinized peridotites outcrop along the active faults as follows: Boiski north striking long fault 9 cutting the Paleozoic deposits, Pelister-Shar Highland segment; north striking long fault 20 disrupturing the Paleozoic deposits near to the eastern border of Ohrid Lake, Galicica, Petrin-Karaorman segment; long fault 22 of submeridional striking about 20 km long and fault 23 about 10 km long, Jablanica segment, here disrupturing the Middle-Upper Triassic limestones (Arsovski 1997).
Theultrabasic bodies along the normal faults cutting the depositional sequences of the Korabi Zone, and the imbricated ultrabasic bodies transgressively covered by the Tithonian-Valanginianmarly flysch around the Mali i Bardhë tectonic window of Kruja zone underlying the nappe sheets of Korabi Zone could be met within the Korabi zone-both settings proving the existence of ophiolite massifs under the Korabi units and are here descibed.

4.1 The ultrabasic bodies observed along normal faults cutting the depositional sequences of the Korabi Zone

Many ophiolite bodies are found along normal faults, more than 25 km to the east of Lura and Bulqiza ultramafic massifs from the frontal part of Korabi Zone (Selishtë, Lan-Lure, Draj-Reç and Resk) up to Korabi Highland (Stanët e Preshit, Avdanicë, Fusha e Panaireve, Piramida 2 etc.), and to the surroundings of the Mali Bardhë and Peshkopia evaporite tectonic windows (Kallë, Vleshë, Dipjakë, Trojak, Shumbat, Renz, Vrenjt, Radomire, Tejs, Biçaja pass, Skertec, stream between Pocest and KatundiiVogël, Maqellara area etc.) (Melo 1966; 2002; Bushi *et al*., 1980; Qirici *et al*., 1982; Kodra *et al*.,1986; Gjata *et al*., 1984;1985; 1987; Qirinxhi *et al*., 1991; Aliaj 1991; 1993; 2018; Aliaj and Meço 1994; Hoxha 2001;Xhomo*et al*., 1991; 2002b).
It is important to mention some ultrabasic outcrops along the normal faults cutting the Middle-Triassic-Jurassic limestones and Silurian-Devonian terrigenous deposits of Muhurri subzone. The ultrabasic rocks of considerable width could be met along the normal faults cutting the nappe of Triassic-Jurassic limestones at Lukani stream and in Lane-Lure. The belts of ultrabasic rocks of around 50 m wide could be met along the normal faults, at the contact between the Triassic limestones and Paleozoic deposits in Draj-Reçi, Reska and Skavica. A big body of ultrabasic rock, more than 200 m wide cutting the Silurian-Devonian terrigenous deposits was found in Venisht, at the Peshkopia-Kukësi new road.
The ultrabasic bodies along the normal faults cutting the different Korabi sequences prove the existence of ophiolite massifs underlying them (Aliaj and Meço 1994). They are considered as diapiric serpentinite bodies. Kodra and Bushati (1991) and Xhomo *et al*., (2002b) said that these serpentine bodies wereformed in the continental margins during the final stage of synrift magmatism.

4.2 The imbricated ultrabasic bodies transgressively overlain by the Tithonian-Valanginian marly flysch around the Mali i Bardhë tectonic window of Kruja Zone underlying the nappe sheets of Korabi Zone

Figure 3 depicts the imbricated ultrabasic bodies transgressively overlain by the Tithonian-Valanginian marly flysch underlying the nappe sheets of Korabi zone located around the three sides of Mali i Bardhë tectonic window of Kruja unit: in the Kallë, Vlesh, Dipjakë and Vrenjt in the west, in the Biçaja pass (Varri i Sejmenit) and Bjeshka e Shehut stream in the east and in Radomira area in the north.
The geological setting of ultrabasic bodies underlying the Korabi nappe sheets (Aliaj 1991; 1993; Aliaj and Meço1994), the geological maps of Albania at the scale 1:200.000 (1983; 2005), the neotectonic map of Albania at the scale 1:200.000 (Aliaj *et al*., 2018), the geological map of Kërçisht-Sorokol area at the scale 1:100.000 (Hoxha 2001) and the geological maps of the Peshkopia and Korabi areas at the scale 1:50.000 (adopted by Onuzi and Pulaj 2005; Hoxha *et al.*, 2007 respectively) were used for the compilation of the geological map of Radomira-Peshkopi area at the scale 1:50.000 (presented here at the scale 1:100.000) (Figure 3).
The geological cross-sections for all the well known ultrabasic bodies around the Mali i Bardhë tectonic window were compiled based on the geologic map of Radomira-Peshkopi area (Figure 3) and on the topographic map of Sllova area at the scale 1:25.000.
The Kalla, Vlesha and Dipjaka ultrabasic bodies, transgressively overlain by the Upper Jurassic-Lower Cretaceous thick marly flysch sequence, delimite with Upper Eocene-Lower Oligocene flysch of Mali i Bardhë tectonic window by a normal fault, and border with the Silurian-Devonian deposits of Muhurri nappe by also a normal fault (Figure 3).
The Kalla ultrabasic bodies could be met in the bigest outcrop 1200 x 700 m associated with 6 outcrops 750 x 100 m, some 100 x 50 m up to 70 x 30 m. The outcrops of ultrabasic rocks consist of serpentinized peridotite and fresh dunite rocks transgressively covered by a belt around 2 km wide of the Upper Jurassic-Lower Cretaceous marly flysch sequence which delimits with Upper Eocene-Lower Oligocene flysch of Mali i Bardhë evaporite dome by a normal fault of high dipping angel. The nappe of Silurian-Devonian deposits of Muhurri subunit borders with the Upper Jurassic-Lower Cretaceous marly flysch overlying the ultrabasic rocks by a normal fault (Figure 3 and 4).

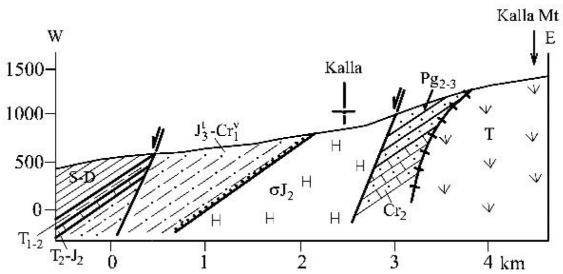


Fig.4: Kalla ultrabasic body geological section.

