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NAPPE STRUCTURES IN SOUTHEASTERN ALBANIA

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ABSTRACT

Some nappe structures, parts of Mirdita ophiolite nappe and of Krasta one, are clearly visible in SE Albania, where the ophiolite nappe covers almost the whole Krasta nappe.

In Leskovik-Erseke area, to the W of Gramos halfwindow of Krasta zone, along a N-S trending belt, are observed thin ophiolite nappe structures, which overthrust Oligocene flysch of the external zones. In Vithkuq-Voskopoje area thick ophiolite nappe structures, NW-SE trending, overthrust Krasta flysch.

Ostrovice nappe structure, part of Krasta nappe, represents a syncline structure, overthrusting Oligocene flysch of Kruja zone.

INTRODUCTION

For the presence of the nappe tectonics in SE Albania are expressed many scholars (Nowack,1929; Zuber,1940; Aubouin and Ndojaj,1964; Belostockij,1978; Aliaj,1987; Melo et al.,1991; Turku and Shehu,1991 etc). Nappe tectonics is also reflected in Geological Maps of Albania, scale 1:200000 (1967,1983). But, in particular the nappe structures of SE Albania are treated by Zuber (1940), Belostockij (1978), Aliaj (1987) and Turku and Shehu (1991). Among them Belostockij (1978) payed much attention to the nappe structure of Albania.

Zuber (1940) divided Vithkuq-Leskovik nappe and Shpat-Voskopoje one, which are parts of socalled by him "Toska nappe". He noted that Devolli nappe swims over "Frasheri flysch".

Belostockij (1978) described in details nappe tectonics around Devolli ophiolite massif, where he distinguished a pile of nappe sheets (two Pindos nappes and one ophiolite nappe on the top). Moglice tectonic window, NE of Ostrovice, composed of Oligocene flysch of Kruja zone, is mentioned by him for the first time.

Aliaj (1987) evidenced the Vithkuq ophiolite nappe through Krasta tectonic window at Rungaje, as well as thin ophiolite nappes in Leskovik-Erseke area. Some examples for nappe emplacement of Korabi Upper Triassic-Lower Jurassic limestones over Mirdita ophiolites around Ohri and Prespa lakes are also given by him.

Turku and Shehu (1991) argue that Devolli ophiolite massif is part of Mirdita nappe.

In order to enlighten the nappe tectonics in SE Albania, the author in this paper pays much attention to it, relying on personal field observation, carried out years ago.

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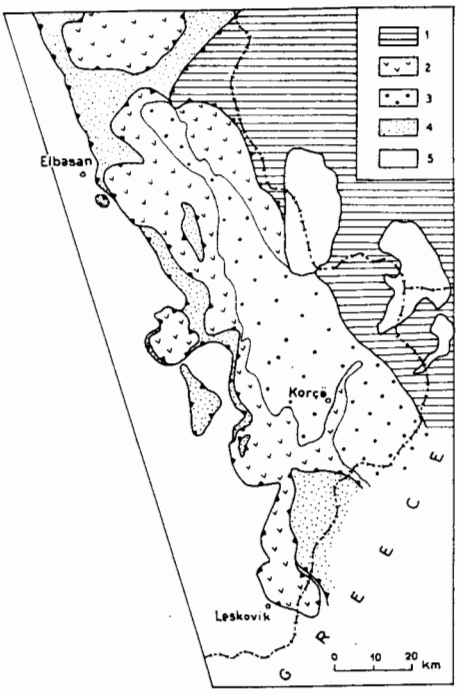

Fig. 1: Tectonic Map of SE Albania 1: Korabi zone, 2: Mirdita zone, 3: Albanian-Thessalian Depression, 4: Krasta zone, 5: Kruja and Ionian zones.

GEOLOGICAL SETTING

In SE Albania the following tectonic zones are cropping out (from E to W): Korabi, Mirdita, Kruja and Ionian zones (Fig 1,2).

