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PETROGRAPHIC CHARACTERISTICS AND GEOCHIMSTRY IN THE PART OF GJILANI REGION – KOSOVA

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Abstract: The country of the Republic of Kosovo is situated in the central part of the Balkan Peninsula. In the Southwest, it is bordered by Albania, in the West by Montenegro, in the North and East by Serbia and in the Southeast by North Macedonia.

In this scientific paper was done the identification detailed for rocks found on the researched region. it was done the identification detailed for rocks found in the researched region. The region research it's done scale by 1:25 000 for comparison map of geology scale by 1:200 000 and paper will be treated the mineralogical content, petrography microscope preparation, and geochemistry.

For the region of Gjilan, the analysis was performed: for large elements, for small elements and traces, and for rare soils. The processing of the analysis of large elements, traces, and sub-traces was performed in the geochemical-petrological software MINPET. Constructed diagrams show that we are dealing with rocks generated in differentiated geodynamic environments.

Most of the rocks analyzed fall in the field of basic and acid rocks, and only a small part of them belong to the medium and ultrabasic rocks. Acid rocks are represented mainly by their Metamorphism types – gneiss and less of those ages with them younger – granite. They generally show geochemical features of volcanic type than orogenic in acid magmatism

The purpose of the paper it the proposal of the paper is the identification rocks in the exploration zone for the preparation petrographic of microscope and processing of the analysis of large elements, traces, and sub-traces was performed in the geochemical-petrological software MINPET.

It was done by the evidencing and detailed description of all the types of rocks found in the researched region. The samples were taken from those rocks for the preparation of petrography microscope preparation. The analyses were completed at the certified laboratory of Geology-Mining Faculty (Polytechnic University of Tirana) – Geosciences Institute.

Keywords**:** *Dardania zone, metamorphism, mineralogical content, petrography microscope preparation, geochemistry*

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1. INTRODUCTION

The country Republic of Kosovo is situated in the central part of the Balkan Peninsula. In the Southwest, it is bordered by Albania, in the West by Montenegro, in the North and East by Serbia and in the Southeast by North Macedonia. The territory extends within longitudes N41 050′58″ and 43 015′42″ and within latitudes E20 001′30″ and 21 048′02″ [1].

Kosovo covers a surface area of 10 908 km^2. It is characterized by an average altitude of 800 m above but shows considerable changes in relief and morphology of terrain (Fig. 1).

Fig. 1. Geographic map of Kosovo
(Wikipedia: Projekti Harta/Kosova)

The region of Gjilan (Serbian-Macedonian massif) composite unit is made up of a variety of relatively high-grade metamorphic rocks, some of which are of Pan African age with a Variscian overprint [5]–[8]. Possible correlations with the Carpathian region are discussed by [9] the term Vardar Zone was also established by