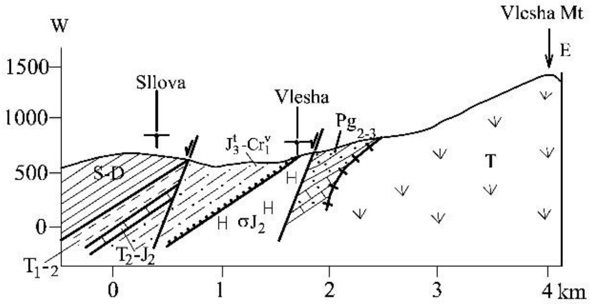


Fig. 5: Vlesha ultrabasic body geological section.

The Vlesha ultrabasic bodies could be found in two separate outcrops of dimensions 250 x 30 m. The Vlesha ultrabasic bodies are reported in (Aliaj 1991) who showed that the fresh ultrabasic rocks are covered by the Upper Jurassic-Lower Cretaseous marly flysch. The Ultrabasic bodies of Vlesha village are transgressively covered by a belt about 2 km wide of the Upper Jurassic-Lower Cretaceous marly flysch. The outcrop of ultrabasic rocks borders by a normal fault ofhigh dipping angel with Upper Eocen-Lower Oligocen flysch of Mali i Bardhë tectonic window of Kruja zone. The nappe of Silurian-Devonian deposits of Muhurri nappe delimits with the Upper Jurassic-Lower Cretaseous marly flysch by also a normal fault (Figure 3 and 5).
The Dipjaka ultrabasic bodies could be found in some outcrops of small dimensions' up to tens meters long and of lens type. The Upper Jurassic-Lower Cretaceous marly flysch that transgressively covers the ultrabasic bodies could be met in the area from the Dipjaka to Venisht villages outcrops of more than 2.5

km long and wide. It borders the Upper Eocene-Lower Oligocene flysch of Mali i Bardhë evaporite dome by a normal fault of high dipping angel. The nappe of Silurian-Devonian deposits delimites with the Upper Jurassic-Lower Cretaceous marly flysch sequence by a normal fault too (Figure 3 and 6).

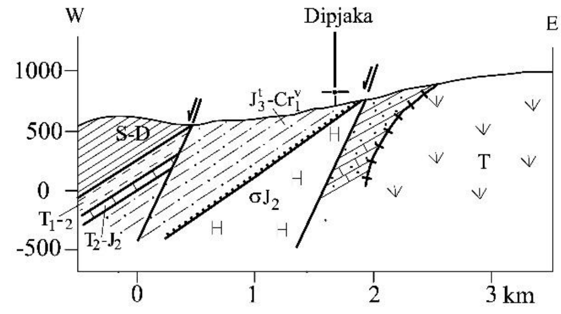


Fig.6: Dipjaka ultrabasic body geological section.

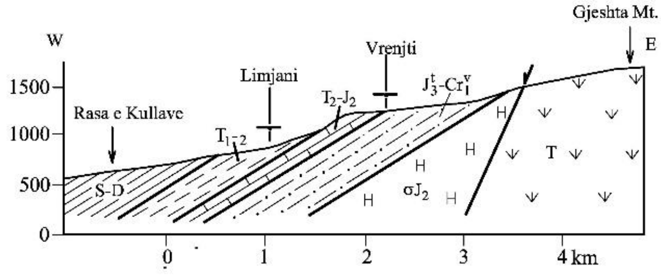


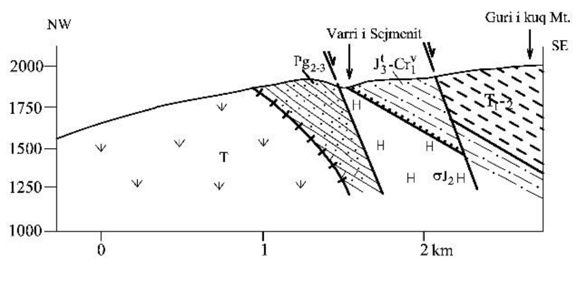
Fig. 7: Vrenjti ultrabasic body geological section.

The Vrenjti ultrabasic bodies are observed in many lens type outcrops of average dimensions (300m long and over 20 m wide) that are transgressively overlain by the Upper Jurassic-Lower Cretaceous marly flysch of about 500 m wide. They are thrust by sequences of Grama nappe which in its turn is thrust by the Silurian-Devonian deposits of Muhurri nappe (Figure 3 and 7).

The Biçaja pass (Varri i Sejmenit), Bjeshka e Shehut and Radomira ultrabasic bodies transgressively overlain by the Upper Jurassic-Lower Cretaceos marly flysch sequence are dislocated in both sides by normal faults (Figure 3).

The Biçaja pass (Varri i Sejmenit) ultrabasic bodies were for the first time reported in (Gjata *et al*., 1984; 1987). An ultrabasic lens shape body transgressively covered by the Upper Jurassic-Lower Cretaceous flysch could be met about 70-80 meters below the Biçaja pass, to north-east of Mali i Bardhë evaporate dome, along a fault of high dipping north-east striking angel. The dimensions are 120 x 30 meters and it is followed towards south-west by the other ultrabasic body outcrops. Gjata *et al*., (1984) underlined that the presence of ultrabasic rock bodies is a typical phenomenon in the area of evaporite dome, although they are found also in the midst of Silurian-Devonian (Presh, Korabi highland), Triassic (Fshat), Jurassic-Cretaceous (Radomiraetc.), Cretaceous and Cretaceous-Paleogene (Kallë, Vleshë), Eocene (Tejs, Radomira, Dipjaka etc.) and near to Middle Miocene deposits.