Korabi zone is composed of Middle Triassic-Lower Jurassic limestones. Some remnants of Upper Cretaceous limestones and Eocene molasse deposits, transgressively overlying on Upper Triassic-Lower Jurassic limestones, are met at Mt. Mali i Thate. Middle Triassic-Lower Jurassic limestones overthrust Mirdita ophiolites at Qafe e Thanes.

Mirdita zone is represented by Upper Triassic-Lower Jurassic limestones, cropping out along its nappe front and by Jurassic ophiolites, tectonically overlying on the first ones; the ophiolites are composed of ultrabasic rocks, rarely by gabbro and volcanic ones, transgressively covered by Cretaceous deposits of Gosau facies (Fig 2). To the N of Vithkuq the ophiolites are transgressively covered by molasse deposits of Middle Oligocene-Lower Miocene of the Albanian-Thessalian trough. Mirdita zone represents a grand ophiolite nappe overlying on Krasta flysch.

Krasta zone is composed of Turonian-Senonian pelagic limestones and of Maestrichtian-Lower Eocene flysch, cropping out in the halfwindow of Mt. Gramos, in Ostrovice nappe and usually along a narrow belt before the ophiolite nappe front, as well as at tectonic window of Rungaje. From Shtike up to Helmes crops out marly flysch of Tithonian-Valanginian and at Polene pelagic limestones of Kimmeridgian-Tithonian underlay this flysch (Meço,1977). Ophiolite nappe covers almost the whole Krasta nappe in S Albania (Fig 1).

Kruja zone is composed of Upper Cretaceous-Eocene neritic limestones and of Oligocene flysch. Limestones crop out in Kulmak and Qeshibesh Mountains, where they form anticline structures, while flysch of "Frasheri type" crops out eastwards (Fig 2).

Ionian zone is represented by Cretaceous-Eocene pelagic limestones and by Oligocene flysch. The limestones constitute anticline structures in Tomorr, Postenan and Melesin Mountains.

It is important to note that, eastwards of Tomorr-Kulmak-Postenan anticline line it is developed the socalled "Frasheri flysch", distinguished for the first time in 1935 by Zuber (1940). This flysch is normally overlaid on limestones and it is represented, from bottom to top, by three packets: packet of clays with rare sandstones, sandstone-conglomerate packet and sandstone-clay packet with limestone olistoliths and olistostromes (Aliaj,1981).