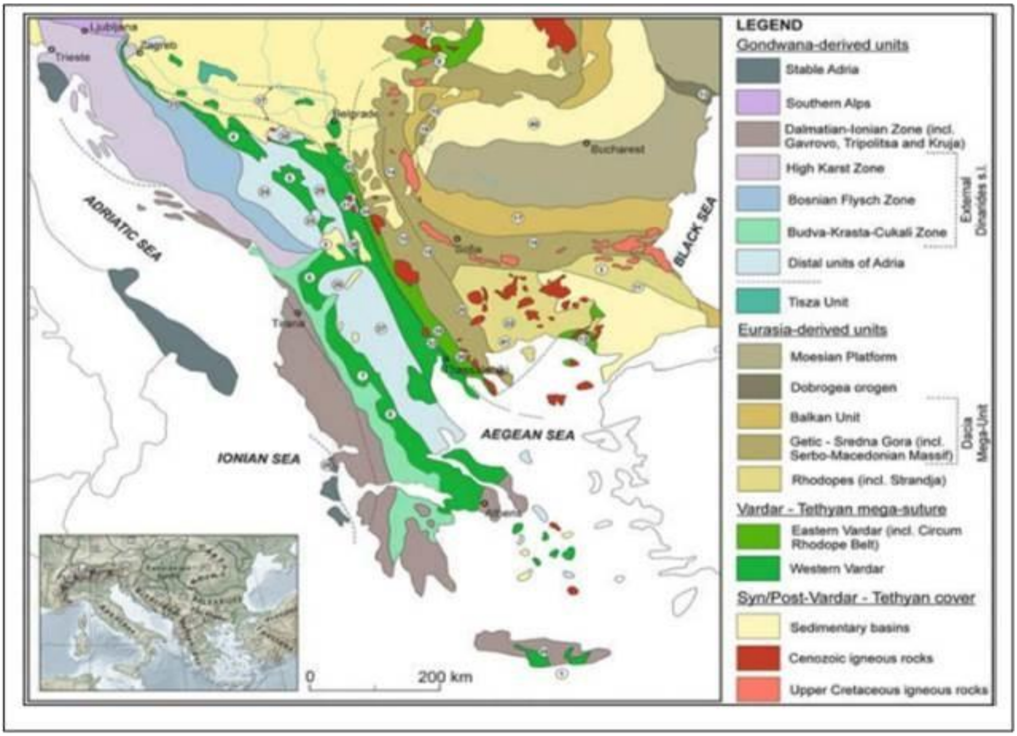


Fig. 2. Simplified sketch of the Geology of Southeast-Europe
(after Cvetković et al. 2016)

Kossmat [13] (1924), named by the river Vardar. Based on differences in their Cretaceous sedimentation history, [14] subdivided the Vardar Zone into three NNW--SSE trending units (Almopias, Paikon, and Peonias), whereas the investigations of [15] led to the present division of the Vardar Zone into the following five units (from W to E): The Almopias Unit; The Paikon Unit; the Guevguelije Unit; The Stip Axios Massif; The Circum Rhodope Belt .The main event of the Hercynian tectonic period that structured the rocks forming in the Dardania zone is associated with the regional deformation D2. Its intensity is depending on the type of rocks, but it is noted an increase of the intensity from west to east. The associated schistosity S2 (penetrating schistosity) is an axial plane schistosity of the isoclinals folds S0, S1. The schistosity S2 is homogenous, with an average strike direction of 345° and dip direction of 45°. The intersection lineation (L2) and the fold axis (B2) are very homogenous with the dip azimuth toward N (350°) and dip angle of 10° T [2] (Fig. 1).

2. STRATIGRAPHIC UNITS

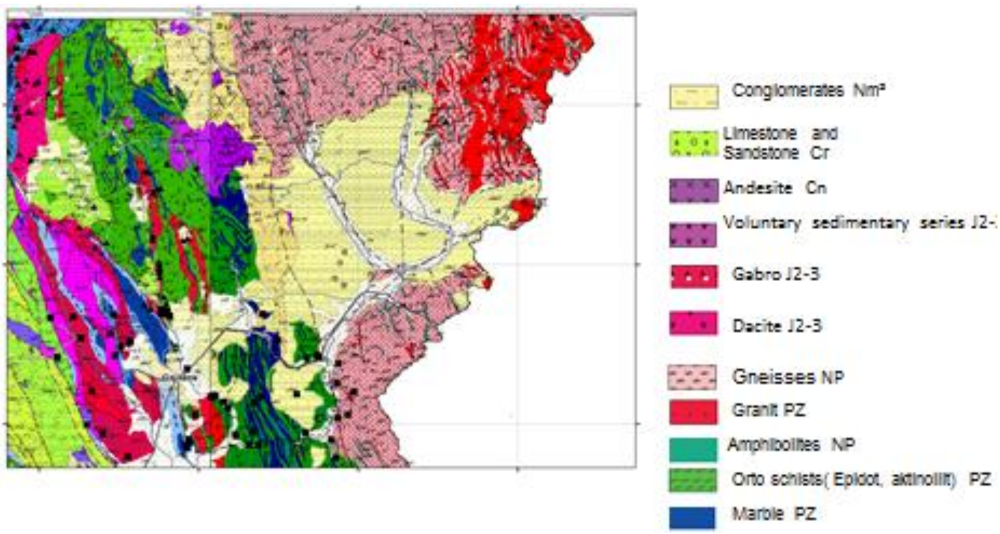


Fig. 3. Geological Map of Gjilani region (ICMM)

3. THE PALEOZOIC CRYSTALLINE BASEMENT (PZ)

The gneissic sequence starts from a series of gneiss and orthogneiss with the presence of tectonic banding without mapped, due to their limited size (Fig. 4). These bandings are represented by these types of rocks such as biotite and biotite-muscovite gneiss, leptynolite, mica schists, leucogneiss, amphibolite, quartzite, and migmatite (Fig. 3). In the beginning, these rocks have represented pelagic sediments with underlayers sinrift basic volcanism, accompanied with granite intrusion which then is metamorphosed in the orthogneisses facies. The grade of metamorphism increases in the sense of the top to down, representing epidote-amphibolite facies in the deep and greenschist facies above [4].