The Biçaja pass ultrabasic outcrop is named "Varri i Sejmenit" by Hoxha (2000; 2001) who pointed out that the best studied outcrops of ultrabasic rocks are those observed in the Radomira-Bjeshka e Zonjave area where the Varri i Sejmenit ultrabasic bodies with the greatest lens of ultrabasic rocks: 750 m long and over 75 m wide could be met. The ultrabasic body transgressively covered by the Upper Jurassic-Lower Cretaceous marly flysch sequence is located near to the evaporite dome, along a normal high dipping angel fault, northeast extending, between the Upper Eocene-Lower Oligocene and Late Jurassic-Lower Cretasous flysch deposits. The Upper Jurassic-Lower Cretaceous flysch that covers the ultrabasic body of Varri i Sejmenit outcrop is dislocated by a normal fault south-east dipping at the border of the nappe of Lower-Middle Triassic deposits (Figure 3 and 8).



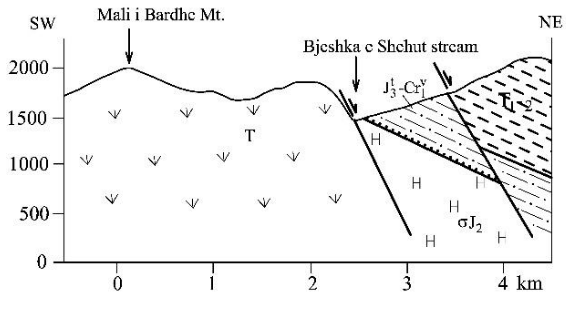


Fig. 8: Varri i Sejmenit geological section.

Fig. 9: Bjeshka e Shehut stream ultrabasic body section.

The ultrabasic bodies of Bjeshka e Shehut stream are found in lens type ophiolite outcrops, 40m long and over 10 m wide, transgressively covered by the Upper Jurassic-Lower Cretaceous flysch deposits which are developed in a less than 1 km wide belt. They delimit the Mali i Bardhë evaporate dome by a normal high dipping angel fault and the Upper Jurassic-Lower Cretaceous flysch borders with the nappe of Lower-Middle Triassic deposits by a normal fault north-east dipping (Figure 3 and 9).

The Radomira ultrabasic bodies are found in many outcrops in the Radomira area, 50 x 20 m, like in Tejas, Ujëmira etc. that are transgressively covered by the Upper Jurassic-Lower Cretaceous flysch sequence of about 2 km wide. They delimite the Mali i Bardhë evaporite dome by a normal high dipping angle fault. The imbricated nappes dislocated by Veleshica River normal fault passing at the border between the Middle Triassic-Middle Jurassic limestone nappe sequence and the nappe of Ordovician-Silurian deposits could be here met (Figure 3 and 10).

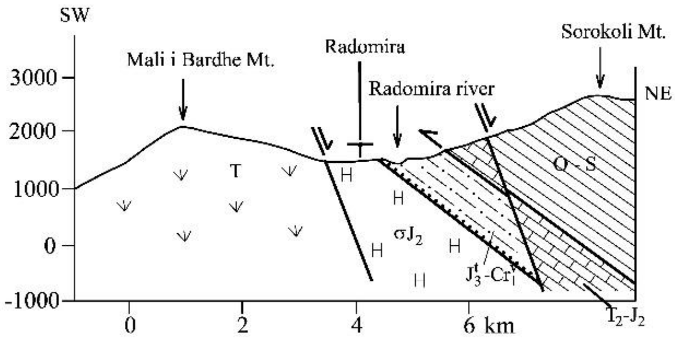


Fig. 10: Radomira ultrabasic body geological section.

The analyzed cases of the imbricated huge ophiolite bodies transgressively covered by the Tithonian-Valanginian marly flysch around the Mali i Bardhë tectonic window of Kruja unit underlying the Korabi nappes prove the existence of the Mirdita ophiolite nappe thrusted by the Korabi one at the top.

The Upper Jurassic-Lower Cretaceous marly flysch could be used as a geological criterion to find the Mirdita ophiolites underlying it within the Korabi tectono-stratigraphic unit. It could be seen at Lunik-Klenjë nappe tongue of Triassic-Jurassic limestones that overlie the ophiolites covered by the Late Tithonian-Valanginianmarly flysch (Figure 12).

The occurrence of a slice consisting of Upper Jurassic-Lower Cretaceous ophiolite-bearing mélange, associated with huge serpentinite bodies, detected in Peshkopia and Sllatinatectonic windows, has been interpreted in (Bortolotti *et al*., 2005) through the mechanism of out-of-sequence thrusting. The proposed reconstruction includes: i) the thrusting of the coupled Mirdita ophiolite nappe and Pelagonian units onto the Krasta-Cukali unit in Early Oligocene time, and ii) the subsequent out-of-sequence thrust in Miocene time that affected the advancing front of the Mirdita nappe (i.e. Upper Jurassic-Lower Cretaceous ophiolite-bearing mélange and associated serpentinite bodies) today found in the Peshkopia and Sllatina tectonic windows. This event could have produced a tectonic structure where the Krasta-Cukali unit and the oceanic derived slices are thrust from the Pelagonian units with Mirdita ophiolite nappe at the top.

The cases of the imbricated huge ophiolite bodies transgressively covered by the Tithonian-Valanginian marly flysch found around the Mali i Bardhë (Sllatina) tectonic window of Kruja unit that underlie the Korabi nappe reportquite a different geological situation from that described in (Bortolotti *et al*., 2005).

The Upper Jurassic-Lower Cretaceous flysch that underliesthe Korabi nappe was wrongly considered in (Xhomo *et al*., 1991b; 2002b; Bortolotti *et al*., 2005; Kodra 2016) when stating that it belongs to the Krasta zone or to the Ostreni subunit of Krasta zone. The stratigraphic succession from the Tithonian-Valanginian Early flysch deposits to the Albian-Cenomanian-Turonian Early flysch ones is missing in the Krasta Zone. The known Early flysch in the Krasta zone in Albania and Pindos zone in Greece has the same Albian-Cenomanian-Turonian age (Aliaj and Kodra 2016).