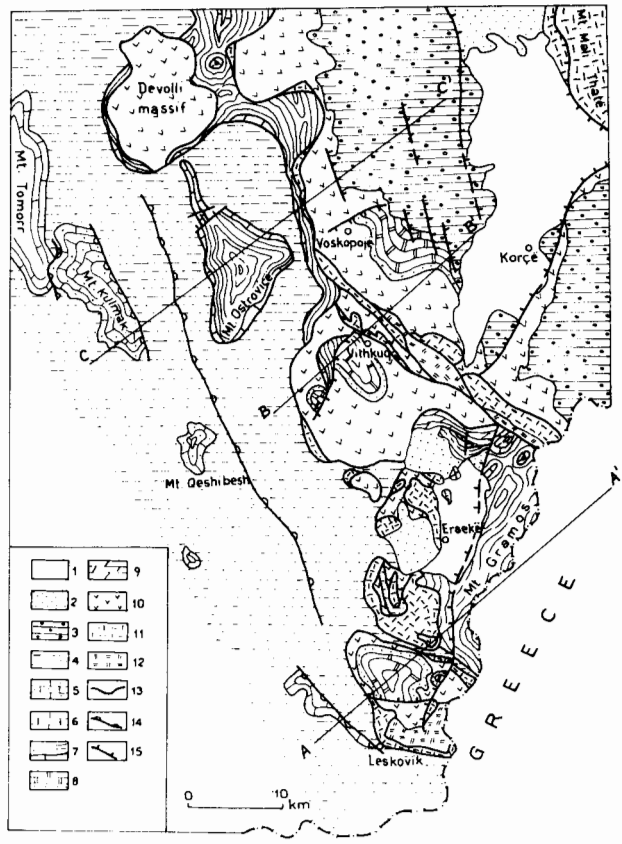

Fig. 2: Geological Map of SE Albania
1: Quaternary deposits, 2: Pliocene molasse, 3: Middle Oligocene-Lower Miocene molasse of the Albanian-Thessalian Depression, 4: Oligocene flysch of the external zones (Kruja and Ionian ones), 5: Upper Cretaceous- Eocene limestones of Kruja zone, 6: Upper Cretaceous-Eocene limestones of Ionian zone, 7: Turonian-Senonian limestones and Maestrichtian-Eocene flysch of Krasta zone, 8: Cretaceous deposits of Gosau facies, 9: Tithonian-Valanginian marls of Krasta zone, 10: Ophiolites (ultrabasic rocks,rarely gabbro and volcanic ones), 11: Upper Triassic-Lower Jurassic limestones, 12: Ophiolite melange, 13: Overthrusts, 14: Reverse faults, 15: Normal faults.

Oligocene age of "Frasheri flysch" is determined in Moglice as well as at Gramos Mountainfoots (Gjata et al.,1982; Pulaj et al.,1983). So, in clay packet, underlying conglomerates in Moglice and Greve, are met *Globigerina linaperta, Globigerina ampliapertura* etc (Gjata et al.,1982), dating Early Oligocene. And silty-clay flysch in GjonÈ, at Gramos Mountainfoots, gave an association of microfaunes similar with that of Kruja flysch (Pulaj et al.,1983). Relying on these data, sandstone-conglomerate packet and sandstone-clay one must belong to younger Oligocene levels.

As a rule, in the studied region, sandstone-conglomerate packet of steep

Fig. 3: A - A' geological cross-section

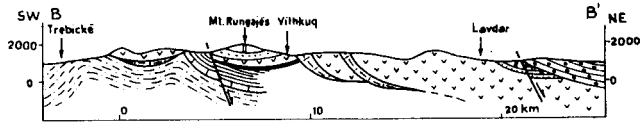

Fig. 4: B - B' geological cross-section

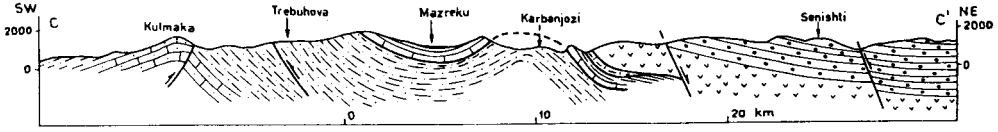

Fig. 5: C - C' geological cross-section

dip angle thrusts clay packet of low dip angle. "Frasheri flysch" is considered by Zuber (1940) as characteristic one for destined structural belt, in front of the nappe unities. We have to say that from south of Gramsh up to Leskovik, over "Frasheri flysch" swim Krasta nappe structures, as in Ostrovice, as well as Mirdita ophiolite nappe structures, as near Leskovik.

Ionian and Kruja zones in SE Albania are affected by reverse faults up to thrusts. While the nappe terrains are affected by normal faults during Pliocene time. Last ones have created graben and halfgraben lake basins along the Drini fault zone, N-S trending (Aliaj,1988).

PECULIARITIES OF NAPPE STRUCTURES IN SE ALBANIA

Nappe structures of Korabi, Mirdita and Krasta zones are discovered in SE Albania. I have to say that in Albania is observed the following pile of grand nappe sheets (from bottom to top): Krasta nappe, Mirdita ophiolite nappe and Korabi one (Aliaj, 1992).