Micaschists sequence is localized in the central and western part of the region and it is built by mica schists with tectonic banding of the limited scale of metamorphic rock types such as green schists amphibolites, gneisses, leptynolites and metalimestones (Fig. 3). According to [16] This sequence is named as Veles series with Palaeozoic age, as subunit of the Vardar zone. In this context, these authors considered this sub-unit as tectonically situated below the Neoproterozoic gneisses sequence of the Serbian-Macedonian mass. We think that the gneiss and mica schists sequence belongs to the Paleozoic crystalline basement of the tectonic unit of Dardania. These sequences are in continuity with each other, where the eastern and deeper part represents a higher level of metamorphism compared with the mica schists sequence which is widespread in the center and west of sheet.

4. THE UPPER OLIGOCENE TRANSGRESSION

Onto the crystalline basement of Paleozoic, with stratigraphic and structural inconsistencies, are placed limestones and dolomites of the upper Oligocene. Onto metalimestones of the crystalline basement is developed the karstic phenomenon in the form of a cavity filled with calcite mineral, which gives rocks a breccias view. Directly onto the surface of weathering are placed sandstone with 70 cm thicknesses which gradually passes into the limestones with over 2.5 m thickness. In yellow dolomites with micrite texture (Oligocene age), are observed bivalve and Ostracoda fragments Conglomerate – sandstone–clay–carbonate formation of meddle Miocen) (Fig. 3) [4].

This formation is placed onto the Paleozoic crystalline basement of the Dardania unit and occupies the central part of a sheet. The formation has a thickness of about 200m and presents alternation of conglomerate, sandstone, limestone, and claystone.

Granitic intrusion with large size is spread in the southwest of the region while some smaller-sized intrusions are mainly distributed in the eastern part of the studied region. These rocks are tectonically transposed, thus presenting concordant and sub concordant bodies with metamorphic rock structures where they are introduced. During intrusion penetration, they have done migmatization and recrystallization of the surrounding schists.

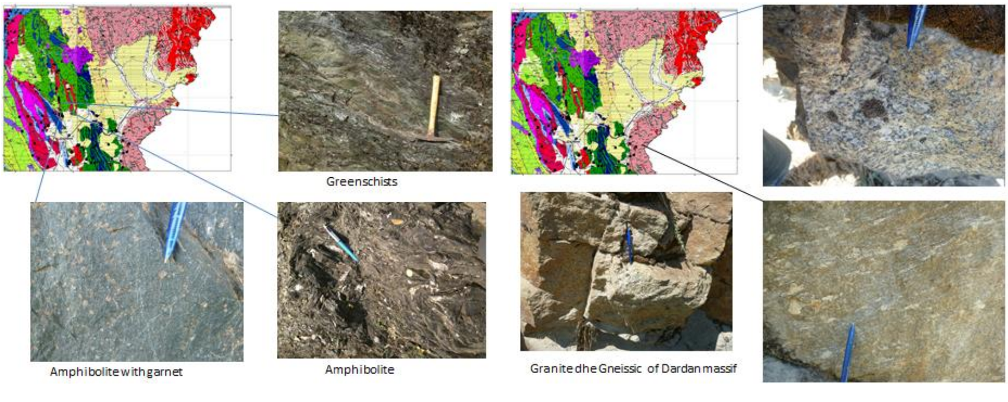


Fig. 4. Granites, Gneisses, Amphibolite, Greenschist of Dardanian massif

Granites are fine grain and contain less colored minerals. Their color is light gray. In the mineral composition are included: microcline, plagioclase (albite), quartz, muscovite, biotite, epidote, apatite, sagenite, leucocsene and metallic minerals. They have subhedral textures

5. PETROGRAPHIC CHARACTERISTICS

Petrographic characteristics in the Gjilani region we have divided into 4 groups:

1) Gneiss (metasedimentary and ortognneis),
2) Micaschists,
3) Gabro,
4) Granodiorit.