5. Peculiarities of gelogical structure transecting across the Mirdita and Korabi tectono-stratigraphic units

The peculiarities of geological structure transecting across the Mirdita and Korabi tectono-stratigraphic units from the Radomira-Sllova area in the north to the Leskoviku-Kolonja area in the south, are presented by the following geological cross-sections: i) Kunora e Lurës-Mali i Bardhë-Korabi Mountain, ii) Dajti Mountain-Krasta-Trebisht, iii) Radokal i Poshtëm-Lin, iv) Kamenica-Babani-Shueci, and v) Postenan-Gramos Mountain-Gramos-Arrenes Mountains. A longitudinal geological-geophysical section transecting along the Lura, Bulqiza and Shebeniku ultrabasic massifs is also presented.
The Triassic-Jurassic age of the carbonate sequence of Korabi unit is presented in the figures and geological sections based on the Geological map of Albania at the scale 1:200.000 (Xhomo *et al*., 2005) and Monography "Geology of Albania" (Xhomo *et al*., 2002b). It is necessary to note that the carbonate sequence developed from Muhurr-Çaja to Korabi Highland subunits is documented based on the conodonts from Upper Spathian to Norian Age (Meço 2010) that developed in Mbasdeja and Gjallica subunits considered as belonging to Mirdita zone, directly to the east of ophiolite massifs, also is documented of Triassic age (Meço 2010; Meço and Nazaj 2018).
Aliaj (1998; 2012), Aliaj *et al*., (2018), Pashko and Aliaj (2018) emphasized that the normal faulting tectonics developed during the Late Miocene- Quaternary neotectonics time period dislocated the fold and thrust structure in the long and wide area under investigation that is included into the internal domain of extensional regime.
The character of nappe emplacement of the border between Mirdita ophiolites and Korabi zone is well seen in Qafmurrë and Lunik-Klenje nappe tongues of Triassic-Jurassic limestones that overlie the ophiolites covered by the Late Tithonian-Valanginian marly flysch sequence, whereas latter (i.e. during neotectonic period) other part of such border was dislocated by normal faults.
The Triassic-Jurassic limestones in Qafmurrë nappe tongue overlie the ophiolites transgressively covered by the Upper Tithonian-Valanginian marly flysch, and by the Lower Cretaceous limestones at Varrosh, west of Qafmurra village, proving their end of Cretaceous nappe emplacement. The Kurbneshi-Skavica dextral strike-slip with a normal faulting component has displaced the Lura ultrabasic massif overlain by Cretaceous limestones and the border between the Mirdita ophiolites and Korabi zoneTriassic-Jurassic limestones (Figure 1 and 2).
A normal fault, 40 km long, north striking, marked with a thin 200-400 m wide ultrabasic belt, has dislocated the Triassic-Jurassic limestones of Korabi zone nearby the border with Lura and Bulqiza ultrabasic massifs and cuts from the east the Qafmurra nappe tounge at Selishta village. This normal fault is well seen north of Selishta, from Lukani to Thatë stream up to Lane-Lura and Ndershena at Kurbnesh-Skavica strike-slip, about 2-4 km from the border of Lura ultrabasic massif and southwards of Selishta up to Fushë-Bulqiza too, near the border with northern part of Bulqiza ultrabasic massif (Shehu *et al*., 1983; Xhomo *et al*., 2005).
Another normal fault of about 80 km long, north striking, has dislocated the Triassic-Jurassic limestones of Korabi zone outside the Albanian border. It cuts east of Trebisht village, the Triassic-Jurassic limestones of Lunik-Klenje nappe tongue and follows the western border of Ohrid Lake and Drini i Zi River up to Dibra graben basin.
The Dibra graben basin in the north and the Ohrid Lake graben basin in the south are aligned along the Drini i Zi fault zone, north-south striking. A great graben basin 8 to 10 km wide and 35 km long extends from the south of Veleshica river to Dibra e Madhe town. It is delimited through normal faults with the north-south extending mountain horsts on both sides: the Triassic-Jurassic limestones of Korabi zone in the west, and the tectonic windows of Mali i Bardhë and Peshkopia of Kruja zone, and the Velivar-Kërçina window of Krasta unit, including small Kërçisht and Dibra e Madhe windows of Kruja zone, in the east (Figure 2).
The Figures 4-10 depict the ultrabasic bodies overlain by Tithonian-Valanginian marly flysch which are buried under Korabi nappe sheets west, north and east of the Mali i Bardhë tectonic window of Kruja zone. The nappe of Muhurri subunit delimits by normal faults with the ultrabasic bodies covered by Tithonian-Valanginian marly flysch from Kalla to Dipjaka, and two east-verging anticlines built by the

overturned Triassic-Jurassic limestones and the Lura ultrabasic massif which are separated from each-other by normal faults follow on its west (Figure 11).

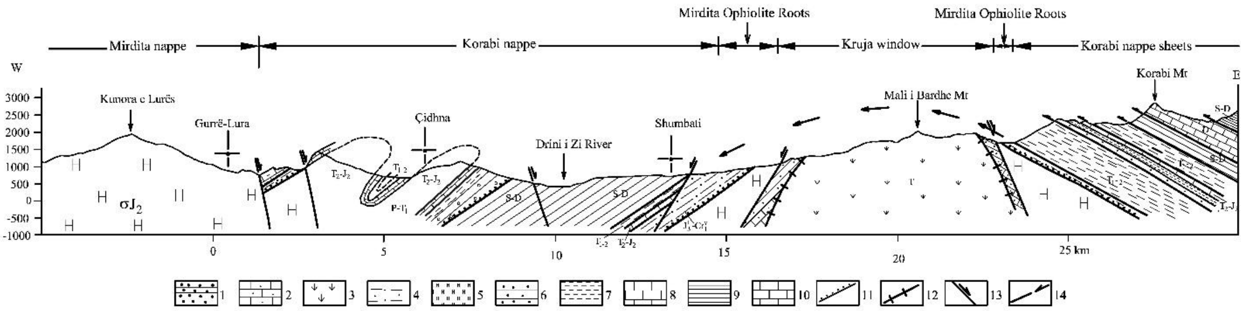


Fig. 11: Kunora e Lurës-Korabi Mt. Geological Section. Kruja Zone: **1**- Upper Eocene-Lower Oligocene flysch, 2- Late Cretaceous neritic limestones, **3**- Triassic evaporates. Mirdita Zone roots: **4**- Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **5**- Middle Jurassic huge ultrabasic bodies. Korabi Zone: **6**- Permian-Lower Triassic Verrucano, **7**- Lower-Middle Triassic terrigenous deposits, **8**- Middle Triassic-Middle Jurassic limestones, **9**- Silurian-Devonian schists, **10**- Devonian limestones,**11**- Transgressive setting, **12**- Tectonic contact, **13**- Normal fault, **14**- E-W displacement of Korabi nappes.