At Qafe e Thanes, at Korabi nappe front, are seen Triassic limestones of Korabi zone which overthrust Mirdita ophiolites (Aliaj,1987). Upper Triassic limestones from Skroske to Katiel overthrust the ophiolites (Molla et al.,1985). At Zemblak we have the same situation too (Peza et al.,1985). In some places as in Peshkepi, Zagradec etc, along normal fault zones, the serpentinites crop out from below Triassic limestones of Korabi zone (Aliaj,1987; Molla and Jani,1986). In this paper Mirdita and Krasta nappe structures, which are clearly visible in SE Albania, are described.

Mirdita nappe structures

In the framework of Mirdita zone in SE Albania are distinguished nappe structures of Leskovik-Erseke area from those of Vithkuq-Voskopoje area. In this paper is not described Devolli nappe outlier, which is well treated in some scientific publications (Belostockij,1978; Turku and Shehu,1991).

Nappe structures of Leskovik-Erseke area

In Leskovik-Erseke area, along a belt 30 km long and 5-10 km wide, to the W of Gramos halfwindow, are developed thin ophiolite nappe structures, maximum up to some hundreds meters thick. They are represented by Upper Tri-

assic-Lower Jurassic limestones which are overlaid by the ophiolites; rarely ophiolites are transgressively covered by Cretaceous Gosau facies as in Leskovik. To the N of Novosele its thickness decreases up to some tens meters.

In Leskovik-Erseke area are distinguished Leskovik nappe and Shalesi one, as well as some fragments of nappe outliers from Novosele up to Luaras (Fig 2).

Both this nappes have oval shape, NW-SE trending, a syncline structure, overthrusted on Oligocene flysch of the external zones; they are some hundreds meters thick (Fig 3). Leskovik nappe occupies a surface 16x10 km, while Shalesi one - 11x7 km area. Below Shalesi nappe, at estern part, Krasta flysch thrusts Oligocene flysch of the external zones.

Nappe structures of Vithkuq-Voskopoje area

In Vithkuq-Voskopoje area two grand nappes, NW-SE trending, are developed: Vithkuq nappe and Voskopoje one (Fig 2, 4).

Vithkuq nappe has halfoval shape, is 20 km long and maximum 12 km wide. It is mainly composed of the ophiolites, transgressively covered by Cretaceous Gosau facies. Ophiolites are tectonically overlaid on Upper Triassic-Lower Jurassic limestones, which are seen at its SW corner. Vithkuq nappe is divided into two parts by Krasta tectonic window at Rungaje and by the normal fault, plunging its eastern part (Fig 4). In Krasta window at Rungaje crop out Upper Cretaceous limestones and Maestrichtian-Eocene flysch. Vithkuq nappe is overthrusted mainly on Krasta flysch and at its SE front on Tithonian-Valanginian marls. It is around 1 km thick.

Voskopoje nappe is represented by a NW-SE 40 km long belt of the ophiolites, from Voskopoje up to Mt. Badarosh; it continues further in Greek territory (IGME,1989). Its frontal part is divided into up to 2-3 nappe imbrications, distinguished by Upper Triassic-Lower Jurassic limestones cropping out at footwall of the ophiolites. Towards NW and SE only one nappe imbrication is seen (Fig 2, 3, 5).

Voskopoje nappe is overthrusted on Krasta flysch. It is more than 1.5 km thick and its structure is affected by normal faults, NNW trending.

Krasta nappe structures

The author has evidenced two nappe atructures of Krasta zone in S Albania: Lleshani nappe, around 8 km SE of Elbasan, and Ostrovice nappe; the last one is included in the region under study. Both are overthrusted on Oligocene flysch of Kruja zone (Fig 1).

Lleshani nappe of oval shape, 3x2 km area, is represented only by Upper Cretaceous pelagic limestones of around 200 meters thickness. They form a syncline structure, overthrusted on Oligocene flysch.