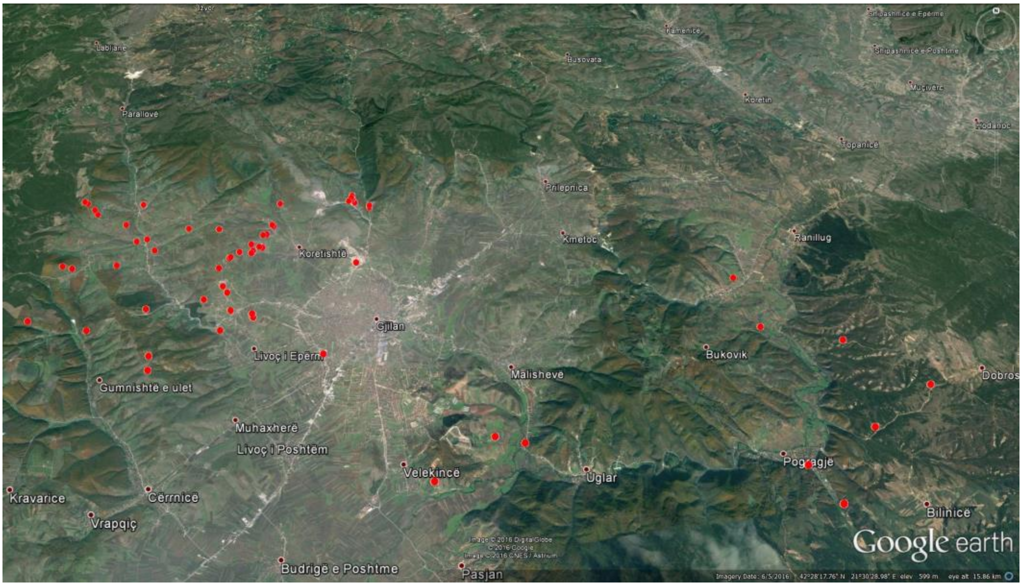
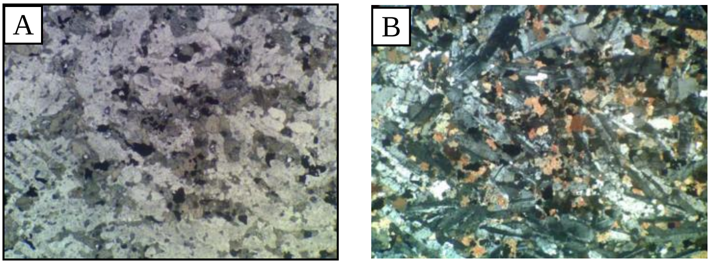


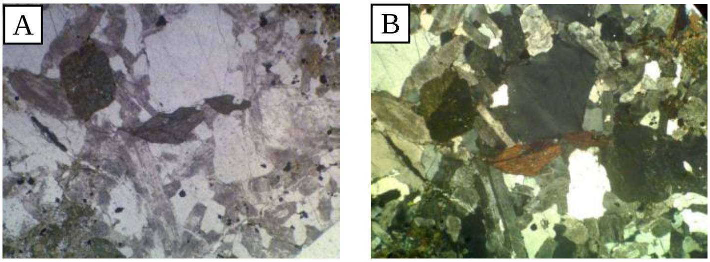
Fig. 5. Aerial photograph of the study area together with the sample for the preparation of petrography

Mineral parageneses of these rocks is built from

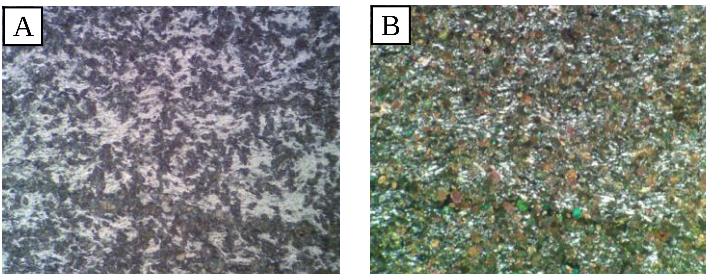
1) quartz, sericitez potassium feldspar, plagioclase, biotite, muscovite and opaque minerals,
2) feldspar, quartz and little mica,
3) quartz, plagioclase, potassium feldspar, biotite and muscovite (granite returned into gneiss),
4) quartz, potassium feldspar, orthoclase, microcline, plagioclase and mica.



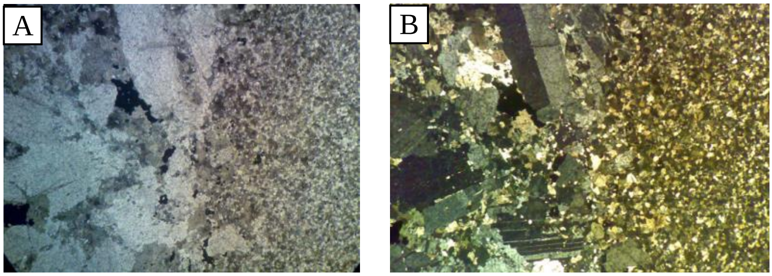
Under polarized light a) without analizator b) with analizator (magnified 25×). Gneiss with heteregranula texture, with mineralogical content: quartz, potassium feldspar, with more plagioclase and little mica. The rock is almost entirely affected by a cataclastic deformation and partially mylonitic deformation (Fig. 5).