The Figure 11 depicts a stack of 6 nappe sheets of different age of Korabi tectono-stratigraphic unit overthrusting the ultrabasic bodies covered by Tithonian-Valanginian marly flysch to the east of Mali i Bardhë window up to Korabi Mountain Highland.

The Okshtuni window of Krasta zone northeast striking consists of Maastrichtian-Middle Eocene flysch outcropping from Neshta to Çerenec villages and of Upper Cretaceous (Senonian) limestones found in a small outcrop at Çerenec village (Kici 1989). The Tithonian-Valanginian marly flysch surrounds the new flysch deposits of Okshtuni window, delimiting it by normal faults (Figure 2 and 12).

The following opinions have arisen about the the setting of the Tithonian-Valanginian flysch in Okshtuni window: i) belonging to the Mirdita nappe underlying the Korabi nappe (Aliaj 1993; 2012), ii) a nappe emplacement onto the Okshtuni anticline and in the same time as a packet overlying the Triassic-Jurassic limestones in the Okshtuni anticlinal structure (Naço *et al*, 1987; Naço and Hamiti 1998), iii) overthrusting the Maastrichtian-Eocene flysch of Okshtuni tectonic window, in the Trebisht tectonic window underlying the Triassic-Jurassic limestones or belonging to the Ostreni Subzone composed of the Tithonian-Cenomanian sandstone-claystone-marly Early Flysch, the Upper Cretaceous limestones with Globotrucana and the Maastrichtian-Eocene flysch (Xhomo *et al*., 2002b; Kodra 2016).

The Tithonian-Valanginian marly flysch outcrops under the Triassic-Jurassic limestones and Lower Paleozoic terrigenous deposits in Trebisht and Zerqan, in Shupenzë and Dovolan, and follows in the Sllova and Radomira area around the Mali i Bardhë Kruja window where it covers transgessively the ultrabasic bodies observed there (Figure 2 and 3). The normal faulting has dislocated and sunk the Mirdita and Korabi nappe sheets.

A small nappe of Triassic-Jurassic limestones is emplaced in Muzhaq and near to it, another klipe of the Lower Cretaceoous limestones in Zdrajsh was displaced far from here after the end of Cretaceous time. The Figure 2 depicts the marly flysch of Tithonian-Valanginian underlaying the Muzhaqi Triassic-Jurassic limestones and Zdrajshi Lower Cretacoues limestones.

On the west of the nappe of Bulqiza ultrabasic massif and on its east-southeast, passing the Okshtuni window of Krasta unit, two nappes of Triassic-Jurassic limestones could be met (Figure 2). Aliaj (1987) said that the upper nappe consisting of Triassic-Jurassic limestones of Korabi zone, and the lower nappe consisting of Mirdita ophiolites unconformably overlain by the Tithonian-Valanginian flysch which in turns overthrusts the Krasta flysch nappe could be met in the Mali me Gropa region. The nappe of Triassic-Jurassic limestones overlying the Tithonian-Valanginian marly flysch that transgressively cover the ultrabasic rocks of Mirdita zone is observed in the Lunik-Klenjae nappe tongue of Korabi zone. In both sides of Trebishti window it overthrusts the Silurian-Devonian deposits that in turns overthrust the Tithonian-Valanginian marly flysch (Figure 12).

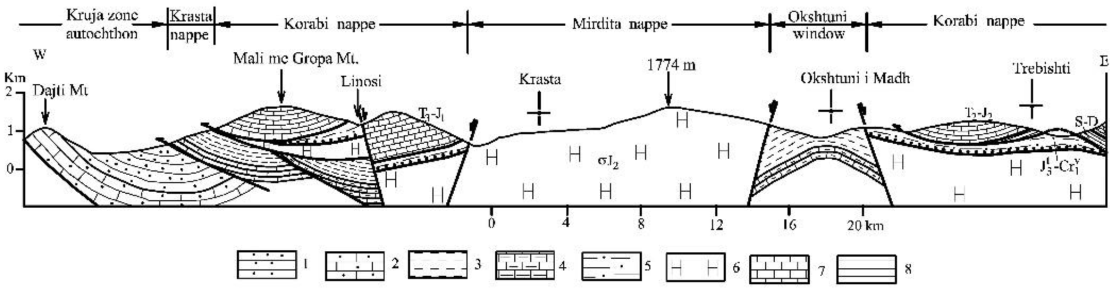


Fig. 12: Dajti Mountain-Trebisht Geological Section. Kruja Zone: **1-** Upper Eocene-Lower Oligocene flysch, 2- Late Cretaceous neritic limestones. Krasta Zone: **3-** Latest Cretaceous-Eocene flysch, **4-** Late Cretaceous pelagic limestones. **5-** Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **6-** Middle Jurassic ultrabasic rocks, **7-** Triassic-Jurassic limestones, **8-** Silurian-Devonian schists.

The Drini i Zi normal fault zone follows the valley of Drini i Zi River from Ohrid Lake to Dibra graben basin and southwards it is associated with the Korça and Erseka basins. The Ohrid Lake and Great Prespa Lake graben basins are bordered by normal faults on both sides having the Mali i Thatë-Galiçica Mountain horst in between. The Korça, Erseka and Devolli half-graben basins border by a normal fault on their eastern side.

The allochthtonous Upper Triassic-Lower Jurassic limestones overlying the Pogradeci ultrabasic massif in Radokal i Poshtëm village (Guri i Çukës Mt.) and the Shebeniku-Jablanica ultrabasic massif at Skroska village could be met in the Përrenjasi area. Parts of such small limestone nappes are covered by the Upper Oligocene molasses. A belt of 1 to 2 km wide of ultrabasic rocks northwest striking along a normal fault cutting the Mali i Thatë anticline according to its axes could be met at the Small Prespa Lake. The ultrabasic rocks in the Qafthana tunnel, that transects the Upper Triassic-Lower Jurassic limestones, have been encountered (Shehu *et al*., 1981). Aklipe of Upper Triassic-Lower Jurassic limestones in the Guri i Çukës Mountain that overlies the Pogradeci ultrabasic massif has been displaced more than 8 km to the southwest from its nappe front at Lini village (Figure 13).