Ostrovice nappe is composed of Upper Cretaceous pelagic limestones and Maestrichtian-Eocene flysch. It extends for 20 km, from Qafa e Martes in S up to Dushar and Verpcke to the N (Fig 2). It represents a syncline structure, which continues as a whole from Mt. Ostrovice up to Mt. Cuka e Bofnjes, with maximum width of 9 km and further northwards is only seen its fragmented axial part of maximum 1.5 km width, built mainly by limestones. Ostrovice nappe is overthrusted on Oligocene flysch of Kruja zone (Fig 5). It is around 1 km thick in Ostrovice and some hundreds meters thick to the N of Mt. Cuka e Bofnjes. Ostrovice nappe is squeezed from below Voskopoje ophiolite nappe, before the front of which, at Lekas, a Krasta nappe imbrication is observed (Fig 2; 5).

TERTIARY DEFORMATION OF THE NAPPE TERRAINS IN SE ALBANIA

Relying on data presented by Aliaj (1988), Mountrakis et al. (1992) and Tagari (1993) here are shortly mention main Tertiary deformation events, which have affected the nappe terrains in SE Albania.

An important compressional phase in Late Eocene caused folding, thrusting and imbrication of Krasta formations, before the emplacement of the ophiolites over Krasta flysch.

Since Early Oligocene till the end of Early Miocene an extensional tectonics has caused a semi-ductile to britle deformation of the ophiolites, their emplacement over Krasta flysch and formation of the Albanian-Thessalian molasse trough.

At the beginning of Middle Miocene a compressional phase caused the closing of the Albanian-Thessalian trough and final emplacement of Mirdita and Krasta nappes. It is important to note that due to this tectonic phase the ophiolite nappes in Leskovik-Erseke area overthrust Oligocene flysch of the external zones.

During Tortonian an extensional event has caused formation of Librazhdi halfgraben molasse trough, which is closed at the end of Late Miocene by a compressional phase.

An important extensional tectonics during Pliocene has caused the fracturation of the nappe terrains by normal faulting, generally N-S trending, and the formation of graben and halfgraben lake basins along the Drini graben fault zone.

CONCLUSIONS

Field studies show that some nappe structures, parts of Mirdita ophiolite nappe and of Krasta one, are clearly evidenced in SE Albania, where the ophiolite nappe covers almost the whole Krasta nappe.

In Leskovik-Erseke area, to the W of Gramos halfwindow of Krasta zone, along a belt 30 km long and 5-10 km wide, are observed thin ophiolite nappe structures, maximum up some hundreds meters thick. Leskovik and Shalesi nappes have oval shape, NW-SE trending, and a syncline structure, swiming on Oligocene flysch of the external zones. In Vithkuq-Voskopoje area two nappe structures, NW-SE trending, are developed. Vithkuq nappe of halfoval shape, 20 km long and maximum 12 km wide, of around 1 km thickness, is divided into two parts by Krasta window at Rungaje and by normal fault which plunges its eastern part. Voskopoje nappe is represented by a 40 km long belt of the ophiolites, which towards SE further continues in Greek territory; it is more than 1.5 km thick. Its frontal part is represented by up to 2-3 nappe imbrications , well distinguished by Upper Triassic-Lower Jurassic limestones cropping out at their base.

Two Krasta nappe structures are evidenced in S Albania: Lleshani nappe, 8 km SE of Elbasan, and Ostrovice nappe; the last one is included in the region under study. Both are of syncline structure and tectonically overlaid on Oligocene flysch of Kruja zone. Ostrovice nappe is composed of Upper Cretaceous pelagic limestones and of Maestrichtian-Eocene flysch, which form a syncline structure, 20 km long and maximum 9 km wide. It is around 1 km thick in Mt. Ostrovice. This nappe structure is squeezed from below Voskopoje ophiolite nappe, before the front of which seems a Krasta nappe imbrication.

Main Tertiary deformation events which have affected the nappe terrains

in SE Albania are mentioned. It is important to stress that an extensional tectonics during Pliocene time has caused the fracturation of the nappe terrains by normal faulting, generally N-S trending, and the formation of graben and halfgraben lake basins along the Drini fault zone.

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