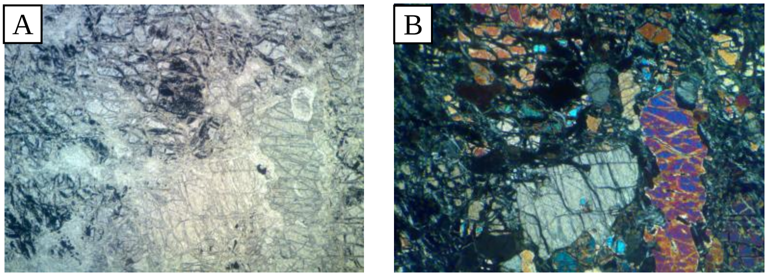
Under polarized light a) without analizator b) with analizator (magnified 30×). Granular magmatic texture. Mineralogical content: quartz, plagioclase has very little amphibole and little potassium feldspar (orthoclase). Tonalite (plagiogranite) or Granodiorite. Quartz appears deformed by wave suppression while plagioclase is slightly alteration and in almost all minerals, we notice sericite and very few oxides of Fe-Ti (Fig. 5).



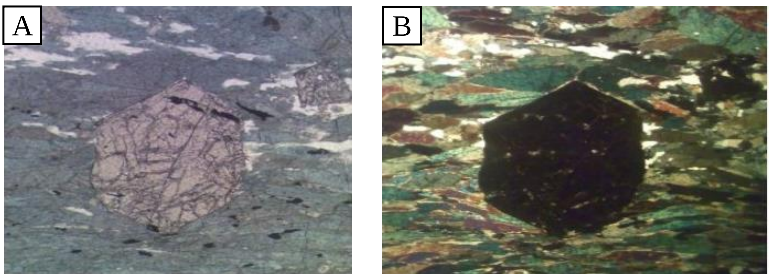
Under polarized light a) without analizator b) with analizator (magnified 30×) Schist with epidote. With mineralogical composition: quartz, many episodes, chlorine and little feldspar (Fig. 5).



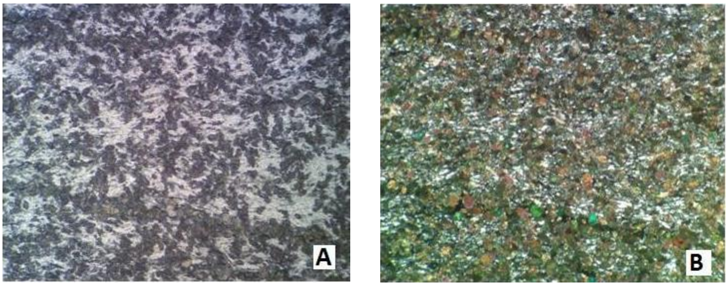
We have a contact of a gabbro (on the left of the photo) with a dolerite dyke (on the right). Gabro has a granular texture while doleoriti has a micro-granular texture. We gabro except pyroxenes and plagioclase, contains Fe or Ti ions. The crystals are highly altered (Fig. 5).



Under polarized light a) without analizator b) with analizator (magnified 30×). Ultrabasic rock mainly serpentinized with contents: olivine, orthopyroxene clinopyroxene, we are dealing with a serpentinized harzburgite (Fig. 5).



Under polarized light a) without analizator b) with analizator (magnified 32×). Details of garnet in amphibolites (Fig. 5).



Under polarized light a) without analizator b) with analizator (magnified 32×). Epidote schist. The rock is made up of quartz, many epidote, chlorite, and small feldspar (Fig. 5).

6. GEOCHIMISTRY

In this scientific paper for the region of Gjilan, the analyzed was performed: for large elements, for small elements and traces, and for rare soils. The processing of the analysis of large elements, traces, and sub-traces was performed in the geochemical-petrological software MINPET. Constructed diagrams show that we are dealing with rocks generated in differentiated geodynamic environments. As seen in Figs. 6–8, most of the rocks analyzed fall in the field of basic and acid rocks.