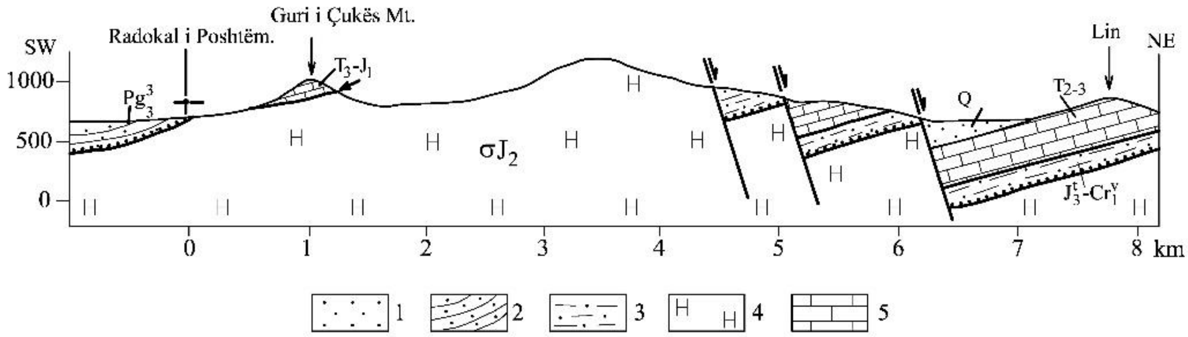


Fig.13: RadokaliPoshtëm-Lin Geological Section. **1-** Quaternary deposits, **2-** Upper Oligocene molasse of Albanian-Thessalian Basin, **3-** Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, **4-** Middle Jurassic ultrabasic rocks, **5-** Triassic-Jurassic limestones.

The Middle Eocene limestones transgressively overlie theTriassic-Jurassic limestones of Mali i Thatë and the ultrabasic rocks in Bilishti area. The aforementioned data show that the displacement of the Korabi and Mirdita nappe sheets finished before the Middle Eocene time in southern Albania.

The ultrabasic rocks outcrop from the north of Korça town up to Nikolica village in the south and eastwards are buried under the molasse of the Albanian-Thessalian basin and reappeared in the Tren-Bitincke-Bilisht area where they were found under the Middle Eocene conglomerate limestones that cover the ultrabasic rocks through Fe-Ni ore deposits (Molla 1985). The belt 300-400 m wide consisting of ultrabasic rocks located along the normal fault north-south striking from Verniku to Kapshtica villages was buried under from the Middle Eocene conglomerate limestones (Xhomo *et al*., 2005).

The Upper Triassic-Lower Jurassic limestones of Mali i Thatë Mountain are dislocated by many normal faults along which the belts of ultrabasic rocks are found as in Peshkëpi and Alarup villages up to Small Prespa Lake—showing the nappe emplacement of Upper Triassic-Lower Jurassic limestones of Mali i Thatë-Galiçica anticline over the ultrabasic rocks (Figure 14).

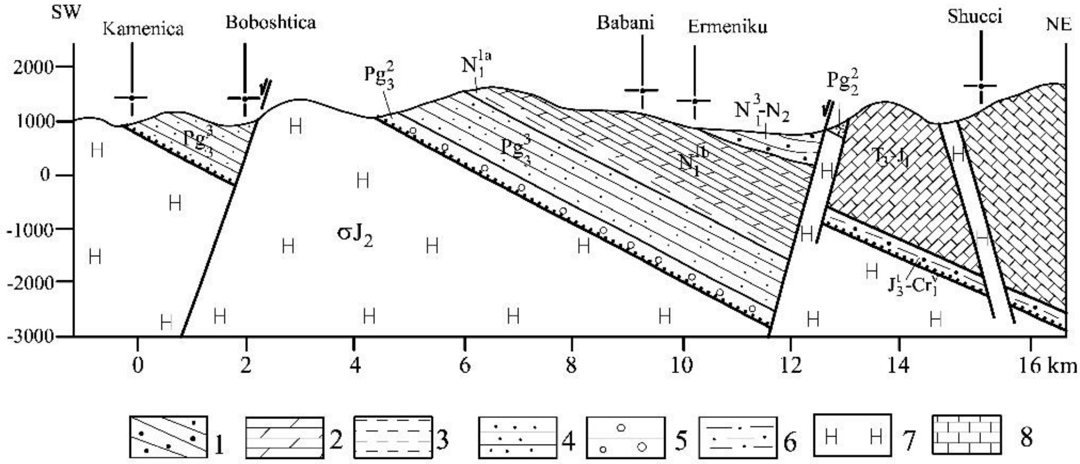


Fig. 14: Kamenica-Shueci Geological SectionMolasse of Devollibasin: 1- Upper Miocene-Pliocene. Molasses of Albanian-Thessalian basin: 2- Burdigalian 3- Aquitanian, 4- Upper Oligocene, 5- Middle Oligocene. 6- Upper Jurassic-Lower Cretaceous marly flysch underlying Korabi nappes, 7- Middle Jurassic ultrabasic rocks, 8- Triassic-Jurassic limestones.

Along prominent normal faults, like the one at the village of Dolnjo Konjsko, south of the city of Ohrid, serpentinites appear as isolated blocks in shear lenses. Due to this position in the Korabi zone their origin and stratigraphic position remains unclear. Furthermore, Mesozoic intrusions of rhyolithes and diabases are preserved in between the limestones and dolomites east of Kosel (Hoffman *et. al*., 2010). Many ultrabasic rocks are also could be found along prominent faults in the western part of Western Macedonian Zone (Arsovski 1997).

In all the cases, the ultrabasic rocks found in Western Macedonian Zone support the nappe emplacement of Korabi zone which is mainly developed in North Macedonia, to the south of Dibra Basin, with the exception of Mali i Thatë Mountain anticline.