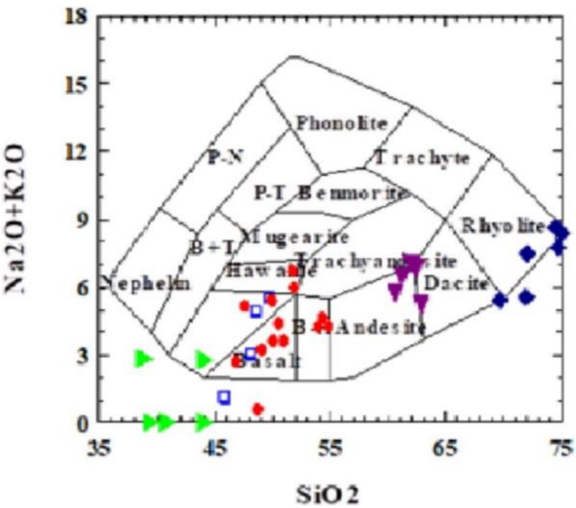


Fig. 6. Classification of rocks based on the diagram $Na_2O + K_2O$-SiO_2

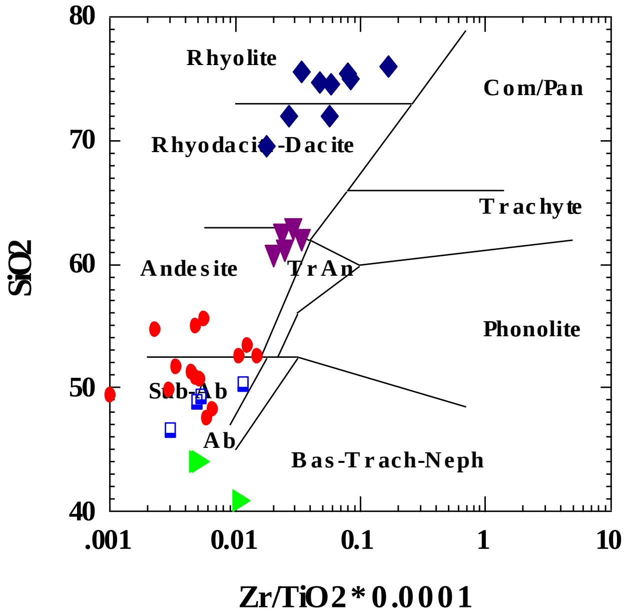


Fig. 7. Classification of rocks based on the diagram SiO_2-Zr/TiO_2 * 0.0001-Nb/Y

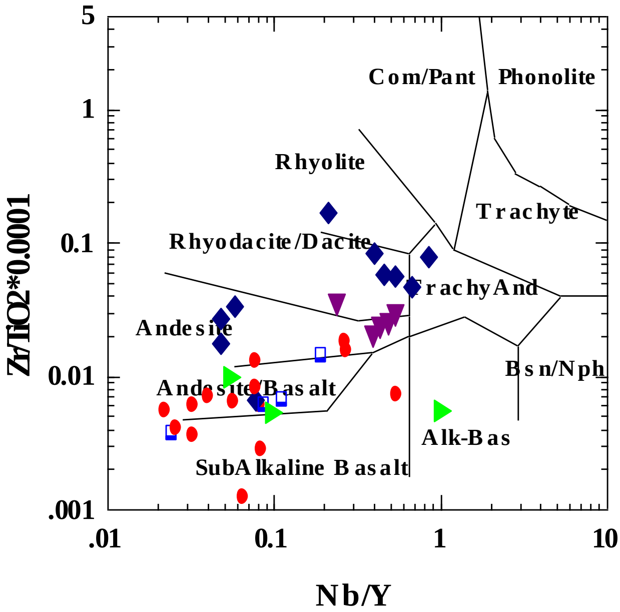


Fig. 8. Classification of rocks based on the diagram Zr/TiO2 * 0,0001-Nb/Y

BASALT

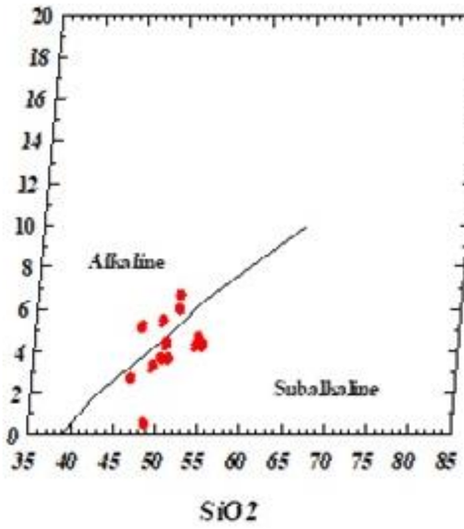


Fig. 9. From the $Na_2O + K_2O$-SiO_2 diagram,
the studied basic rocks show mainly geochemistry close to the sub-alkaline basalts,
but some of them show a slight alkaline affinity

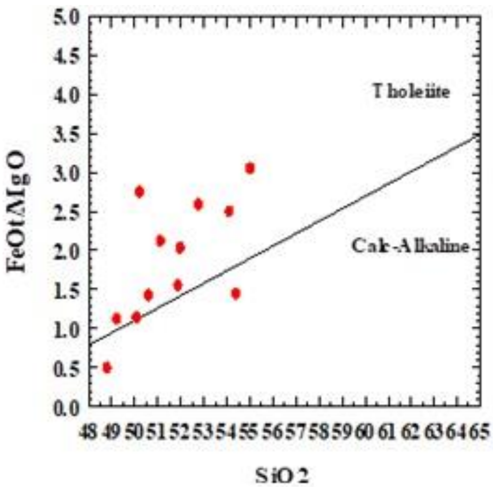


Fig 10 In the FeOt / MgO – SiO2 diagram,
a subdivision of sub alkaline basalt into tolerant and Calc-alkaline basalts is made,
a tendency of their mainly tolerant affiliation is seen

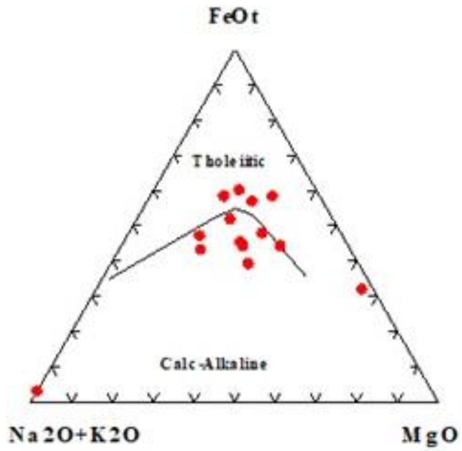


Fig. 11. In diagram A-FM, the basalts fall on the boundary of the division
of the tolerant and calc-alkaline fields, which shows that they show a close affinity
both with the basalts of the Mesoceanic backbone and those in the subduction zone,
while in the diagram of Fig. 1 studied basalts show mainly geochemical affinity
similar to the basalts of volcanic arches

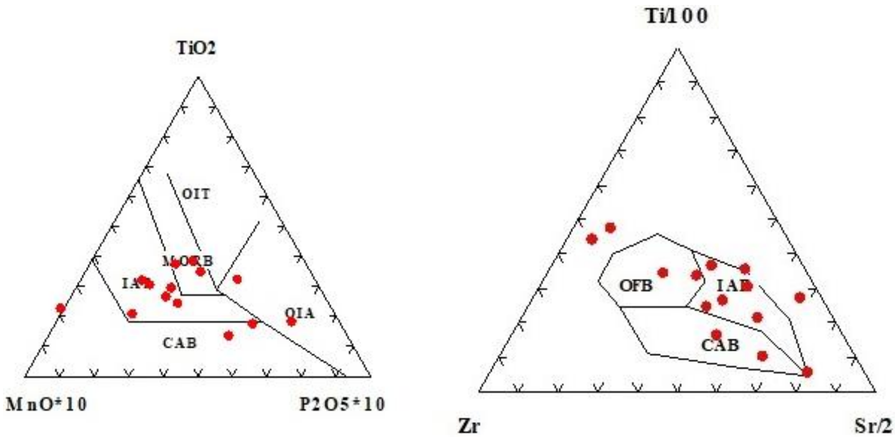


Fig. 12. In these 2 diagrams, the basal rocks analyzed fall in the basalt area
of IAT island arc tholeiitic and of typical island-arc basalts (IAB)

7. GNEISS AND GRANITE

Acid rocks are represented mainly by their Metamorphism types – gneiss and less of those ages with them younger – granite. They generally show geochemical features of volcanic type than orogenic in acid magmatism.

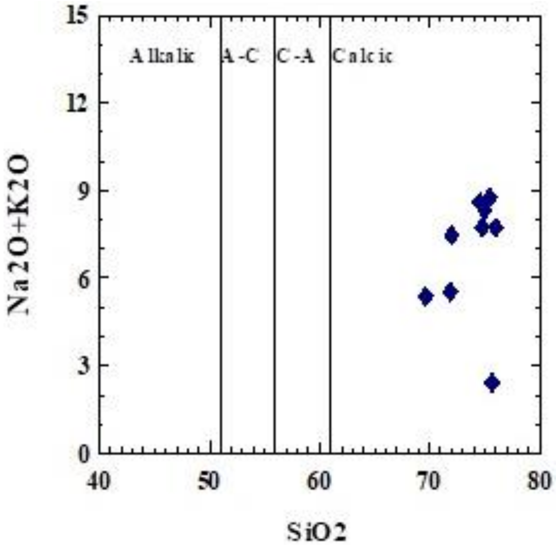


Fig. 13. The diagram $Na_2O + K_2O$-SiO_2.
alkalic, A-C alkali-calcic, C-A calc-alkalic, and calcic