The north dipping normal fault from Helmes of Erseka to Kazani pass borders on the north the Gramosi tectonic half-window of Krasta zone. It separates the Nikolica-Korça and the Selenica e Pishës-Vithkuq ophiolite nappe in the north from small ophiolite nappes completely detached from their roots in the south.

An ophiolite belt 30 km long and 5-10 km wide consisting of thin ophiolite nappes could be found in the Leskoviku-Erseka area. They are represented by the ophiolitic nappe which overthrusts the nappe of Upper Triassic-Lower Jurassic limestones. One of the greatest ophiolite nappes is the Radanji nappe consisting of the ultrabasic rocks hundred meters thick overlain by the Upper Cretaceous (Senonian) limestones (Xhomo *et al*., 2005). The Shalësi ophiolite nappe is represented by a very small ophiolite body. The Radanji ophiolite nappe represents an ophiolite block displaced for more than 20 km from the Grammos-Arrenes area ophiolite nappe in Northern Greece (Figura 15).

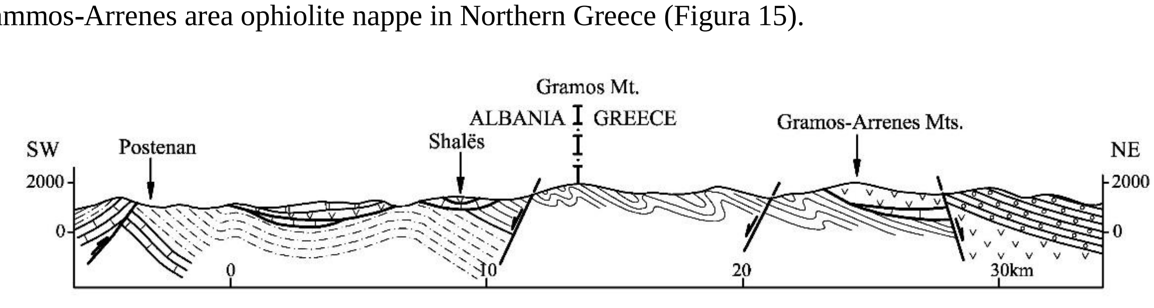


Fig. 15: Postenan-Shales-Gramos Mt.-GrammosArrenes Mts. geological section (Aliaj 1994).

The Gramosi half-window consists partly of Upper Cretaceous pelagic limestones outcropping at Butka village and mainly of Maastrichtian-Eocene folded flysch which outrops from Gramosi Mountain foots to the Pelza, Çukapeçi and Vallamare mountains marking the border line Albania-Greece. It borders the Kolonja Pliocene-Quaternary half-graben basin through a north-south striking normal fault.
The Korça-Nikolica ophiolite belt at Kazani pass follows southeast in Northern Greece where it outcrops in Grammos-Arrenes area as an ophiolite nappe overlying the Gramosi flysch half-window through Beotian flysch of Lower Cretaceous (Nirta *et al*., 2010). The Grammos-Arrenes ophiolites outcrop between the Pindos Flysch to the West and the Meso-Hellenic basin to the East and represent the northernmost exposure of the Pindos Ophiolite belt in Greece. A normal fault north-east dipping has caused the burying of the Grammos-Arrenes area ophiolites under the molasses of the Meso-Hellenic basin (Aliaj 1994; Nirta *et al*., 2010; Figure 15).
The Triassic-Jurassic limestones that overlie the ophiolites transgressively covered by Late Tithonian-Valanginian marly flysch could be met at Qafmurra and Lunik-Klenja tongues of the Kunora e Lurës-Bulqiza-Shebeniku longitudinal geological-geophysical section (Figure 16). The Lura, Bulqiza and Shebeniku ultrabasic massifs are characterized by high gravity intensity anomalies, whereas the Qafmurra nappe tongue by the amplitude of 20mgl gravity intensity, the Okshtuni window of Krasta unit has the lowest gravity intensity, and the gravity anomaly is gradually increased over the Lunik-Klenja toungue toward the Shebeniku ultramafic massif. The Figure 16 depicts a genetically unique ophiolite belt divided into two parts by the transversal Okshtuni tectonic window during the Late Miocene extensional tectonism.

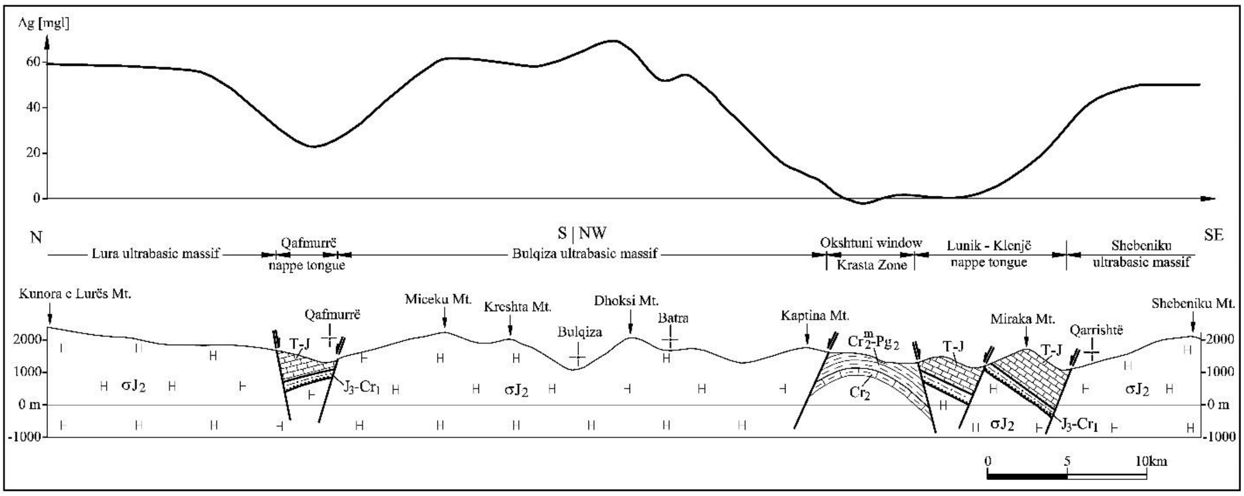


Fig. 16: Kunora e Lurës Mt.-Bulqiza-Shebeniku Mt.geological-geophysical section.