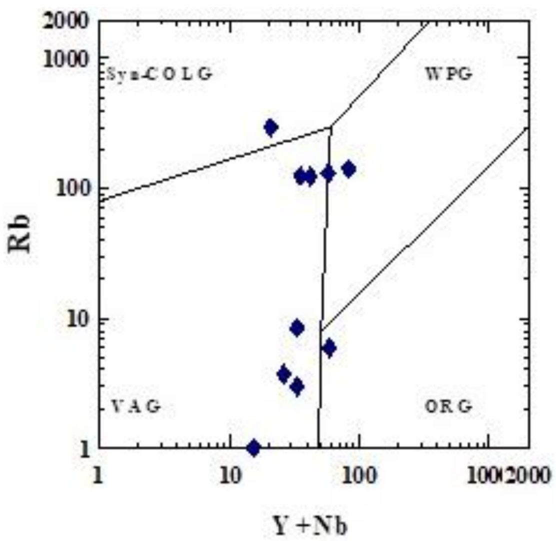


Fig. 14. The diagram Y + Nb-Rb SYN-COLG: syn-collisional granites,
WPG: within-plate granites, ORG: ocean ridge granites,
VAG: volcanic arc granites

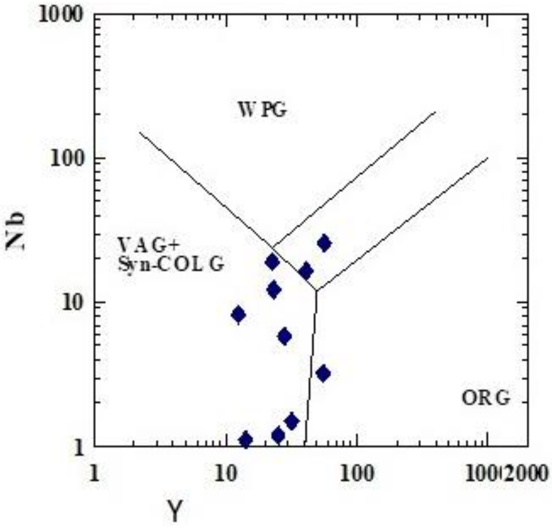


Fig. 15. The diagram Y -Nb SYN-COLG: syn-collisional granites,
WPG: within-plate granites, ORG: ocean ridge granites,
VAG: volcanic arc granites

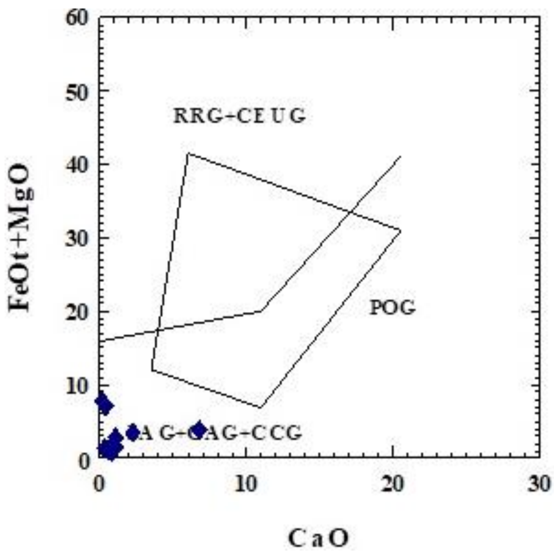


Fig. 16. AG, island-arc granites; CAG, continental arc granites;
CCG, continental collision granites; RRG, rift-related granites;

CEUG, continental epeirogenic uplift granites;
POG, post-orogenic granites OP oceanic plagiogranite.
Of these, IAG, CAG, CCG, and POG types are considered orogenic granites,
while RRG, CEUG, and OP types are considered anorogenic granites

8. CONCLUSION

The explored region represents an important point in the geology of Kosovo and beyond. In this region is the border between Vardar geological unit and the Dardanian tectonic unit.

The Petrographic characteristics in the Gjilani region we have divided into 4 groups: 1) Gneiss (metasedimentary and orthogneiss), 2) Mica schists, 3) Gabbro, 4) Granodiorite.

For the region of Gjilan, the analysis was performed: for large elements, for small elements and traces, and for rare soils. The processing of the analysis of large elements, traces, and sub-traces was performed in the geochemical-petrological software MINPET. Constructed diagrams show that we are dealing with rocks generated in differentiated geodynamic environments.

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Acid rocks are represented mainly by their Metamorphism types – gneiss and less of those ages with them younger – granite. They generally show geochemical features of volcanic type than orogenic in acid magmatism.

The analyses were completed at the certified laboratory of the Geology-Mining Faculty (Polytechnic University of Tirana) – Geosciences Institute. These analyses were carried out for the research work in my doctoral studies in the Geology-Mining Faculty (Polytechnic University of Tirana).

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