All the geological cross-sections transecting across the Mirdita and Korabi tectono-stratigraphic units from the Radomira-Sllova area in the north to the Leskoviku-Kolonja area in the south show that in the east of the eastern ophiolite belt the Triassic-Jurassic limestones of Korabi zone overthrust the ophiolites from the Gurra-Lura to Lunik-Klenjatounge up to Mali iThatë Mt., while in west and east sides of the Mali iBardhë tectonic window, at the core of Korabi zone, the roots of Mirdita ophiolites overthrust by different Korabi nappe units could be met.

6. CONCLUSIONS

The following conclusions could be drawn:
The scholary opinions about the root zones of Mirdita ophiolites could be grouped as follows: some scholars considered the Mirdita ophiolites with a root zone underlying the Korabi nappe (Zuber 1940; Belostockij 1978; Aliaj 1987; 1991; 1993; 2018; Qirinxhi *et al*., 1991), some others with a root zone within Mirdita Zone (Robertson and Shallo 2000) or as rooted intheMirdita Ocean but not showing their

root zone (Xhomo *et al*., 2002a:b; Kodra 2016) and the other ones without roots (Melo 2002; Frashëri *et al*., 2009; Bushati 1994), while a minority Albanian scholars (Çollaku*et al*.,1990; 1991) and many foreign scholars who carried out geological studies in Albania (Kilias *et al*., 2001; Bortolotti *et al*., 2004; Gawlick *et al*., 2008; Schlagintweit *et al*., 2008; Tremblay *et al*., 2015) considered that Mirdita ophiolites represent a far-travelled nappe with roots in Vardar zone, brought into its present position in Middle-Late Jurassic time.

The Mirdita zone includes the ophiolites with their sedimentary cover and the boundary with Korabi zone passes after the eastern margin of the ophiolites which follows from Kukës-Peshkopi region in the north to Mali i Thatë mountain in the south. The post-emplacement deposits lying on top of ophiolite rocks are: i) the Late Jurassic (Kimmeridgian-Tithonian) sedimentary sequence of different facies from pelagic limestone (Polena section, Korça area) and cherty silty deposits referred to as Simoni mélange (Lumi i Zi, Puka area) to platformic carbonates (Kurbnesh area) found on top of ophiolitic rocks of Mirdita zone which proves that nappe stacking of Mirdita ophiolites occurred from the Middle to Late Jurassic time, and ii) the shallow-water limestones of Berriasian-Valanginian age, which unconformably overlie the eastern ophiolite nappe (Munella, Mali i Shenjtit areas), significally earlier than previously reported as of the Barremian to Aptian age. The Berriasian-Valanginian shallow-water limestones and the Upper Jurassic-Lower Cretaceous marly flysch found on top of eastern ophiolite nappe unit could be considered as two different facial deposits-probably dating the Lower Cretaceous age.

The Korabizone is characterized by a Paleozoic basement consisting of the Ordovician to Devonian sequence unconformably covered by a Permo-Triassic clastic sequence grading upward to Triassic-Jurassic carbonate sequence. The Korabi units are deformed in a large antiform showing at its core several Kruja and Krasta tectonic windows and the Tithonian-Valanginian marly flysch sequence overlying huge ultrabasic bodies around the Mali iBardhë tectonic window. The Mali i Bardhë window of Kruja zone, the Velivari-Kërçina window of Krasta zone including in it the Peshkopia, Kërçishti and Dibra e Madhe windows of Kruja zone and the Okshtuni window, are observed within Korabi zone. The Tithonian-Valanginian marly flysch sequence transgressively covers the huge ultrabasic bodies around the Mali i Bardhë tectonic window of Kruja zone.

These two settings of ultrabasic bodies could be met in the Korabi zone: i) the ultrabasic bodies along the normal faults cutting the depositional sequences of Korabi zone, and ii) the imbricated ultrabasic bodies transgressively covered by the Tithonian-Valanginian marly flysch sequence located around three sides of Mali i Bardhë tectonic window of Kruja unit as follows: in the Kalle, Vlesh, Dipjaka and Vrenjton the west, in Biçaja pass (Varri i Sejmenit) and Bjeshka e Shehut stream on the east and in Radomira area on the north. The surrounding of Mali i Bardhë tectonic window is the only area proving the presence of huge ophiolite bodies showing the roots of Mirdita ophiolites underlying the Korabi nappes. Both setting of the ultrabasic bodies prove to the existence of ophiolite massifs underlying the Korabi units.

The tectonic windows of Kruja and Krasta units observed within the Korabi zone have been formed due to the Late Miocene to present extensional tectonism, accompanied by normal faulting and evaporite diapirism which created dome pattern horsts that favoured the erosion of the Mirdita and Korabi upper nappe sheets seen only at the margins of the Mali i Bardhë tectonic window of Kruja zone and of the Okshtuni and Velivari-Kerçina tectonic windows of Krasta zone.

The geological building of Korabi tectono-stratigraphic unit, including into its core several tectonic windows of Krasta and Kruja units, shows the following stack of nappe sheets, from top to bottom: Korabi nappe, Mirdita ophiolite nappe transgressively overlain by the Upper Jurassic-Lower Cretaceous marly flysch sequence and Krasta nappe overlying the Kruja "autochthon".

All the geological cross-sections transecting across the Mirdita and Korabi tectono-stratigraphic units, from the Radomira-Sllova area in the north to the Leskoviku-Kolonja area in the south, show that, in the east of the eastern ophiolite belt, the Triassic-Jurassic limestones of Korabi zone overthrust the ophiolites from the Gurra-Lura to Lunik-Klenjetounge up to Mali iThatë Mt., and in west and east sides of the Mali i Bardhe tectonic window, at the core of Korabi zone, are seen the roots of Mirdita ophiolites overthrust by different Korabi nappe units. The Kunora e Lurës Mt.-Bulqiza-Shebeniku Mt. longitudinal geological-geophysical cross-section show that the ophiolite belt is genetically unique divided into two parts by the transversal Okshtuni tectonic window formed during the Late Miocene extensional tectonism.

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